REPORT

STAIRS AND HARVEY BUILDING

HALIFAX, NS

PEDESTRIAN WIND STUDY

PROJECT #2001116

DECEMBER 9, 2019

SUBMITTED TO

Summer Wind Holdings Limited
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1. INTRODUCTION

RWDI was retained by Summer Wind Holdings Limited to conduct a pedestrian wind study for the proposed Stairs and Harvey Building in Halifax, NS (see Image 1).

This assessment was based on the following:

- A review of regional long-term meteorological data from Shearwater Airport;
- Design drawings received from WSP on November 8, 2019 and additional drawings as requested on December 4, 2019;
- Wind-tunnel studies undertaken by RWDI for similar projects in the Halifax 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. To better quantify these wind conditions, or evaluate the effectiveness of the recommended mitigation measures, physical scale-model tests in a boundary-layer wind tunnel would typically be required.

Note that other wind issues, such as those related to cladding and structural wind loads, snow drifting, etc., are not considered in the scope of this pedestrian wind assessment.

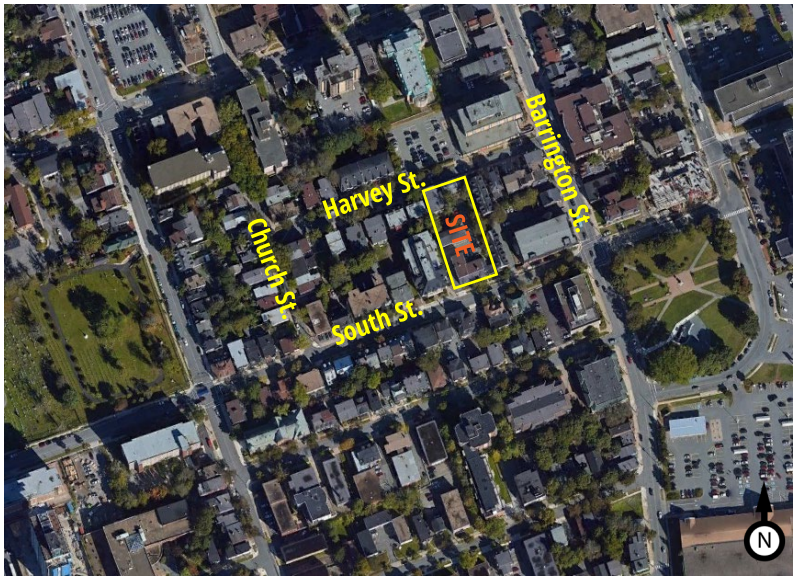


Image 1: Aerial View of Existing Site and Surrounding (Courtesy of Google™ Earth)

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 site is bounded by Harvey St. to the north and South St. to the south, between Church St. and Barrington St. (see Images 1 and 2).

The site is currently occupied by four residential buildings of 1.5 to 3 storeys and immediately surrounded by low-rise buildings in all directions (see Image 1). Further away, surrounding buildings are generally low-rise, with mid-rise buildings to the north and northeast. Downtown Halifax and Harbour are approximately 500 m to the north and east, respectively.

The proposed development will consist of a new 8-storey building on the north portion of the site, and an existing 1.5 storey building along South St., which will be revitalized (see Images 2 and 3). Pedestrian areas on and around the site include the main building entrances, rooftop amenity area and surrounding sidewalks (see Image 3).

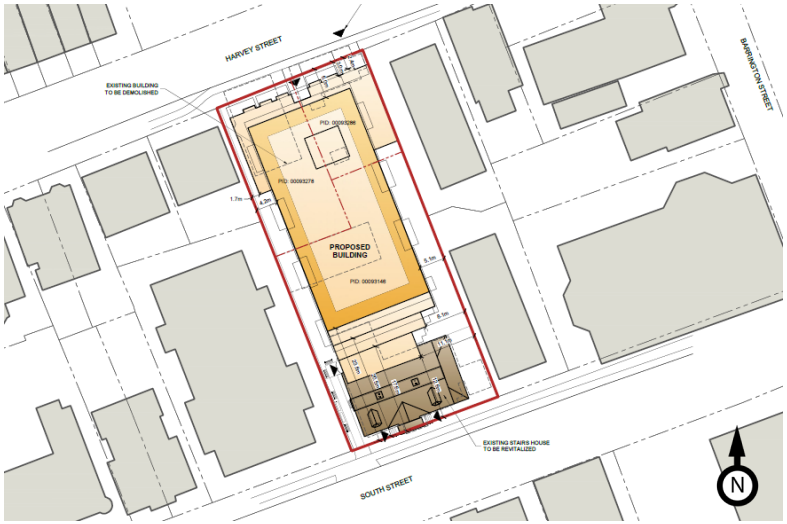


Image 2: Site Plan

Image 3: 3D Rendering of the proposed development (South St. overview)

3. METEOROLOGICAL DATA

Meteorological data from Shearwater Airport recorded between 1988 and 2018 were used as reference for wind conditions.

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 (regardless of speed), winds are frequent from the southwest quadrant in the summer, as indicated by the upper wind rose in Image 4. During the winter, the prevailing winds are from northwest quadrant, as shown by the lower wind rose in Image 4. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10m) occur more often in the winter than in the summer.

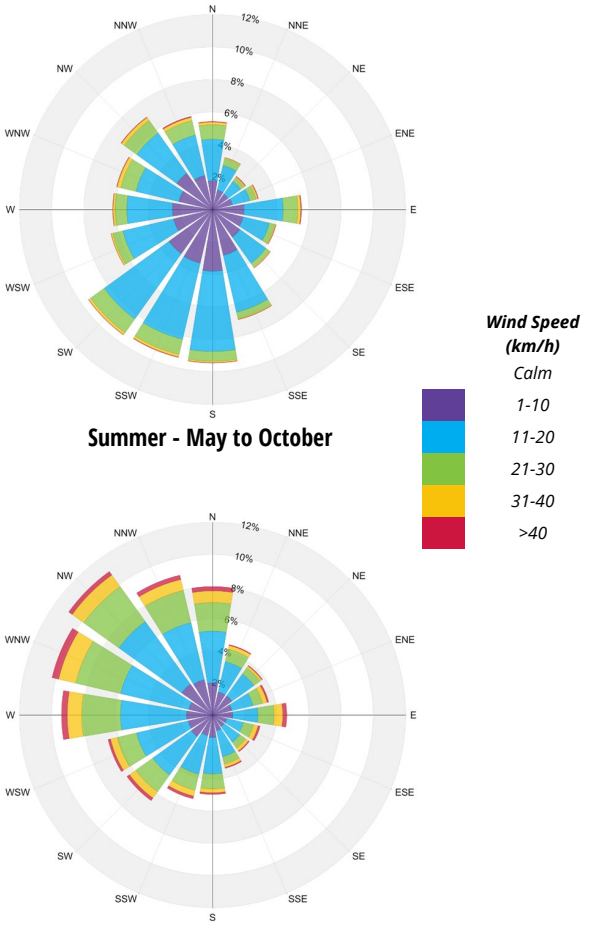


Image 4: Directional Distribution of Winds Approaching Shearwater Airport (1988 – 2018)

4. 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 and by the building design and city planning community. 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 (i.e. 9 hours per year), the wind conditions are considered severe.

4.2 Pedestrian Comfort

Wind comfort levels are categorized by pedestrian activities:

- **Sitting (≤ 10 km/h)**: Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blow 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 wind speeds are expected for at least four out of five days (i.e. 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 (10m height and with 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 lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger. Wind speeds comfortable for sitting are appropriate for terraces during the summer, when these areas will be mainly used.

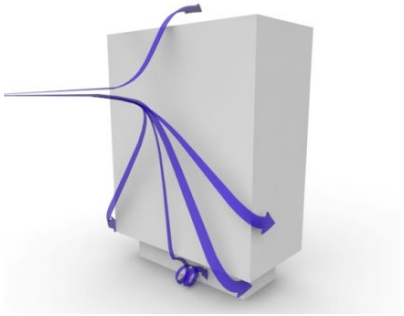
5. PEDESTRIAN WIND CONDITIONS

5.1 Background

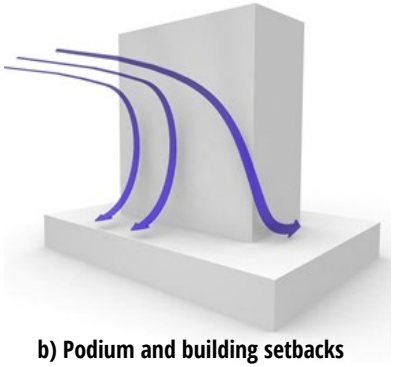
Predicting wind speeds and occurrence frequencies is complicated. It involves building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies regarding pedestrian wind conditions around buildings, yielding a broad knowledge base. This knowledge has been incorporated into RWDI's proprietary 3D software that allows, in many situations, for a qualitative, screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing.

Buildings that are taller than their immediate surroundings 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. If this building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable conditions. Building setbacks and podiums will reduce the direct impact of downwashing wind flows at grade (see Image 5b).

Detailed discussions on the potential wind comfort conditions at key pedestrian areas are provided in the sections that follow.



a) Downwashing flow



b) Podium and building setbacks reduce impact of downwashing

Image 5: General Wind Flow Patterns

5.2 Existing Wind Conditions

The site of the proposed development is exposed to the prevailing winds from the western hemisphere. However, given the low height of the existing buildings on and around the site, interaction of winds with these buildings will not result in regions of elevated conditions. Wind conditions on and around the existing site are expected to be comfortable for sitting or standing during the summer and for strolling or walking during the winter. These conditions are appropriate for the intended use of the areas.

5.3 Surrounding Sidewalks

The proposed development is not a tall building (8 storeys), but it is slightly higher than the existing building around it and will have some interaction with the prevailing winds. The stepped façade on the south, north, northwest and northeast sides of the proposed building at Level 4 and the low-rise buildings to the west of the site, will help to deflect the prevailing southwesterly and northwesterly winds accelerating down the façade away from the ground (see Image 6). Additionally, separation of the 8-storey portion of the development from the sidewalks of South St. by the existing 1.5 storey building is a positive features which helps to keep slightly higher winds away from those sidewalks. As a result of these positive design features and the moderate height of the building, wind speeds around it and along the sidewalks of Harvey St. and South St. are not going to significantly increase when compared to what is currently experienced, and will remain appropriate for the intended use, throughout the year.

Image 6: Flow patterns around the building

5.4 Entrances

The main lobby entrance to the proposed development is located along the north façade while the entrances to the amenity area are located along the south façade (marked by red triangles in Image 7). The residential entrance is located in a recessed area. This is a positive design feature which will protect the entrance from winds accelerating along Harvey St. Entrances to the amenity area are protected by the building itself and the neighbouring building to the west from the prevailing westerly and northwesterly winds. The existing and proposed trees along South Street will reduce the southwesterly winds during the summer. Appropriate wind conditions are expected at all entrances throughout the year.

Image 7: Ground floor plan

5.5 Rooftop Amenity Area

Since the proposed development is taller than its immediate surroundings, the rooftop amenity area will be exposed to the prevailing winds from all directions (see Image 8). As a result, wind speeds at this amenity area might be slightly higher than desired for passive activities during the summer when it will be mainly used. The proposed guardrails around the perimeter of this area are positive features which will provide some protection from the prevailing winds; however, they need to be min 2 to 2.5m tall to provide adequate protection. Other hard or soft landscaping elements such as trellises, windscreens and planters throughout the amenity area can provide additional wind protection. Examples of these mitigation features are shown in Image 9.

Image 8: Prevailing winds approaching the rooftop amenity area

5. PEDESTRIAN WIND CONDITIONS

Image 9: Examples of wind mitigation measures at the rooftop amenity area

6. SUMMARY

Wind conditions on and around the proposed Stairs and Harvey Building Development in Halifax, NS are discussed in this report, based on the local wind climate, surrounding buildings, RWDI's past experience with wind tunnel testing of similar buildings, and screening-level wind flow modelling.

The proposed development has a number of positive design features, such as the stepped facades at Level 4, setbacks from streets, and the recessed main entrance. As a result of these positive design features, as well as the relatively low height of the proposed building, appropriate wind conditions are expected at all sidewalks and entrances throughout the year.

Wind speeds at the rooftop amenity area might be slightly higher than desired during the summer. Wind control measures have been recommended which can help to improve the wind conditions.

7. APPLICABILITY OF RESULTS

The assessments presented in this report are for the proposed Stairs and Harvey Building Development in Halifax, NS, based on the design drawings and documents received from WSP on November 29, and December 4, 2019

In the event of any significant changes to the design, construction, 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. However, it would be the responsibility of others to contact RWDI to initiate this process.