FINAL REPORT

114 UNIVERSITY AVENUE II

EDMONTON. AB

PEDESTRIAN WIND IMPACT ASSESSMENT

PROJECT #2001930

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SUBMITTED TO

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1. INTRODUCTION

RWDI was retained by Stantec to assess the wind comfort conditions for the proposed University Avenue and 114th Street development in Edmonton, AB (Image 1) for re-zoning application, as required by the City of Edmonton as per Bylaw 16733, Section 14.2. This qualitative assessment is based on the following:

- a review of the regional long-term meteorological data from Edmonton International Airport;
- design drawings and documents received from Brian Allsopp Architects Ltd on November 9 and 12, 2020;
- wind-tunnel studies undertaken by RWDI for similar projects in Edmonton Area;
- our engineering judgment, experience and expert knowledge of wind flows around buildings[1-3]; and,
- use of software developed by RWDI (Windestimator[2]) for estimating the potential wind conditions around generalized building forms.

This qualitative approach provides a screening-level estimation of potential wind conditions. Conceptual wind control measures to improve wind comfort are recommended, where necessary. In order to quantify these conditions or refine any conceptual mitigation measures, physical scale-model tests in a boundary-layer wind tunnel would be required.

Note that other wind issues, such as those related to cladding and structural wind loads, air quality, door operability, etc., are not considered in the scope of this assessment.

Image 1: Rendering of the Proposed Project

1. 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. 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. 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. SITE & BUILDING INFORMATION

The project site is located along University Avenue, on the east side of 114th Street NW in Edmonton, AB (Image 2). The lands can be legally described as Lots 22-26, Block 6, Plan 2064S. Currently the site is occupied by a number of low-rise residential houses which will be demolished. The project site is surrounded by an open field to the north, northeast and northwest and by low-rise residential developments in all other directions. Farther away, mid to high-rise developments are located to the north of the project site. North Saskatchewan River is located approximately 1km to the west.

Image 2 – Aerial View of the Site and Surroundings (Credit: Google™ Earth)

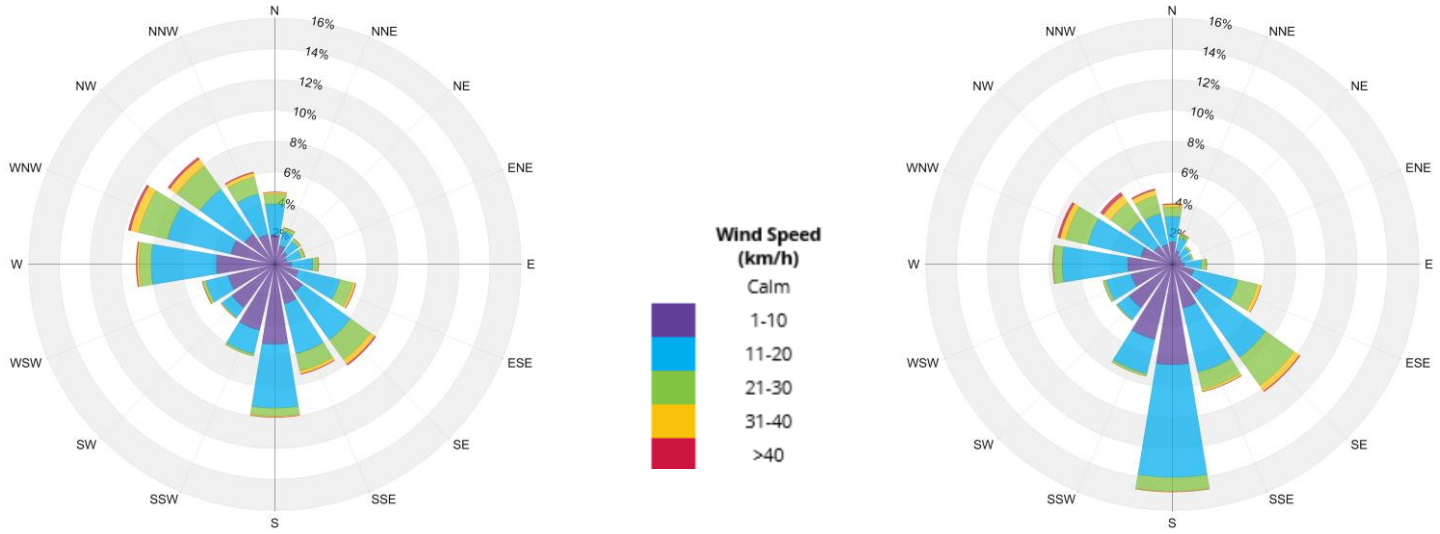
The proposed project is a 6-story residential building (18.6m tall plus the mechanical floor) (see Image 3). Key pedestrian accessible areas on and around the proposed development include main entrance and adjacent sidewalks.

Image 3 – South elevation of the proposed project

4. METEOROLOGICAL DATA

Meteorological data recorded at the Edmonton International Airport, for the period from 1987 to 2017, were used as a reference for wind conditions in the proposed project location. The distributions of wind frequency and directionality for summer (May through October) and winter (November through April) seasons are shown in Image 4.

When all wind data is considered, winds are frequent from the west through northwest and southeast through south directions in both seasons. Strong winds of a mean speed greater than 30 km/h occur mainly from the northwest and southeast directions during both seasons, The analysis methods have accounted for these and all winds directions.



Summer – May through October

Winter – November through April

Image 4 – Directional Distribution of Winds (% Blowing From Direction) Recorded at Edmonton International Airport (1987 – 2017)

5. PEDESTRIAN 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 as well as by the building design and city planning community. The criteria are as follows:

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.

Pedestrian Comfort

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: None of the comfort categories are met
Wind conditions are considered suitable for sitting, standing, strolling 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 proposed development, wind speeds comfortable for walking or strolling are appropriate for sidewalks; lower wind speeds conducive to standing are desired at the main building entrances, where pedestrians are apt to linger.

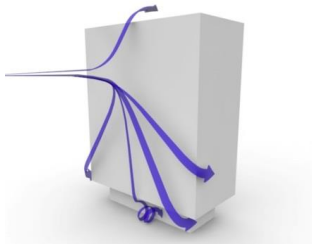
6.1 Background

Predicting wind speeds and occurrence frequencies is complicated. It involves the 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. 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.

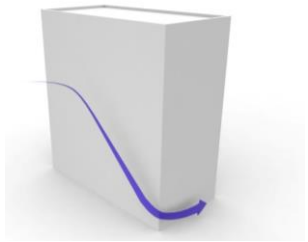
The proposed development will be taller than the immediate surroundings. Taller buildings tend to intercept stronger winds at higher elevations and redirect them to the ground level. Such a downwashing Flow (see Image 5a) is the main cause for increased wind activity around tall buildings at the pedestrian level. Oblique winds also cause wind accelerations around the exposed building corners (see Image 5b). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable conditions.

The proposed development includes some positive design features that are favorable for wind control. These include: recessed building entrance and overhang structures/ balconies creating horizontal protection at grade level.

Given the local wind climate, low-rise surroundings and positive design features mentioned above, it is expected that the wind conditions would meet the wind safety criterion on and around the proposed development. Following is a discussion of the wind comfort conditions at key pedestrian areas.



a) Downwashing Flow



c) Corner Acceleration

Image 5 – General wind flow pattern

6.2 Adjacent Sidewalks

As mentioned earlier, the proposed project is taller than the immediate surroundings. As a result, the proposed building will be exposed to the predominant northwesterly and southeasterly winds. These winds are expected to downwash off the building facades and accelerate at grade level, particularly at building corners (Images 5a and 5b). The resultant wind speeds may have slightly increased with the new development in place, but the wind conditions are still predicted to be suitable for pedestrians usage on the sidewalks of University Avenue, 114th Street NW and other nearby lanes. Wind conditions are generally expected to be comfortable strolling or walking throughout the year.

6.3 Main Entrance and Project Perimeter

Main entrance to the proposed development is located along the north façade, as indicated by a red triangle in Image 6. The north entrance will be sheltered from the predominant southeasterly winds This entrance is recessed into the building façade and includes a vestibule. Vestibules are positive design features as occupants can wait within the vestibule on a windy day. With these features in place, wind conditions on the main entrance are expected to be suitable for the intended use.

Wind conditions in the project perimeter are generally predicted to be suitable for sitting or standing throughout the year. Wind speeds likely conducive to strolling or walking are predicted near building corners, due to corner accelerations. A seating area/ patio is planned in the recessed area on the south side of the building (blue area in Image 6). During the summer when this area will be frequently used, wind conditions comfortable for sitting or standing are predicted in this area. Occasional higher wind speeds conducive to strolling or walking may occur near the building corners as mentioned earlier. If calmer wind conditions suitable for passive activities are desired in this area, dense landscaping and/ or porous partitions near building corners can be considered. Examples of these are shown in Image 7.

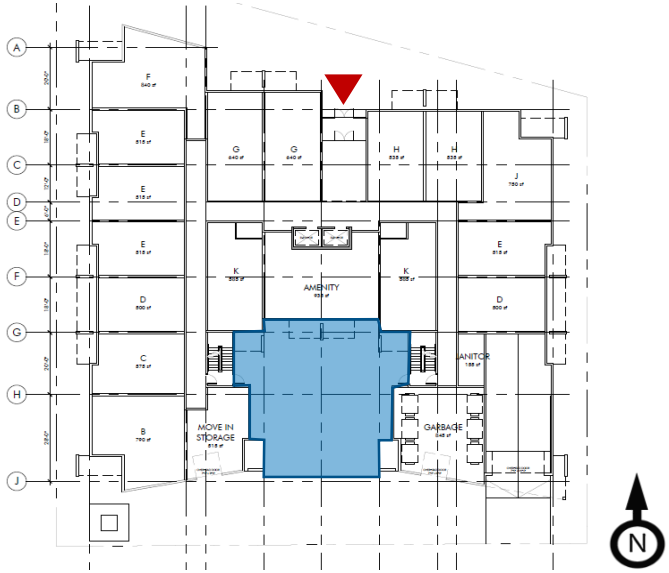


Image 6 – Main floor plan

6. PEDESTRIAN WIND CONDITIONS

Image 7 – Examples of wind control features

7. SUMMARY

The proposed University Avenue and 114th Street project will be located in Edmonton, AB. The design of the development includes several features that are positive for wind control. The expected wind flow patterns and pedestrian usage conditions have been discussed.

Wind conditions on the main entrances and sidewalks are predicted to be suitable for the intended use throughout the year. Occasional high wind activity may occur at the grade level seating area, particularly near building corners.

Conceptual wind control measures have been discussed in the report which can help to improve the conditions at areas where higher than desired wind speeds are predicted.

8. APPLICABILITY OF RESULTS

The assessment presented in this report are for the University Avenue and 114th Street based on the design drawings and documents received from Brian Allsopp Architects Ltd on March 4, 2020 . 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.