230 & 240 THE DONWAY WEST

TORONTO, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2000964
OCTOBER 30, 2023

SUBMITTED TO

Donway Co-operative Development Corporation
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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 230 & 240 The Donway West development in Toronto, Ontario. This effort is intended to inform good design and has been conducted in support of the Official Plan and Zoning By-Law Amendment (OPA/ZBA) application for the project.

The project site is currently occupied by the low-rise The Donway Covenant United Church and is located on the west side of The Donway West, between Duncairn Road to the north and Langbourne Place to the south. To the east of the site are mid-rise condominiums of similar height to the proposed project and to the west is Norman Ingram Public School with a large open sports field (Image 1). Downtown Toronto is approximately 10 km to the south-southwest of the site, while Toronto Pearson International Airport lies approximately 20 km to the west.

The project will consist of the redevelopment of the current The Donway Covenant United Church to include residential uses. The redevelopment features a 6-storey stepped building. The Church will be integrated on the ground floor of the south "wing". Behind the Church, there will be a two-level townhouses. Condominium units will be located on the upper floors and throughout the rest of the building. The redevelopment will also include underground parking. A site plan is provided in Image 2.

Pedestrian areas of interest include building entrances, sidewalks and walkways, the grade-level outdoor amenity space and above-grade terraces.

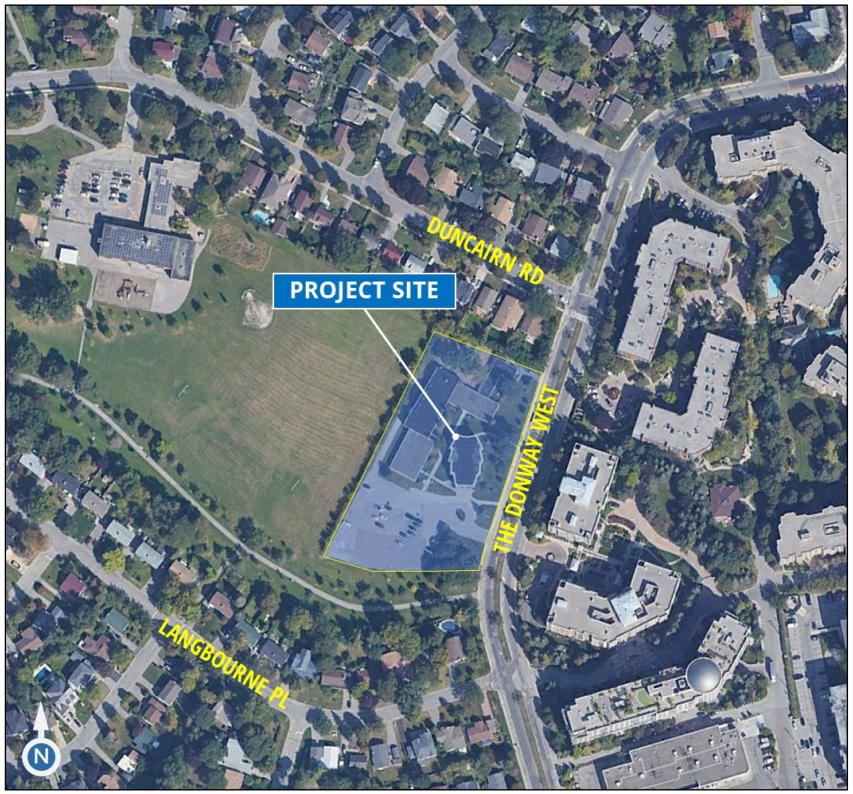

Image 1: Aerial View of the Existing Site and Surroundings (Credit: Google Maps)

1. INTRODUCTION

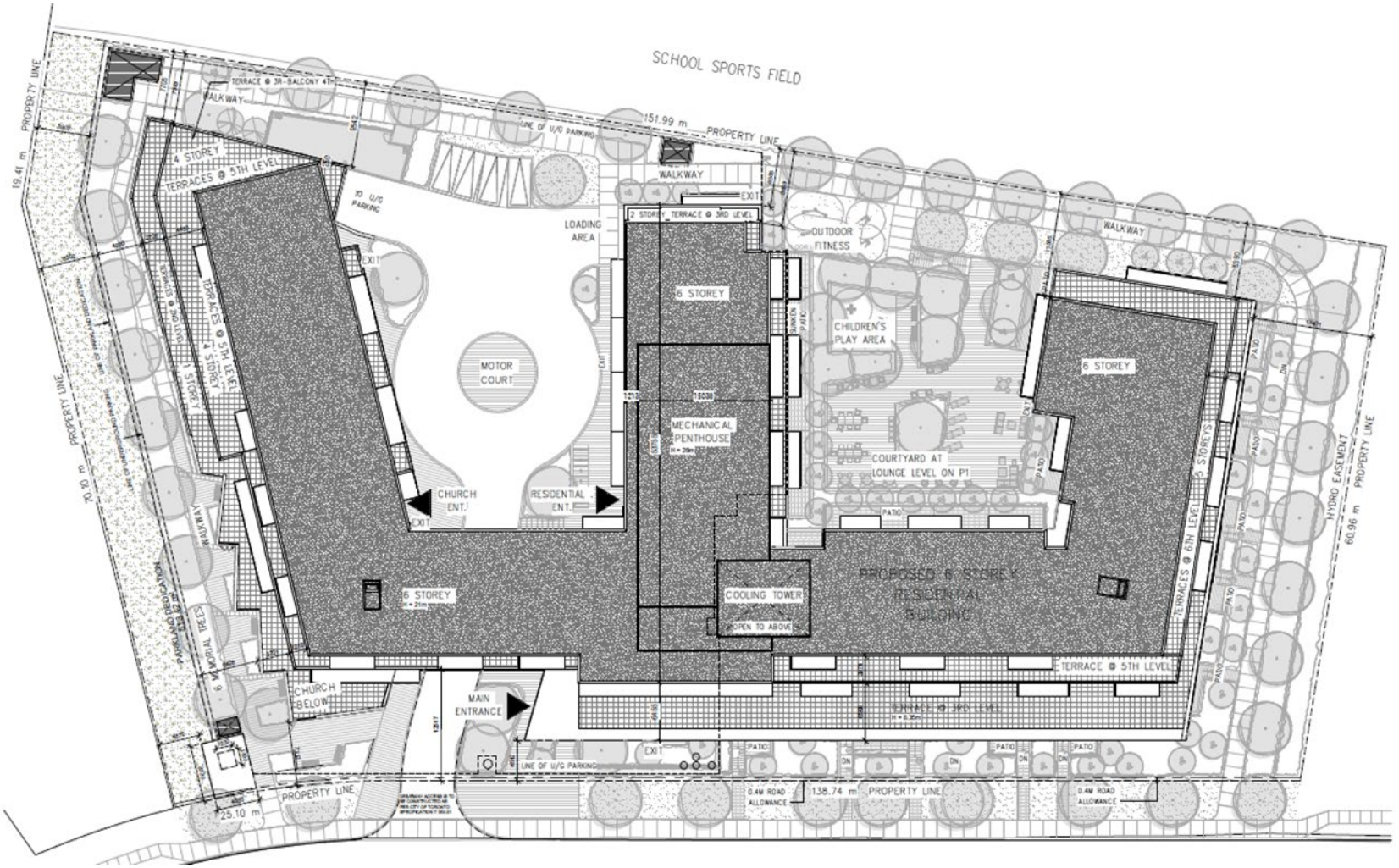

Image 2: Site Plan (Courtesy Architecture Unfolded)

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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:

- Architectural and landscaping drawings received from Architecture Unfolded and NAK Design Group Inc. on October 24 and October 27, 2023;
- 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 Toronto 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, 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 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 the east year-round and from the southeast in the summer.

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.

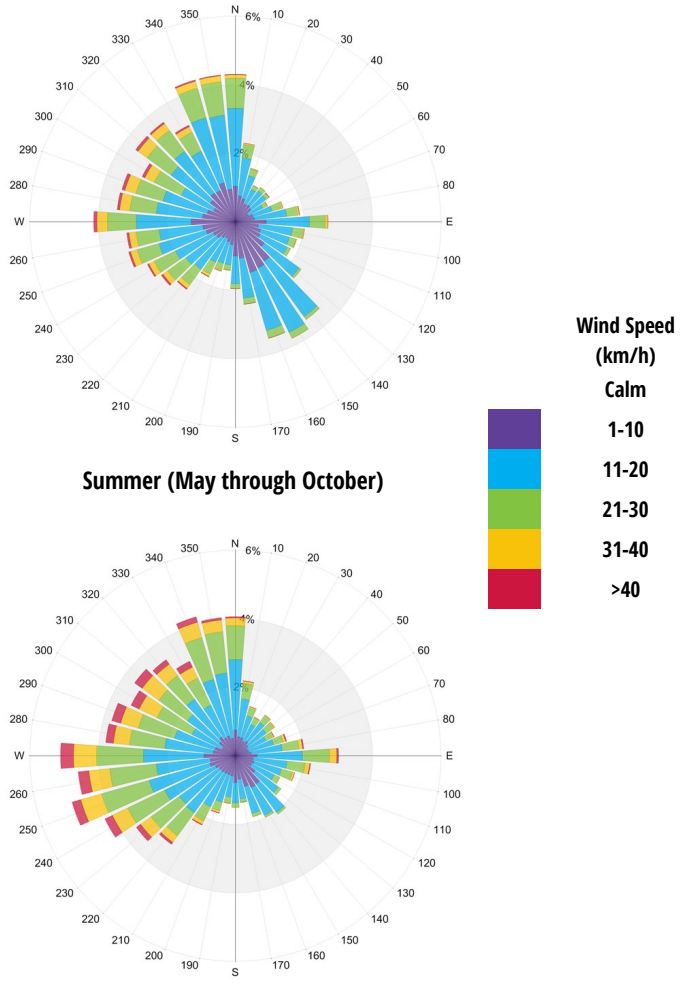


Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport (1989 to 2019)

4. WIND CRITERIA

The 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 including the City of Toronto. 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.

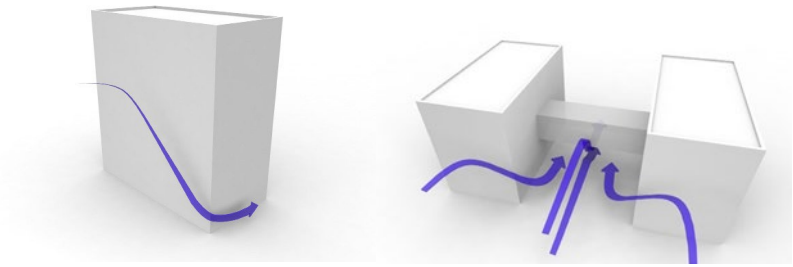
For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks; lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger, and calm wind speeds suitable for sitting or standing are desired in areas where passive activities are anticipated, such as the outdoor dining and amenity terraces.

5. RESULTS AND DISCUSSION

5.1 Wind Flow Around Buildings

The proposed re-development will be taller than its immediate surroundings to the west and therefore will tend to intercept the stronger winds at higher elevations and redirect them to the ground level. These winds subsequently move around exposed building corners (Corner Acceleration, Image 4a) and between the gaps and undercuts of adjacent buildings (Channelling Effect, Image 4b) causing a localized increase in wind activity. If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

Design details such as stepped massing and wind screens / tall trees with dense underplanting (Image 5) 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) Corner Acceleration **b) Channelling Effect**

Image 4: Generalized Wind Flows

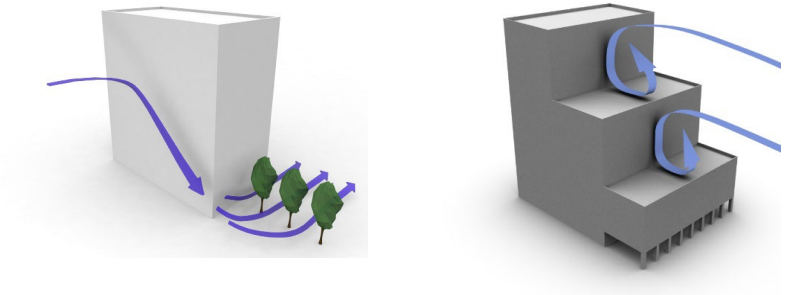


Image 5: Examples of Common Wind Control Measures

5.2 Existing Scenario

The existing site is currently occupied by the low-rise Donway Covenant United Church and is surrounded by an open school yard to the west, low-rise residential housing the north and south and mid-rise condominiums to the east. As there are no high-rise buildings immediately within the project vicinity, light to moderate wind activity is typically observed.

Wind conditions on sidewalks and walkways immediately around the site are considered comfortable for sitting or standing in the summer and for strolling or walking in the winter. Wind conditions exceeding the safety criterion are not expected.

5.3 Proposed Scenario: Wind Flow

The proposed building, at 6-storeys, is slightly taller than the existing church and therefore will be more exposed to prevailing winds. The site is relatively well sheltered to the east due to the adjacent condominiums of similar height; however, the site will be exposed to prevailing westerly winds due to the open school yard. As this is a primary wind direction for strong winds, particularly during the winter season (refer to Section 3), localized wind flow accelerations are likely to occur near exposed building corners on the west side of the site. However, the proposed stepped massing of the redevelopment is positive as it will help prevent accelerating wind flows from reaching grade level and should be carried forward in the design.

The following sections provide a discussion of the potential wind conditions around the project. The expected wind conditions are shown in Images 6a and 6b for the summer and winter seasons, respectively.

5.4 Proposed Scenario: Predicted Wind Conditions

Image 6a: Predicted Wind Conditions - Summer

5.4 Proposed Scenario: Predicted Wind Conditions

Image 6b: Predicted Wind Conditions - Winter

5.5 Proposed Scenario: Wind Safety

The project site is exposed to westerly prevailing winds due to the open school yard; however, at 6 storeys tall, the height of the proposed building is considered moderate from a wind impact perspective. Coupled with the building height, the proposed stepped massing reduces the potential for severe gusts. Therefore, wind conditions around the project are expected to meet the wind safety criterion.

Wind-tunnel testing should be conducted at a later design stage to quantify these wind conditions.

5.6 Proposed Scenario: Wind Comfort

5.6.1 Entrances

The main entrance to the proposed development is positively located in a recessed area and is sheltered by the building from westerly winds. As a result, wind conditions comfortable for sitting or standing are predicted throughout the year (marked with a triangle in Images 6a and 6b). These conditions are considered appropriate for an entrance where patrons are apt to linger.

The main church and residential entrances are located on the west side of the building corridor (marked with triangles in Images 6a and 6b). These entrances are more exposed to prevailing winds and in a region where channelling wind flows are expected to occur. For these reasons, wind conditions comfortable for sitting or standing are anticipated most of the time during the summer; however, conditions comfortable for strolling are expected in the winter due to seasonally stronger winds. These conditions are considered slightly higher than desired for an entrance location.

If lower wind speeds during the winter are desired by the design team, strategies may include recessing the entrances into the façades of the building and/or installing wind screens or planters on the west sides of the entrances. Examples of these measures are provided in Image 7.

Image 7: Examples of Wind Control Measures for Building Entrances

5.6 Proposed Scenario: Wind Comfort

5.6.2 Sidewalks and Walkways

Wind conditions at most areas at grade level around the project, including sidewalks and walkways, are predicted to be comfortable for sitting or standing in the summer and for strolling or walking in the winter (Images 6a and 6b). The highest wind speeds are expected at the west-facing corners of the building, where conditions will likely be comfortable for strolling or walking throughout most of the year.

The proposed stepped massing and undercuts at grade level are positive from a wind moderation perspective (Section 5.1) and should be retained as the design progresses. Existing and proposed landscaping onsite will also help reduce wind speeds locally when foliage is present.

It is recommended that the wind impact of the project be quantified through a wind tunnel study at a later design stage to confirm these predicted conditions and evaluate the level of wind mitigation efforts if required.

5.6.3 Outdoor Amenity Space

RWDI understands that there is an outdoor amenity space planned within the "U-shaped" courtyard on the west side of the development. During the summer, wind conditions are expected to be comfortable for sitting or standing in this area (Image 7a), which is considered appropriate for passive activities (e.g. seating, lounging, etc.). Higher wind speeds, comfortable for strolling are expected in the winter, but they are considered to be appropriate due to the reduced use of the outdoor area in the cold months.

The proposed landscaping located to the west of the outdoor amenity space is expected to provide shelter from westerly prevailing winds and should be maintained in the design (Image 8). If lower wind speeds are desired, the use of localized planters and/or moveable screens may be explored. RWDI can assist with the design and placement of these wind control elements as the project design progresses.

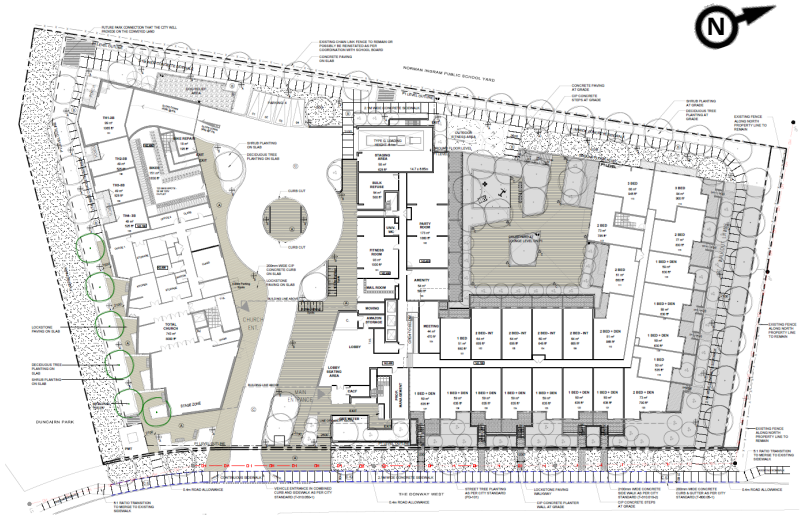


Image 8: Proposed Landscaping Plan (Courtesy NAK Design Group Inc.)

5.6 Proposed Scenario: Wind Comfort

5.6.4 Terraces

It is RWDI's understanding that there will be pedestrian accessible terraces on levels 2, 3 and 5 of the proposed development. Owing to their relatively low elevation, wind conditions are expected to be comfortable for sitting or standing in these areas in the summer (Images 6a and 6b). These conditions are considered appropriate. Similar to the outdoor amenity space, higher wind speeds comfortable for strolling are expected in the winter due to seasonally stronger winds; however, these conditions may be considered appropriate due to the limited usage of the terraces during the winter months.

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed 230 & 240 The Donway West development in Toronto, ON. 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.

Our findings are summarized as follows:

- The proposed building, at 6-storeys, is taller than the existing surroundings to the west and therefore will be more exposed to prevailing winds, particularly from the west direction due to the open school yard.
- Wind conditions on and around the proposed project are not expected to exceed the recommended criteria for pedestrian safety.
- In general, wind conditions on sidewalks and walkways are predicted to be comfortable for sitting or standing in the summer and strolling or walking in the winter. These conditions are considered appropriate.
- Suitable wind conditions are predicted for the main entrance located along The Donway West throughout the year. Exceptions include the church and residential entrances during the winter, where conditions may be slightly higher than desired. Conceptual wind control measures have been presented for consideration.
- Wind conditions within the outdoor amenity space and on the above-grade terraces are anticipated to be appropriate for passive pedestrian use during the summer season when these areas will be in use most often.

7. STATEMENT OF LIMITATIONS

The assessment presented in this report are for the proposed 230 & 240 The Donway West development 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)
18-16_DONWAY-WEST 7	Pdf	10/24/2023
230 The Donway_Landscape Set_Rezoning_2023.10.27	Pdf	10/27/2023

Limitations

This report was prepared by Rowan Williams Davies & Irwin Inc. for Donway Co-operative Development Corporation ("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.