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October 1, 2024

166 South Service Inc.
c/o Clarence Zichen Qian
Distrikt
90 Wingold Avenue, Unit 1
Toronto, Ontario M6B 1P5
czqian@distrikt.com

Re: Pedestrian Wind Study Results for Oakville TOC
166 South Service Road
RWDI Reference No. 2202917

Dear Clarence,

We have prepared this letter to comment on potential changes to wind conditions that may result from recent design updates to the proposed development at 166 South Service Road in Oakville, Ontario. These comments are based on the wind tunnel assessment conducted by RWDI in November 2023 for the then-proposed design, and reported on in September 2024 (*Report – Pedestrian Wind Study – 166 South Service Road, Oakville, Ontario – RWDI #2202917 – September 30, 2024, by Tim Aiello, Hanqing Wu, and Scott Bell*).

Updated Tower Designs

Based on new drawings dated September 6th, 2024, the overall massing and designs of the proposed buildings are similar to those used for the original wind study. The site and landscape plans used for the wind study are shown in Images 1a and 1b, and the site and landscaping plans of the updated design are shown in Images 1c and 1d. The proposed design changes that may have an impact on pedestrian wind conditions are summarized below and identified in red in Image 1c:

- Tower 1 and Tower 2 have decreased by one storey, and Tower 3 has increased by five storeys. Despite the decrease in the number of storeys, tower heights are expected to increase by 6.5 m for Tower 1, 7 m for Tower 2, and 20.8 m for Tower 3 because of the increased floor heights.
- An additional residential entrance is now located on the west façade of Tower 2, and additional retail entrances are now located around Tower 2 and Tower 3.
- Each above-grade outdoor amenity is now located one or two storeys higher.
- Two new above-grade outdoor amenities are now located on Level 3 and Level 5, immediately east and south of Tower 2.
- One storey has been added to the podia, where the now-Level 5 above-grade outdoor amenity between Tower 1 and Tower 2 has increased in size, extending along the north façade of Tower 1.

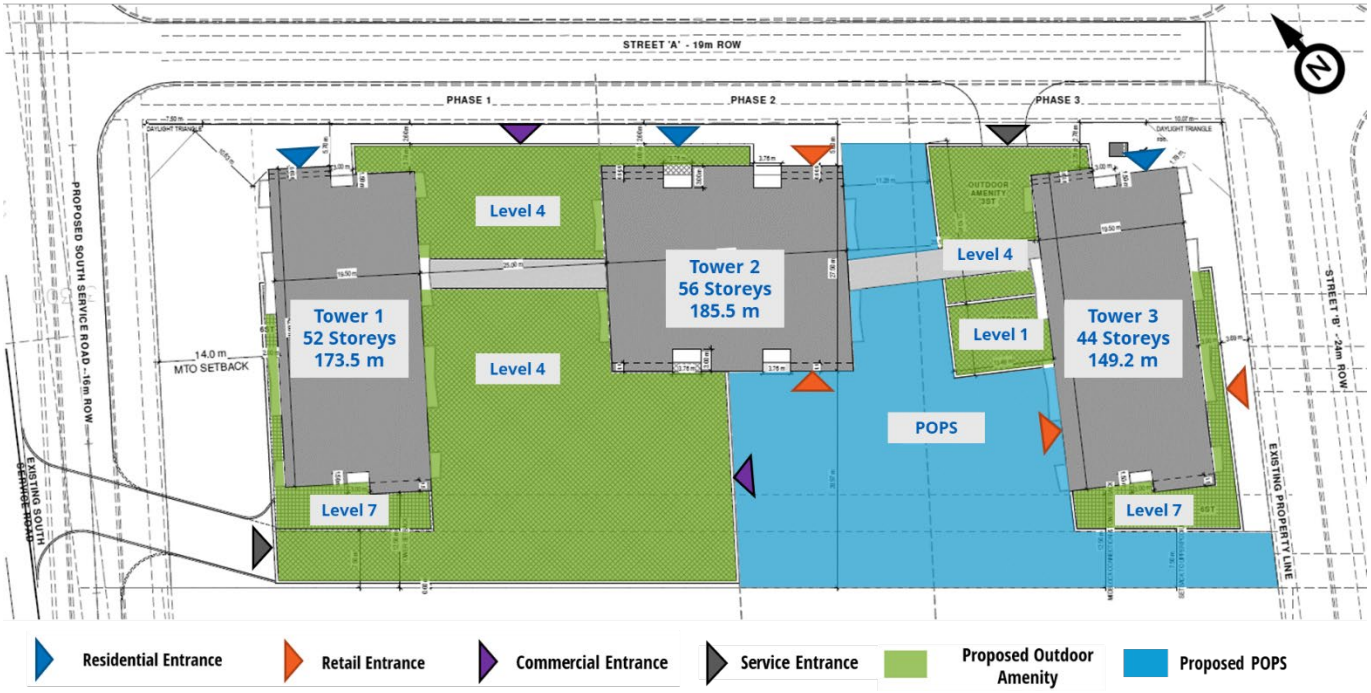

Image 1a: Original Site Plan (2023-07-08), Courtesy of Distrikt

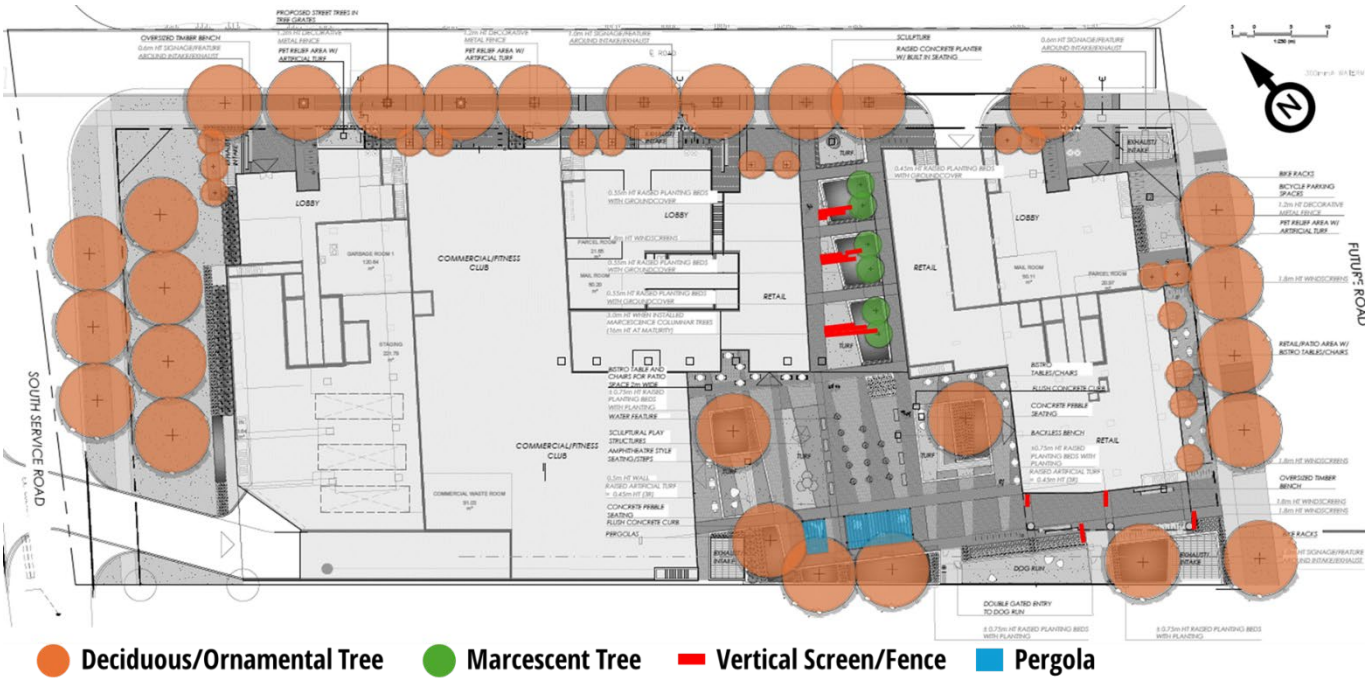

Image 1b: Original Landscape Plan (2023-10-05), Courtesy of Adesso Design Inc.

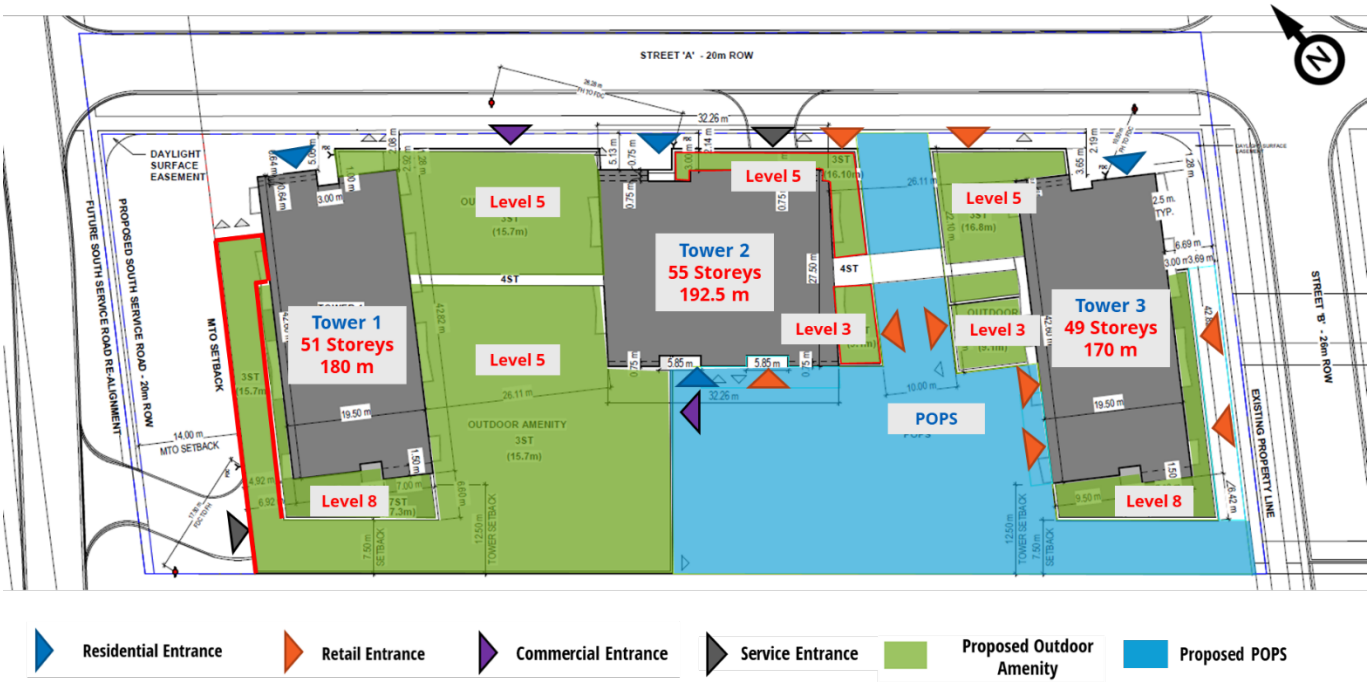

Image 1c: Updated Site Plan (2024-09-06), Courtesy of Distrikt

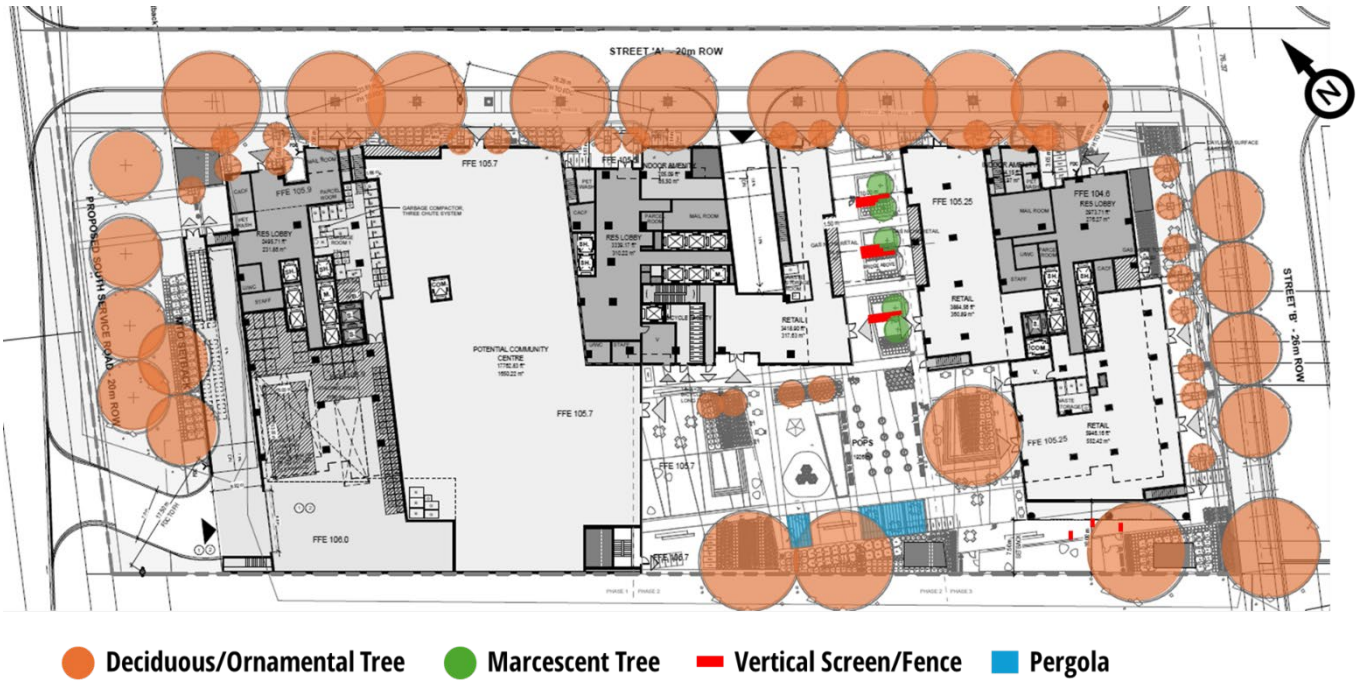

Image 1d: Updated Site Plan with Landscaping (2024-09-15), Courtesy of Distrikt

Predicted Pedestrian Wind Conditions

In the original wind study, the pedestrian wind conditions in most assessed areas of interest were predicted to be appropriate for the intended use. Exceptions to this were the higher than desired and unsafe wind speeds at the following locations:

- Summer (Wind Comfort)
  - Near the residential entrance of Tower 1
  - On the Level 4 above-grade outdoor amenities between Towers 1 and 2
  - On the Level 4 above-grade outdoor amenity of Towers 2 and 3
- Winter (Wind Comfort)
  - Two retail entrances and one commercial entrance to Tower 2
  - Along surrounding sidewalks and parking lots
- Annual (Wind Safety)
  - Two ground-level sidewalk areas to the north of Tower 1, and to the south of Tower 3
  - In the middle of the Level 4 above-grade outdoor amenity between Towers 1 and 2

The changes to the proposed development are not expected to significantly alter wind conditions around the buildings relative to the results that were predicted in the original wind study. However, with the increase in tower heights, in particular for Tower 3, a marginal increase in wind speeds may occur locally around the development, where an increase in downwashing wind flow would be expected. Generally, wind speeds that may be higher than desired for use of some grade and above-grade outdoor areas of interest are expected to continue to occur. The landscape plan presented in Image 1b for the original wind study contained marcescent landscape plantings, screens, and pergolas that were expected to diffuse both prevailing and building-induced wind flows. The landscape design for the now-proposed development (Image 1d) is expected to be similar in composition, where included plantings, screens, and pergolas are expected to continue to diffuse problematic wind flows.

After the proposed addition of entrances, the retail entrances found within and near the corridor between Towers 2 and 3 may be impacted by corner-accelerated and channelled wind flows that could result in higher than desired wind speeds during the winter. The now-proposed west façade residential entrance to Tower 2 and the north and south façade entrances to Tower 3 are to be located in areas sheltered from problematic wind flows, where wind speeds would be expected to be suitable for pedestrians throughout the year.

With the now-proposed locations of above-grade outdoor amenities, wind speeds are expected to remain similar to those found in the original wind study. On the newly proposed outdoor amenities on Level 3 and Level 5 immediately adjacent to Tower 2, and the new section of the Level 5 outdoor amenity to the north of Tower 1, wind conditions would be expected to be comparable to outdoor amenities of similar elevations. Note that localized building-induced wind flows may occur on sections of the outdoor amenities nearest to the corners Tower 1 and Tower 2, potentially resulting in higher than desired wind speeds. On the newly proposed outdoor amenity levels, we recommend the design

team consider above-grade wind control strategies previously employed in the original wind study, including but not limited to tall perimeter parapets (minimum 1.8 m tall), vertical screens, landscaping, and canopies and/or pergolas.

Concluding Remarks

The aforementioned design changes to the proposed development are not expected to significantly alter wind speeds and respective wind conditions on and around the proposed development site as compared to the original wind study, where higher-than-desired wind speeds are anticipated to remain near some building entrances and in the above-grade outdoor amenities. The overall conclusions set forth in the original wind study report would remain applicable for the updated design of the proposed development. During later stages of the development application, further testing may be completed to assess wind comfort and safety without the presence of mitigation measures, and to assess the impact that future surrounding developments currently under review may have on wind flows in the area.

We trust this satisfies your current requirements. Should you have any questions or require additional information or wind-tunnel tests at later design stages, please do not hesitate to contact us.

Yours truly,

RWDI

Scott Bell, GSC
Project Manager

Tim Aiello, M.Sc.
Technical Coordinator

Statement of Limitations

This letter was prepared by Rowan Williams Davies & Irwin Inc. ("RWDI") for 166 South Service Inc. ("Client"). The findings and conclusions presented in this letter have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this letter are based on the information available to RWDI when this letter was prepared. Because the contents of this letter may not reflect the final design of the Project or subsequent changes made after the date of this letter, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in the previous report and this letter have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in the previous report and this letter have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report/letter 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 letter carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

REPORT

166 SOUTH SERVICE ROAD

OAKVILLE, ON

PEDESTRIAN WIND STUDY
RWDI # 2202917
October 1, 2024

SUBMITTED TO

166 South Service Inc.

CC TO:

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 166 South Service Road development in Oakville, ON. The assessment was based on the wind-tunnel testing conducted for the proposed development under the Existing and Proposed configurations of the site and surroundings. The results were analysed using the regional wind climate records and evaluated against the RWDI Pedestrian Wind Criteria for pedestrian comfort (pertaining to common wind speeds conducive to different levels of human activity) and pedestrian safety (pertaining to infrequent but strong gusts that could affect a person's footing). The predicted wind conditions are presented in Figures 1A through 3B, and Table 1, and are summarized as follows:

- Wind comfort conditions on and around the existing site are expected to be appropriate for the intended use of pedestrian areas throughout the year.

- Positively, the inclusion of features such as large podia, marcescent landscape plantings, screens, and trellises are expected to diffuse prevailing and building-induced wind flows, resulting in wind speeds that are anticipated to be suitable for pedestrian use of sidewalks, building entrances, the POPS Plaza, and in the corridor between Towers 2 and 3 during the summer. During the winter, as a result of seasonally stronger winds, wind speeds near three entrance locations to Tower 2 are expected to be slightly higher than desired for pedestrian use.

- A localized area adjacent to the northeast corner of Tower 1 in summer, and many test locations along sidewalks and on parking lots around the proposed development in winter are expected to experience winds that are uncomfortable for pedestrians.

- During the summer, when above-grade outdoor spaces are anticipated to be used the most, wind speeds at most areas are expected to be suitable for patron use. Wind speeds near localized areas on the Level 4 amenity terraces between Towers 1 and 2 and adjacent to Towers 2 and 3 may be higher than desired for passive use.

- In the Existing configuration, wind speeds at all locations assessed are anticipated to meet the annual pedestrian wind safety criterion. After the addition of the proposed towers, wind speeds in localized areas on either side of the development, and on the Level 4 amenity terrace between Towers 1 and 2 are expected to exceed the safety criterion.

- To address the higher than desired wind speeds on the ground level and above-grade outdoor amenity areas expected to occur mainly during the winter, additional wind control concepts are discussed in the report for the consideration of the design team.

- if an understanding of the expected wind climate around the proposed development prior to the implementation of mitigation features is desired, additional wind tunnel testing may be considered.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 166 South Service Road development in Oakville, ON. This report presents the project objectives, approach and the main results from RWDI's assessment and provides conceptual wind control measures, where necessary. Our Statement of Limitations as it pertains to this study can be found in Section 4 of this report.

1.1 Project Description

The proposed development site is located south of the Queen Elizabeth Way, on South Service Road East. The site is surrounded by low-rise suburban neighbourhoods, commercial buildings, and parking lots in all directions (Image 1). The proposed project will consist of three high-rise buildings: Tower 1 at 52 storeys, Tower 2 at 56 storeys, and Tower 3 at 44 storeys, each with a 3-storey podium.

1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to the RWDI Criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including public sidewalks, building entrances, and outdoor amenities.

Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)

2 BACKGROUND AND APPROACH

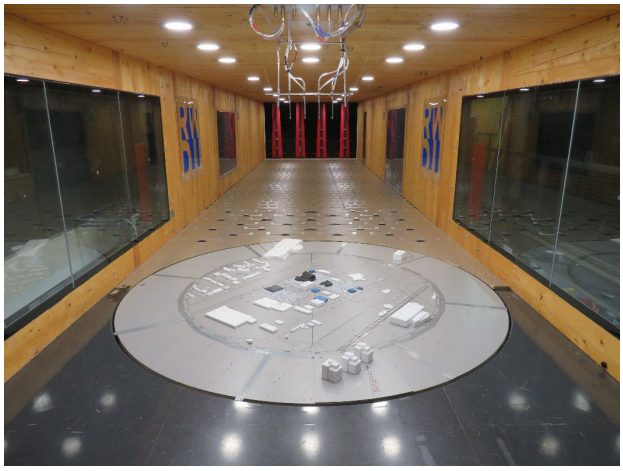
2.1 Wind Tunnel Study Model

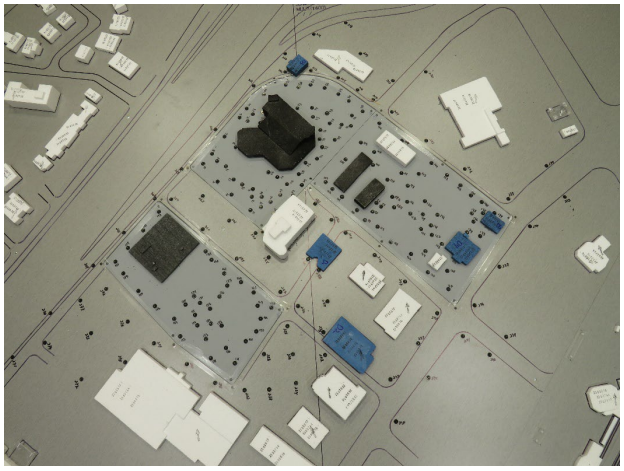
To assess the wind environment around the proposed project, a 1:400 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

A - Existing: Existing site with existing surroundings (Image 2A),

B - Proposed: Proposed project with existing surroundings (Image 2B), and,

The wind tunnel model included all relevant surrounding buildings and topography within an approximate 480 m radius around the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 101 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5 m above local grade in pedestrian areas throughout the study site. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site. Wind speeds were measured for 36 directions in 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model.





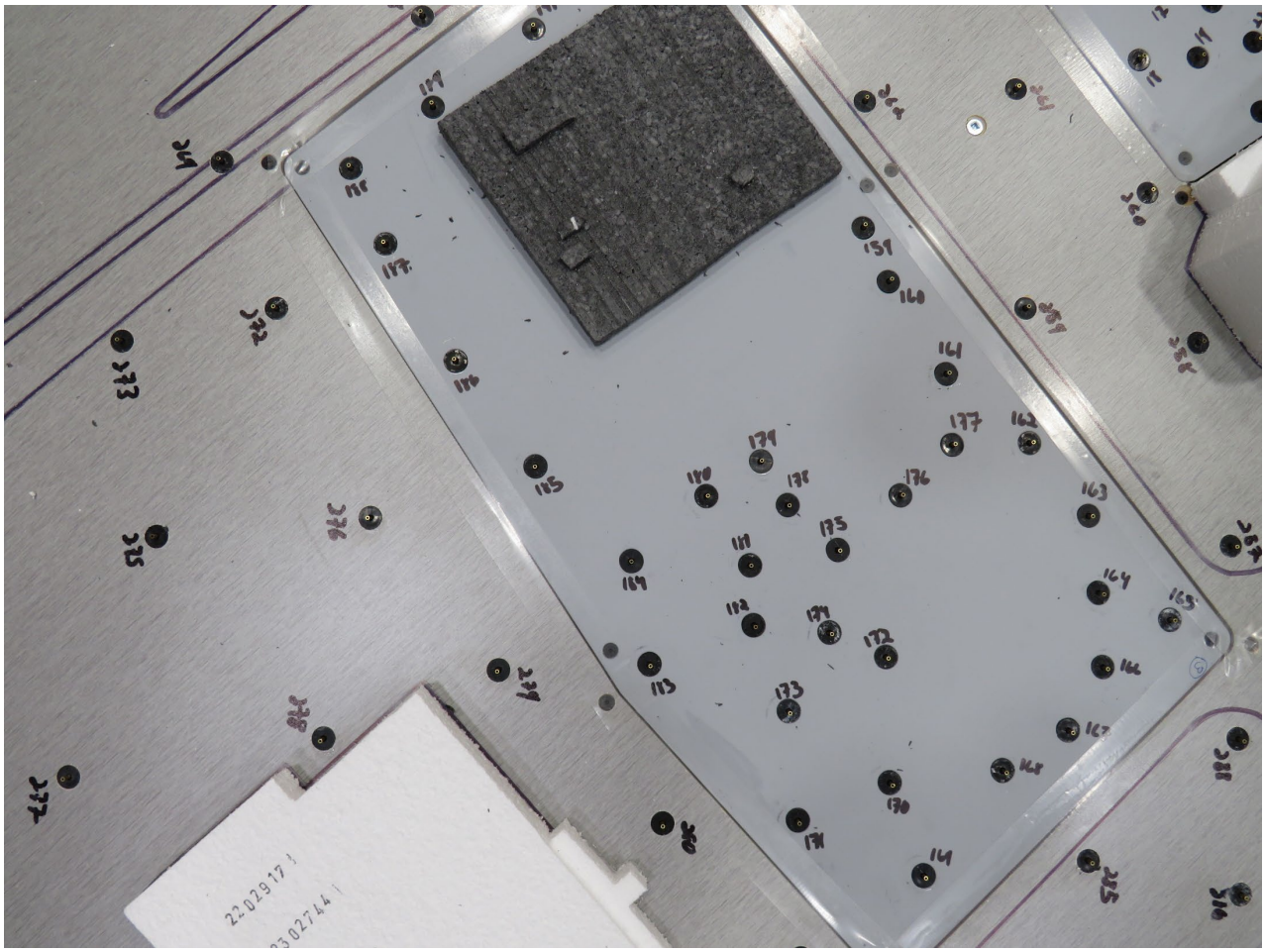
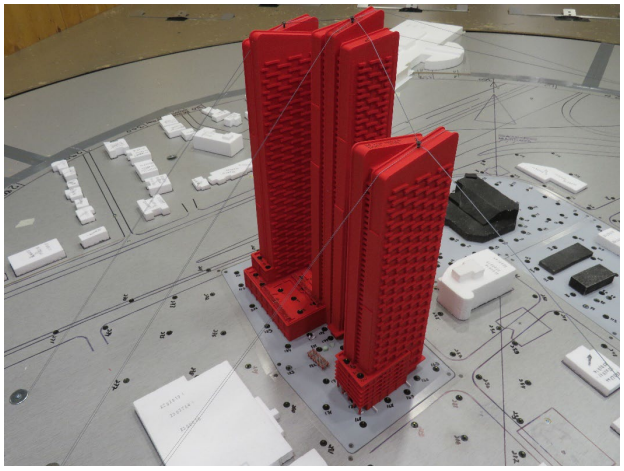


Image 2A: Wind Tunnel Study Model – Existing Configuration



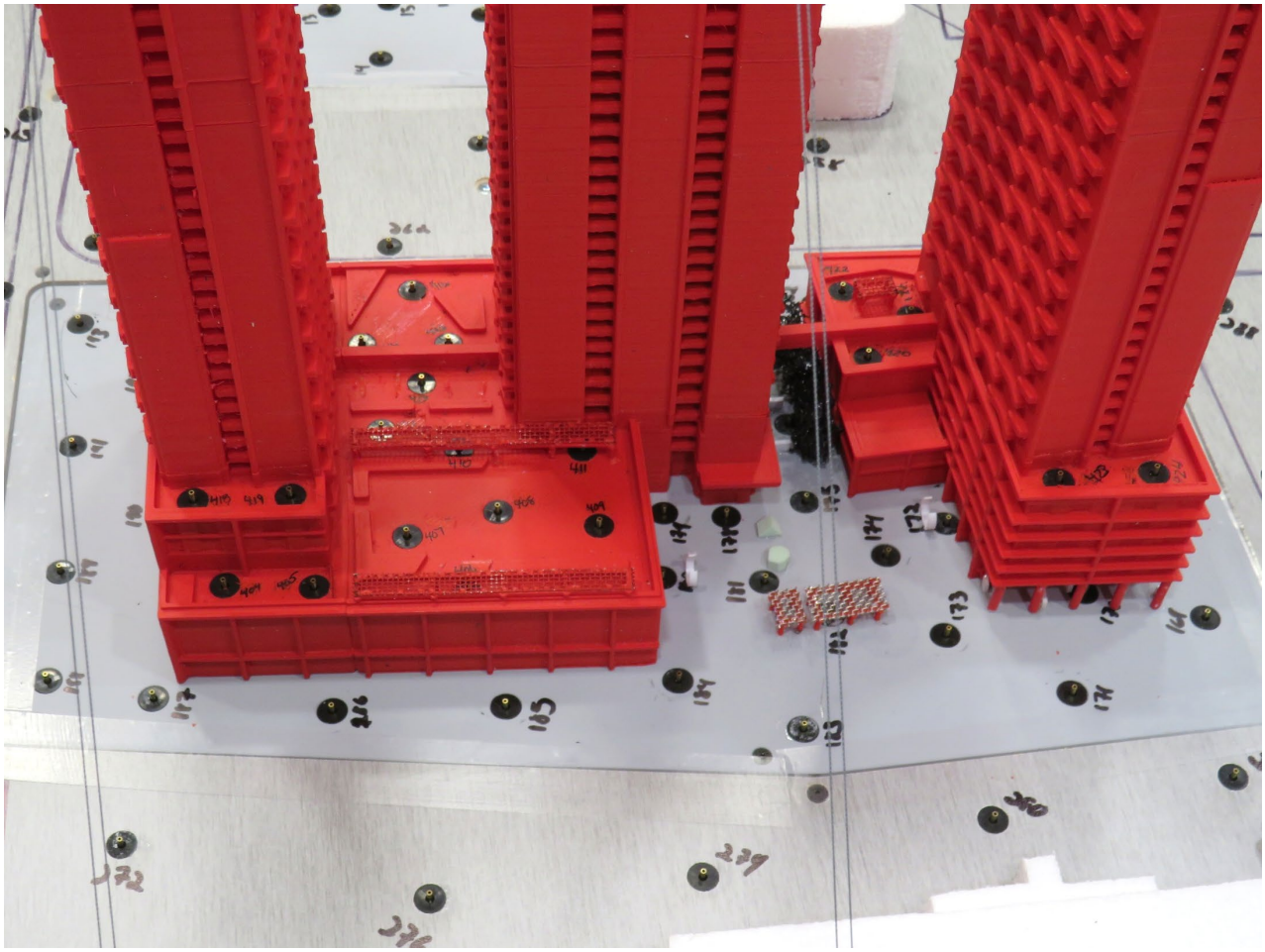
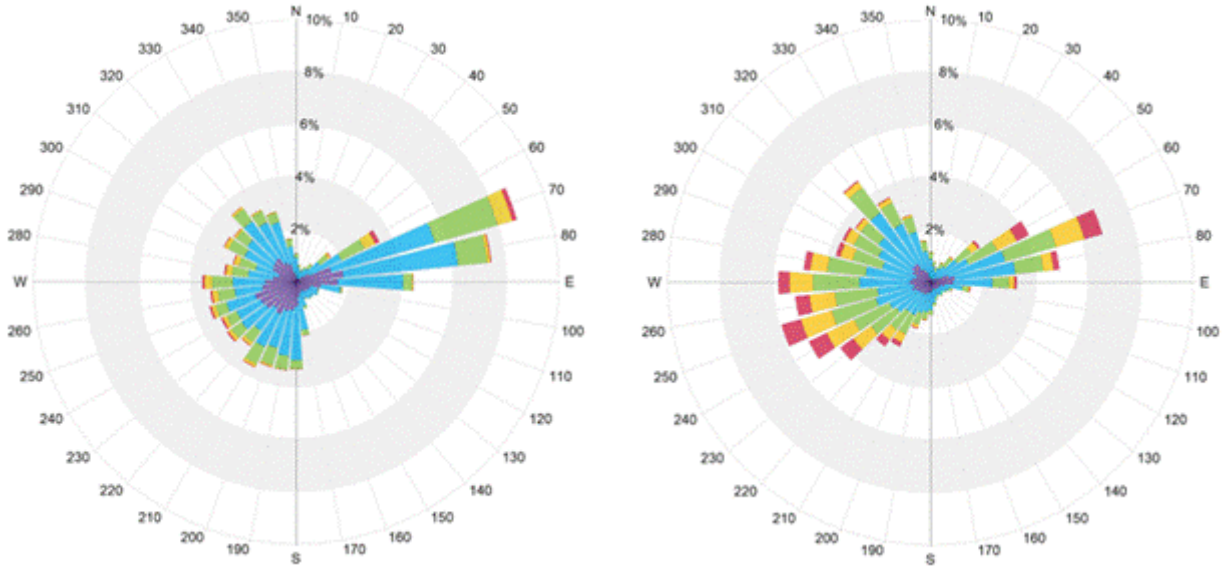


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Billy Bishop Toronto City Airport between 1990 and 2020, inclusive, were analyzed for the Summer (May through October) and Winter (November through April) seasons. Image 3 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. Winds from the east-northeast and westerly directions are predominant in both summer and winter, as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 4.3% and 17.2% of the time during the summer and winter seasons, respectively.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the wind criteria for pedestrian comfort and safety.



Summer (May – October) **Winter (November – April)**

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	5.6	2.6
1-10	30.4	17.1
11-20	43.3	37.8
21-30	16.3	25.3
31-40	3.4	11.4
>40	0.9	5.8

Image 3: Directional Distribution of Winds Approaching Billy Bishop Toronto City Airport between 1990 and 2020

2.3 RWDI Pedestrian Wind Criteria

The RWDI pedestrian wind criteria, which have been developed by RWDI through research and consulting practice since 1974, are used in the current study. These criteria have been widely accepted by municipal authorities as well as by the building design and city planning community. Regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can affect a person's perception of the wind climate. Therefore, comparisons of wind speeds for the existing and proposed building configurations are the most objective way in assessing local pedestrian wind conditions. In general, the combined effect of mean and gust speeds on pedestrian comfort can be quantified by a Gust Equivalent Mean (GEM).

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 17	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds of this magnitude are considered a nuisance for all pedestrian activities, and wind mitigation is typically recommended

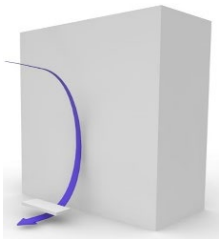
Notes:
(1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and *Gust Speed = Mean Speed + 3*RMS Speed*;
(2) Wind conditions are considered to be comfortable if the predicted GEM speeds are within the respective thresholds for at least 80% of the time between 6:00 and 23:00. Nightly hours between 0:00 and 5:00 are excluded from the wind analysis for comfort since limited usage of outdoor spaces is anticipated; and,
(3) Instead of standard four seasons, two periods of summer (May to October) and winter (November to April) are adopted in the wind analysis, because in a cold climate such as that found in Oakville, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:
(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day; and,
(2) Only gust speeds need to be considered in the Wind Safety Criterion. These are usually rare events but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

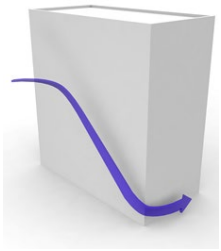
2.4 General Wind Flow Mechanisms

In the discussion of wind conditions, reference is made to the following wind flow mechanisms (Image 4):



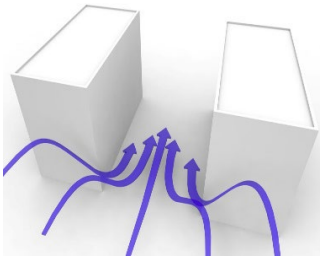
DOWNWASHING

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



CORNER ACCELERATION

When wind moves around the buildings a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level. The effect is intensified when the wind approaches at an oblique angle to a tall façade and are deflected down and around the exposed corners.



CHANNELLING EFFECT

Wind flow tends to accelerate through the space between buildings, under bridges or in passages through buildings due to channelling effect caused by the narrow gap. The effect is intensified if the channel is aligned with the predominant wind direction.

Image 4: General Wind Flow Mechanisms

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens, tall trees with dense landscaping, etc. (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.

Podium/tower setback, canopy, landscaping and wind screens (left to right)

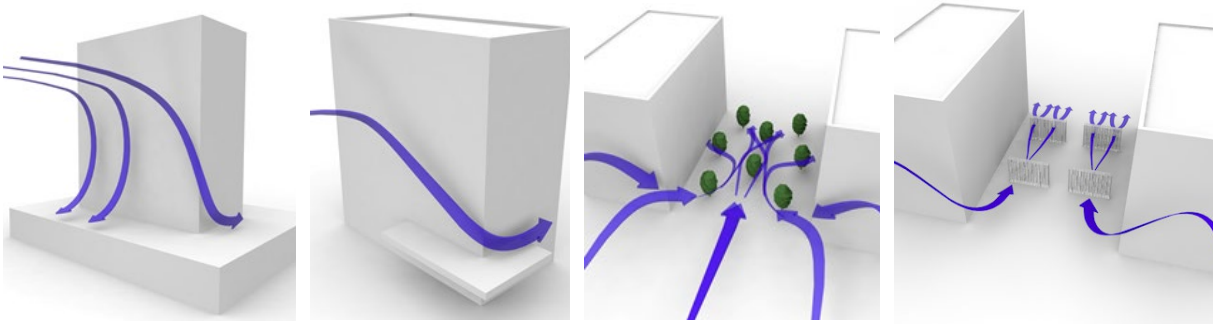


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 3B located in the "Figures" section of this report and the associated wind speeds are presented in Table 1, located in the "Tables" section of this report. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

3.1 Existing Configuration

The existing building on site is low and does not redirect winds to create any notable impact. Wind conditions on and around the site are comfortable for sitting or standing in the summer (Figure 1A) and comfortable for standing, strolling, or walking in the winter (Figure 2A). Wind speeds at all areas on and near the project site meet the Wind Safety Criterion (Figure 3A).

3.2 Proposed Configuration

The proposed buildings are taller than the immediate surroundings in all wind directions. As a result, winds intercepted by the towers at high elevations are expected to downwash to the ground level, accelerating around building corners and through the gaps between the towers. The resultant on-site wind speeds at grade are expected to be generally higher than those in the Existing configuration. These effects are expected to be moderated by the podia of the towers, which act as horizontal breaks for downwashing winds (see Image 5). The inclusion of features such as marcescent landscape plantings, screens, and pergolas are positive, and are expected to help diffuse prevailing and building-induced wind flows.

3.2.1 Wind Safety

In the Proposed configuration, the safety criterion is expected to be exceeded in localized areas on either side of the development at ground level (Locations 42 and 65 in Figure 3B), and on the Level 4 amenity terrace between Towers 1 and 2 (Location 87 in Figure 3B).

3.2.2 Wind Comfort

3.2.2.1 Sidewalks and Walkways

Wind speeds on most sidewalks around the site are expected to be comfortable for sitting, standing, strolling, or walking in the summer (Figure 1B), where uncomfortable wind conditions are anticipated at a localized area at the northeast corner of Tower 1 (Location 2 in Figure 1B). In the winter, wind speeds are predicted to be generally higher. Speeds comfortable for walking or lower are still predicted at most measured locations; however, uncomfortable wind speeds are anticipated over large regions around all towers (Figure 2B). Conditions further away from the proposed buildings are anticipated to remain similar to the existing scenario.

3.2.2.2 Building Entrances

Building entrances are proposed near Locations 1, 4, 6, 7, 11, 13, 20, 24, and 28 in Figures 1B and 2B. During the summer, wind speeds near each entrance are expected to be comfortable for sitting or standing, which is suitable for pedestrian use (Figure 1B). During the winter, seasonally stronger winds are expected to occur and interact with the massing of the proposed towers. Resulting wind speeds near Locations 7, 11, and 13 are expected to be comfortable for strolling, which is slightly higher than desired for pedestrian use (Figure 2B). Generally, to improve wind conditions near entrance areas, the design team may consider relocating entrances away from building corners of corridors between towers, recess entrances into the building façade, and/or installing vertical screens or overhead canopies around the entrances (Image 6).

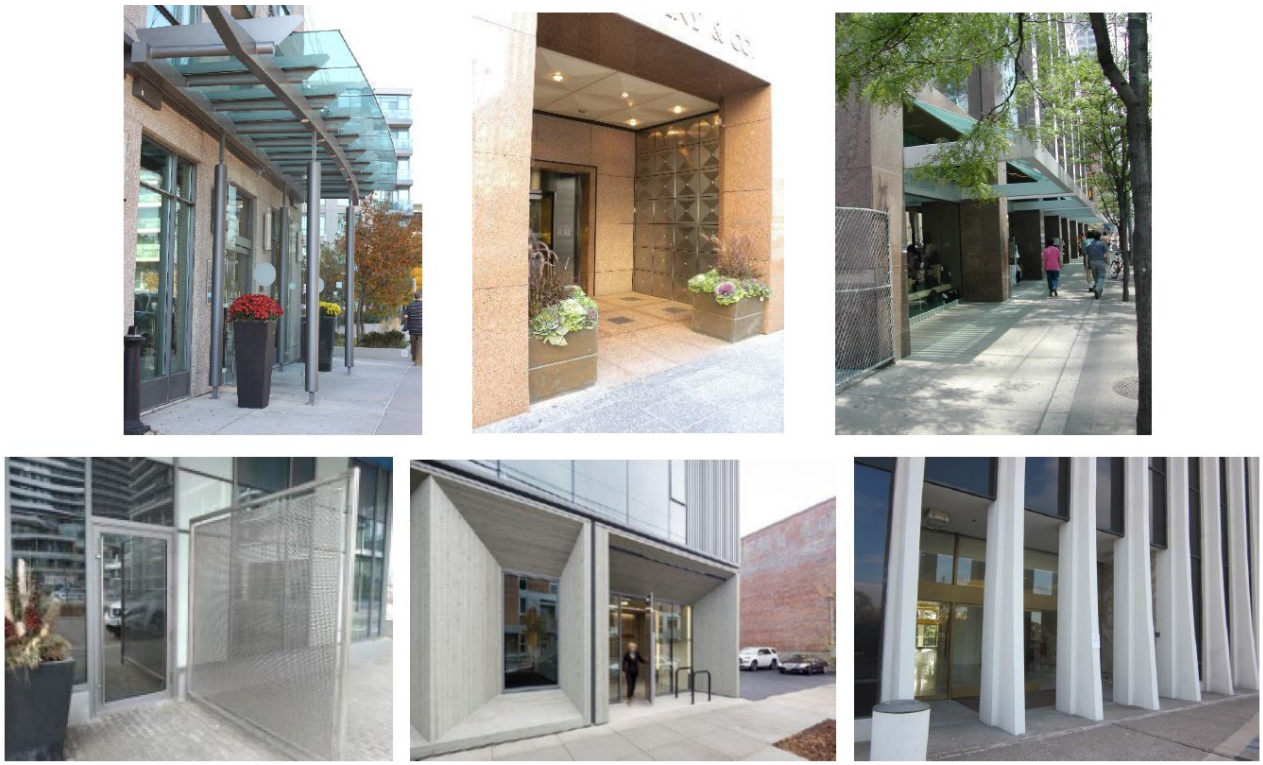


Image 6: Design Strategies for Wind Control at Entrances Experiencing Problematic Wind Flows

3.2.2.3 Privately-Owned Publicly Accessible Space (POPS) Plaza

The privately-owned publicly accessible space (POPS) is expected to encompass the plaza area between Tower 2 and Tower 3 (Locations 8 through 22 in Figures 1B and 2B). Wind conditions at the plaza between the towers are expected to be comfortable for sitting or standing in the summer, and comfortable for sitting, standing, or strolling in the winter (Figures 1B and 2B). These wind speeds are adequate for passive uses during the summer, and active uses during the winter when pedestrians may be less likely to utilize outdoor spaces.

3.2.2.4 Above-Grade Outdoor Amenity Spaces

In the summer, wind speeds on the above-grade outdoor amenity spaces are anticipated to be comfortable for sitting or standing across most areas assessed, and would be comfortable for passive patron use (Figure 1B). Higher

speeds due to channelling and corner-accelerations are expected to occur in an area between Towers 1 and 2 (comfortable for walking; Location 87 in Figure 1B), and near the northeast corner of both Tower 2 and Tower 3 (comfortable for strolling; Locations 83 and 96 in Figure 1B). In the winter, elevated wind speeds are predicted on most areas on the terraces (Figure 2B); however, high wind speeds in the winter may not be a serious concern if limited use of the terraces is expected in the colder months of the year.

Positively, the inclusion of pergola features and tall perimeter guardrails are expected to moderate some amounts of wind flows throughout the year. The design team may consider a variety of additional wind control measures to mitigate against additional higher-than-desired wind speeds. These measures may include canopies and additional pergolas at the base of each tower to diffuse downwashing wind flows, in addition to tall vertical screens and/or planters to diffuse the incoming wind flows through each space. Examples of these measures are presented in Image 7.

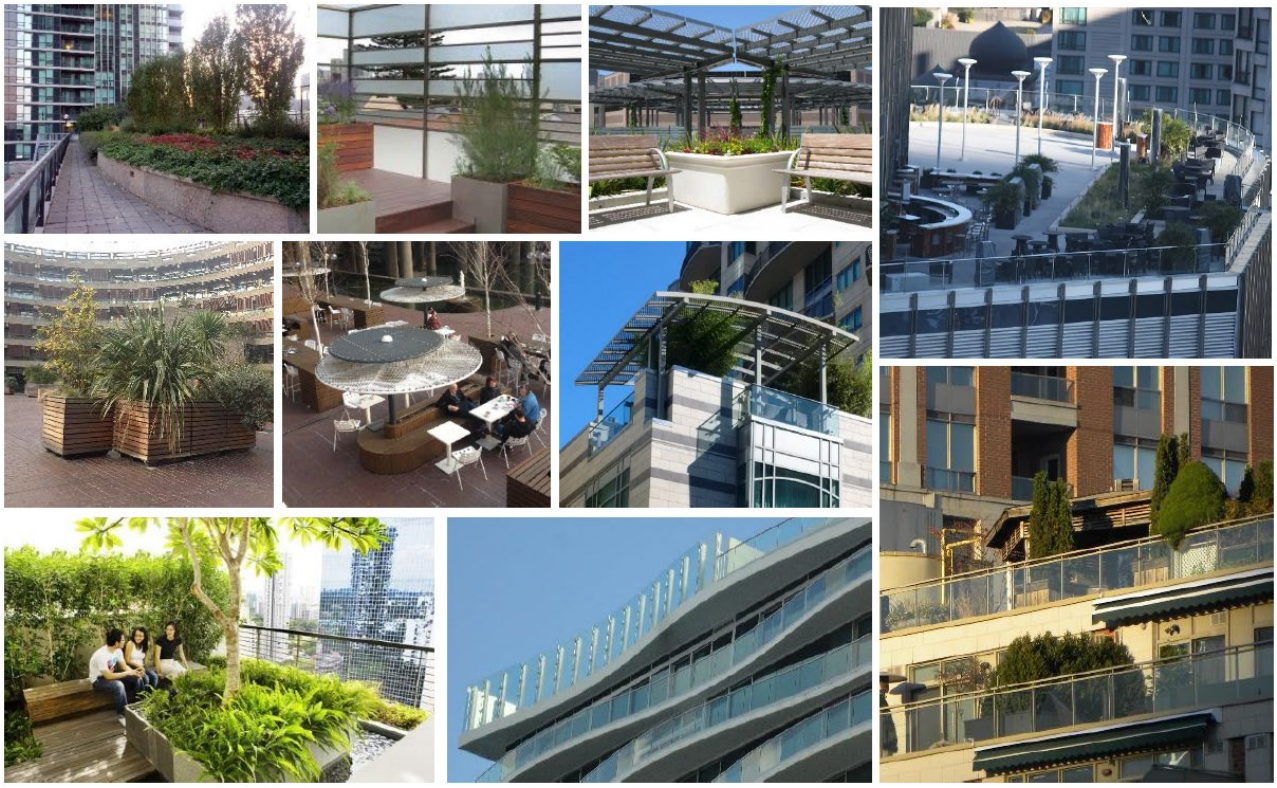


Image 7: Design Strategies for Wind Control on the Above-Grade Outdoor Amenities

4 STATEMENT OF LIMITATIONS

Limitations

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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.

Design Assumptions

RWDI confirms that the pedestrian wind assessment (the "**Assessment**") discussed herein was performed by RWDI in accordance with generally accepted professional standards at the time when the Assessment was performed and in the location of the Project. No other representations, warranties, or guarantees are made with respect to the accuracy or completeness of the information, findings, recommendations, or conclusions contained in this Report. This report is not a legal opinion regarding compliance with applicable laws.

The findings and recommendations set out in this report are based on the following information disclosed to RWDI. Drawings and information listed below were received from the Client and used to construct the scale model of the proposed development ("**Project Data**")

File Name	File Type	Date Received (dd/mm/yyyy)
2128_Oakville Transit Hub_Arch ZBA-OPA Coordination Set_23-09-14	PDF	15/09/2023
21-238L-Ground-0_Landscape Concept_Issue for Review & Coordination_2023-10-05	PDF	10/10/2023
2023-09-13_2128 Oakville Transit Hub_ Design Development_w landscape_BR	SKP	10/10/2023

The recommendations and conclusions are based on the assumption that the Project Data and Climate Data are accurate and complete. RWDI assumes no responsibility for any inaccuracy or deficiency in information it has received from others. In addition, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design, quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

The opinions in this report can only be relied upon to the extent that the Project Data and Project Specific Conditions have not changed. Any change in the Project Data or Project Specific Conditions not reflected in this report can impact and/or alter the recommendations and conclusions in this report. Therefore, it is incumbent upon the Client and/or any other third party reviewing the recommendations and conclusions in this report to contact RWDI in the event of any change in the Project Data and Project Specific Conditions in order to determine whether any such change(s) may impact the assumptions upon which the recommendations and conclusions were made.

5 REFERENCES

1. ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.

2. Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

3. Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4. Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5. Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

6. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

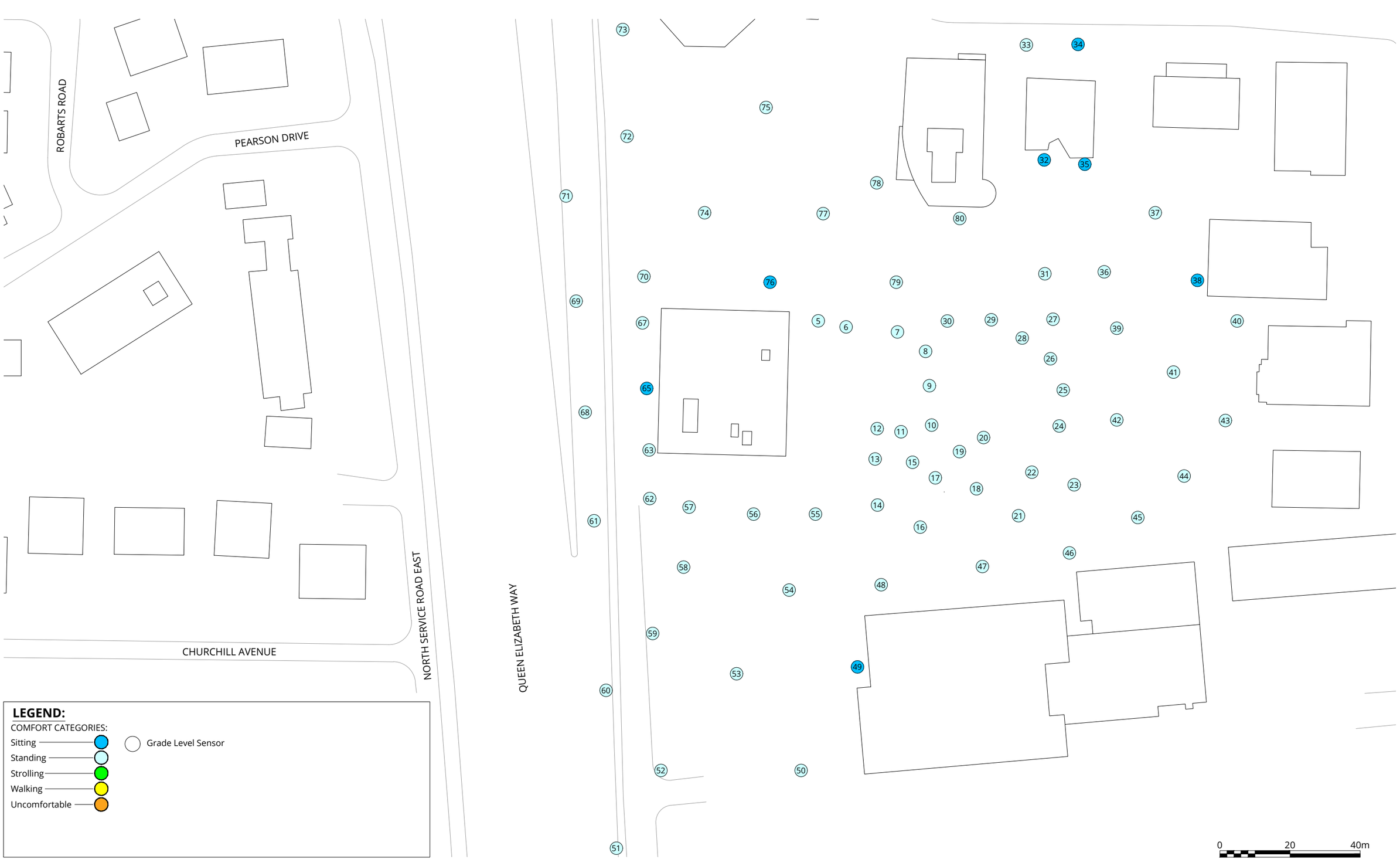
7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

8. Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp.215-226.

9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.

10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

FIGURES



Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

166 South Service Road - Oakville, ON

True North

Project #2202917

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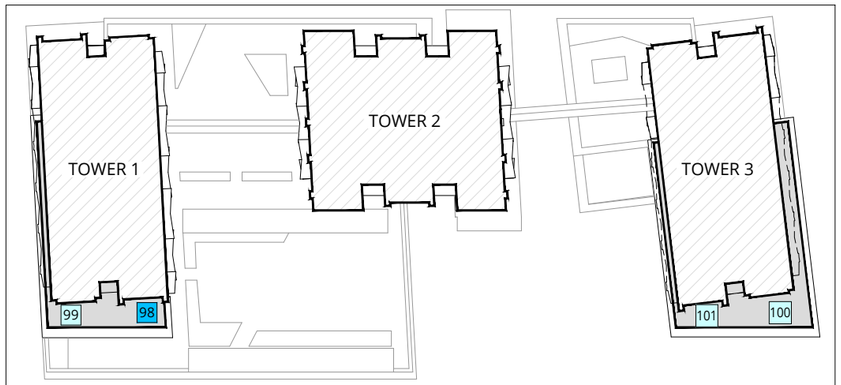
Date Revised:	Nov. 1, 2023



Level 7 Terraces
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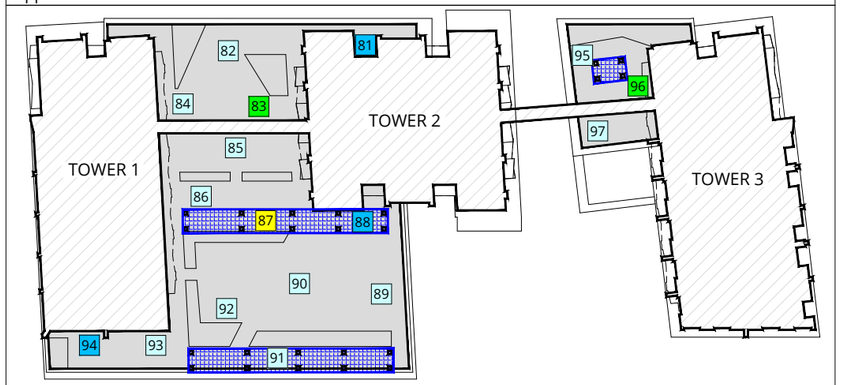

Level 4 Amenity Terraces
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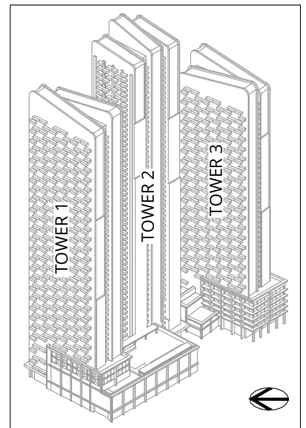

Isometric View of Buildings

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

- Grade Level Sensor
- Amenity Terrace Sensor
- Building Above Removed for Clarity
- Main Entrance Location

LANDSCAPING:
- Play Structure (2-3m Tall)
- Sculpture (4-5m Tall)
- Proposed Marcescent (10m Tall)

MITIGATION:
- Solid Screen Wall (1.8m Tall)
- Pergola (3.5m Tall)

0 20 40m

Pedestrian Wind Comfort Conditions

Proposed Configuration
Summer (May to October, 6:00 to 23:00)

166 South Service Road - Oakville, ON

True North

Project #2202917

Drawn by:	GRE	Figure:	1B
Approx. Scale:	1:1250		
Date Revised:	Nov. 1, 2023		

Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

166 South Service Road - Oakville, ON

True North

Project #2202917

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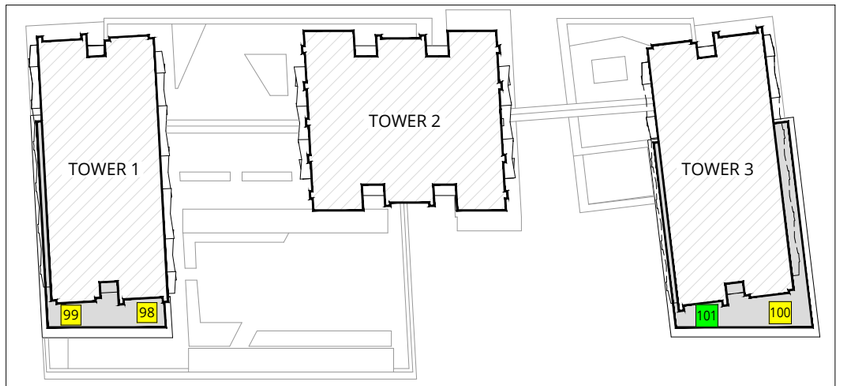
Date Revised:	Nov. 1, 2023



Level 7 Terraces
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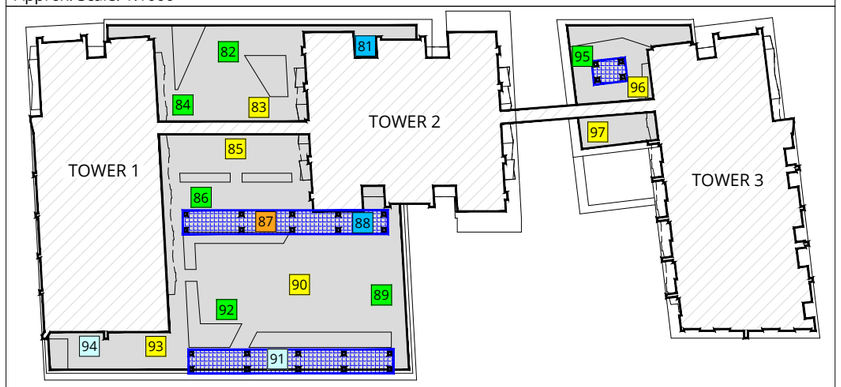

Level 4 Amenity Terraces
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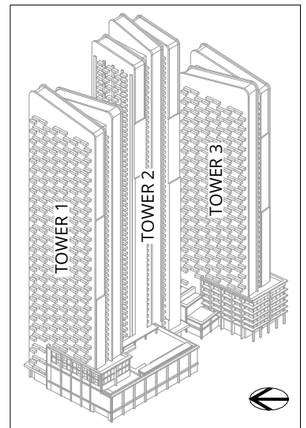


Isometric View of Buildings

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

- Grade Level Sensor
- Amenity Terrace Sensor
- Building Above Removed for Clarity
- Main Entrance Location

LANDSCAPING:
- Play Structure (2-3m Tall)
- Sculpture (4-5m Tall)
- Proposed Marcescent (10m Tall)

MITIGATION:
- Solid Screen Wall (1.8m Tall)
- Pergola (3.5m Tall)

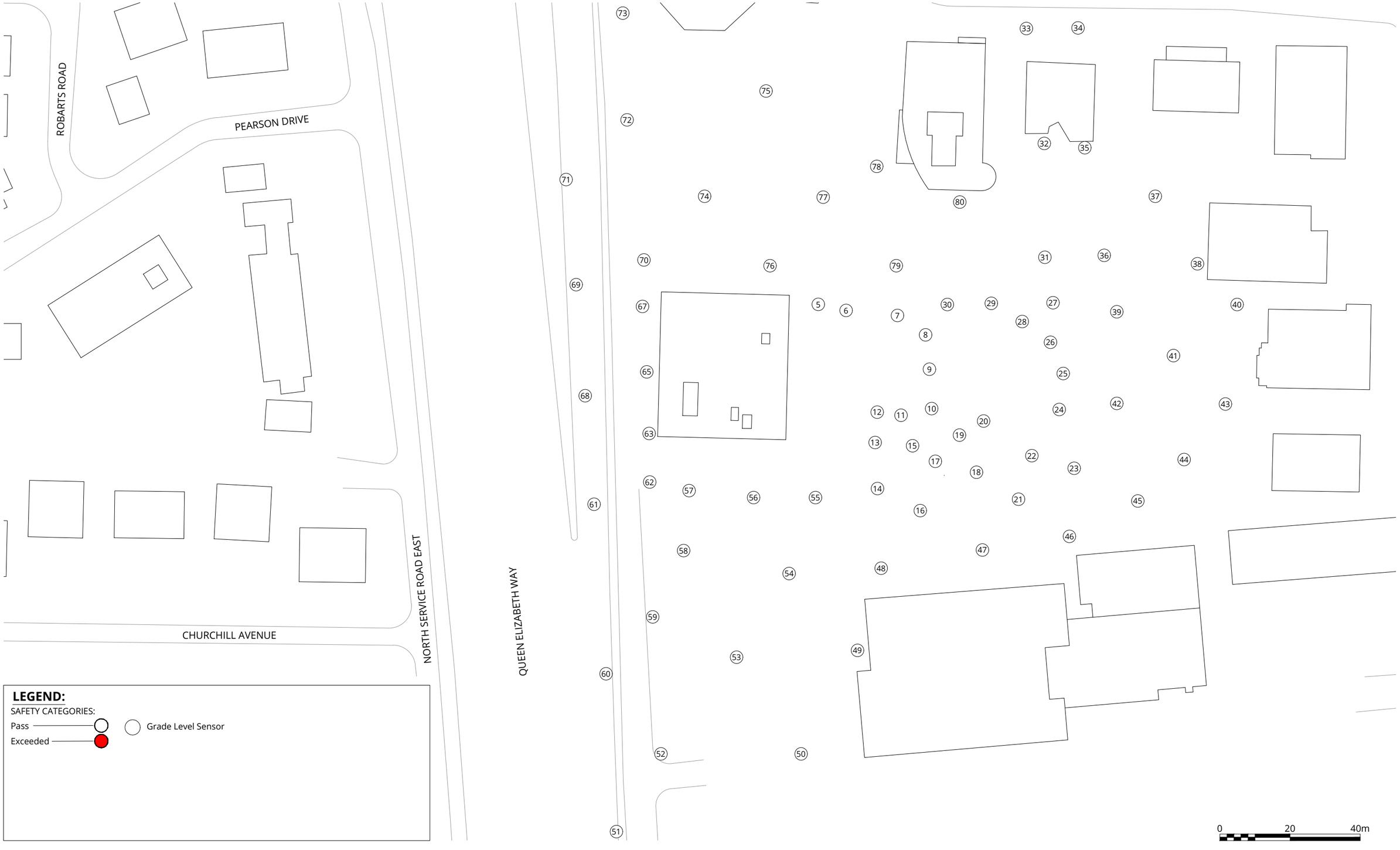
Pedestrian Wind Comfort Conditions
Proposed Configuration
Winter (November to April, 6:00 to 23:00)

166 South Service Road - Oakville, ON

True North

Project #2202917

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1:1250		
Date Revised:	Nov. 1, 2023		



LEGEND:

SAFETY CATEGORIES:

Pass

Exceeded

Grade Level Sensor

0 20 40m

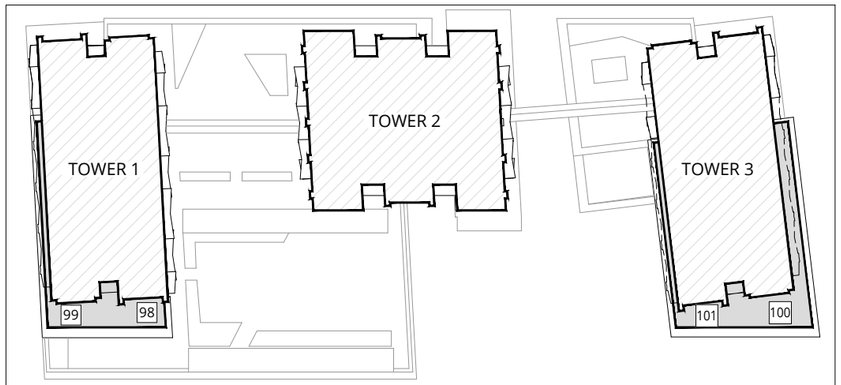
Pedestrian Wind Safety Conditions
Existing Configuration
Annual (January to December, 0:00 to 23:00)

166 South Service Road - Oakville, ON

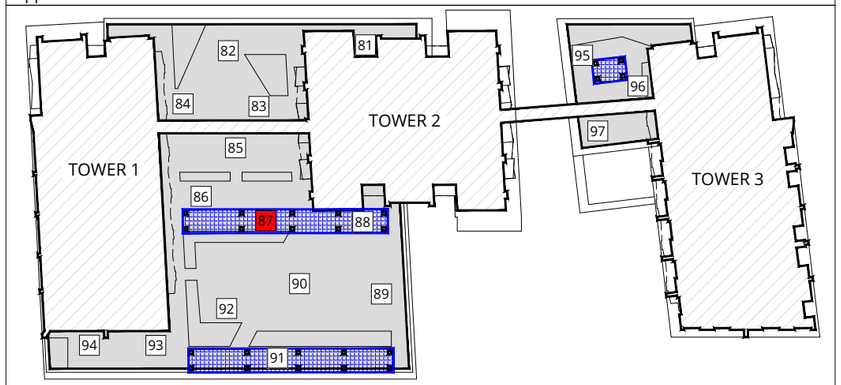
True North

Project #2202917

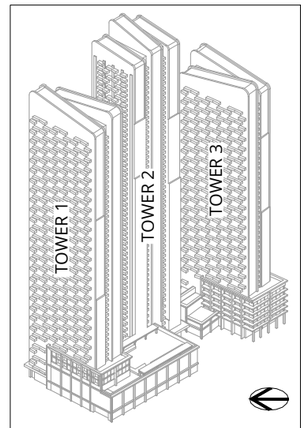
Drawn by:	GRE	Figure:	3A
Approx. Scale:	1:1250		
Date Revised:	Nov. 1, 2023		



Level 7 Terraces
Approx. Scale: 1:1000



Level 4 Amenity Terraces
Approx. Scale: 1:1000



Isometric View of Buildings

LEGEND:

SAFETY CATEGORIES:
- Pass
- Exceeded
- Grade Level Sensor
- Amenity Terrace Sensor
- Building Above Removed for Clarity
- Main Entrance Location

LANDSCAPING:
- Play Structure (2-3m Tall)
- Sculpture (4-5m Tall)
- Proposed Marcescent (10m Tall)

MITIGATION:
- Solid Screen Wall (1.8m Tall)
- Pergola (3.5m Tall)

0 20 40m

Pedestrian Wind Safety Conditions
Proposed Configuration
Annual (January to December, 0:00 to 23:00)

166 South Service Road - Oakville, ON

True North

Project #2202917

Drawn by:	GRE	Figure:	3B
Approx. Scale:	1:1250		
Date Revised:	Nov. 1, 2023		

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
1	Existing	-	-	-	-	-	-
	Proposed	11	Standing	14	Standing	56	Pass
2	Existing	-	-	-	-	-	-
	Proposed	21	Uncomfortable	30	Uncomfortable	88	Pass
3	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Strolling	80	Pass
4	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	55	Pass
5	Existing	12	Standing	15	Strolling	59	Pass
	Proposed	11	Standing	14	Standing	62	Pass
6	Existing	13	Standing	16	Strolling	60	Pass
	Proposed	10	Sitting	13	Standing	53	Pass
7	Existing	13	Standing	18	Walking	63	Pass
	Proposed	12	Standing	16	Strolling	61	Pass
8	Existing	13	Standing	17	Strolling	59	Pass
	Proposed	13	Standing	16	Strolling	59	Pass
9	Existing	13	Standing	17	Strolling	60	Pass
	Proposed	12	Standing	17	Strolling	60	Pass
10	Existing	13	Standing	18	Walking	62	Pass
	Proposed	13	Standing	17	Strolling	65	Pass
11	Existing	12	Standing	18	Walking	62	Pass
	Proposed	10	Sitting	15	Strolling	66	Pass
12	Existing	12	Standing	18	Walking	63	Pass
	Proposed	8	Sitting	11	Standing	44	Pass
13	Existing	13	Standing	18	Walking	62	Pass
	Proposed	11	Standing	15	Strolling	59	Pass
14	Existing	13	Standing	19	Walking	62	Pass
	Proposed	12	Standing	17	Strolling	66	Pass
15	Existing	12	Standing	17	Strolling	59	Pass
	Proposed	11	Standing	15	Strolling	60	Pass
16	Existing	12	Standing	17	Strolling	57	Pass
	Proposed	14	Standing	19	Walking	76	Pass
17	Existing	13	Standing	18	Walking	60	Pass
	Proposed	11	Standing	15	Strolling	58	Pass
18	Existing	13	Standing	17	Strolling	59	Pass
	Proposed	11	Standing	16	Strolling	65	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
19	Existing	13	Standing	18	Walking	61	Pass
	Proposed	10	Sitting	13	Standing	49	Pass
20	Existing	13	Standing	18	Walking	59	Pass
	Proposed	8	Sitting	10	Sitting	41	Pass
21	Existing	12	Standing	16	Strolling	55	Pass
	Proposed	14	Standing	20	Walking	74	Pass
22	Existing	13	Standing	17	Strolling	58	Pass
	Proposed	8	Sitting	12	Standing	61	Pass
23	Existing	12	Standing	16	Strolling	55	Pass
	Proposed	20	Walking	28	Uncomfortable	85	Pass
24	Existing	13	Standing	18	Walking	60	Pass
	Proposed	11	Standing	12	Standing	62	Pass
25	Existing	13	Standing	18	Walking	60	Pass
	Proposed	10	Sitting	12	Standing	59	Pass
26	Existing	14	Standing	19	Walking	61	Pass
	Proposed	11	Standing	13	Standing	77	Pass
27	Existing	14	Standing	19	Walking	62	Pass
	Proposed	16	Strolling	20	Walking	75	Pass
28	Existing	13	Standing	19	Walking	60	Pass
	Proposed	11	Standing	13	Standing	65	Pass
29	Existing	14	Standing	18	Walking	61	Pass
	Proposed	13	Standing	17	Strolling	62	Pass
30	Existing	13	Standing	17	Strolling	59	Pass
	Proposed	12	Standing	15	Strolling	56	Pass
31	Existing	14	Standing	19	Walking	62	Pass
	Proposed	15	Strolling	20	Walking	80	Pass
32	Existing	9	Sitting	13	Standing	52	Pass
	Proposed	11	Standing	15	Strolling	59	Pass
33	Existing	11	Standing	15	Strolling	53	Pass
	Proposed	13	Standing	16	Strolling	56	Pass
34	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	12	Standing	16	Strolling	59	Pass
35	Existing	8	Sitting	12	Standing	58	Pass
	Proposed	12	Standing	16	Strolling	67	Pass
36	Existing	13	Standing	19	Walking	61	Pass
	Proposed	15	Strolling	20	Walking	81	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
37	Existing	13	Standing	19	Walking	62	Pass
	Proposed	13	Standing	18	Walking	84	Pass
38	Existing	10	Sitting	14	Standing	54	Pass
	Proposed	14	Standing	20	Walking	90	Pass
39	Existing	13	Standing	19	Walking	62	Pass
	Proposed	16	Strolling	21	Uncomfortable	85	Pass
40	Existing	13	Standing	16	Strolling	74	Pass
	Proposed	14	Standing	22	Uncomfortable	86	Pass
41	Existing	13	Standing	17	Strolling	61	Pass
	Proposed	16	Strolling	23	Uncomfortable	81	Pass
42	Existing	13	Standing	17	Strolling	59	Pass
	Proposed	16	Strolling	23	Uncomfortable	92	Exceeded
43	Existing	12	Standing	15	Strolling	62	Pass
	Proposed	14	Standing	21	Uncomfortable	65	Pass
44	Existing	13	Standing	16	Strolling	59	Pass
	Proposed	16	Strolling	24	Uncomfortable	78	Pass
45	Existing	12	Standing	16	Strolling	55	Pass
	Proposed	15	Strolling	23	Uncomfortable	76	Pass
46	Existing	12	Standing	14	Standing	57	Pass
	Proposed	17	Strolling	23	Uncomfortable	74	Pass
47	Existing	11	Standing	14	Standing	52	Pass
	Proposed	17	Strolling	21	Uncomfortable	83	Pass
48	Existing	12	Standing	16	Strolling	59	Pass
	Proposed	17	Strolling	20	Walking	83	Pass
49	Existing	9	Sitting	14	Standing	54	Pass
	Proposed	9	Sitting	12	Standing	49	Pass
50	Existing	13	Standing	18	Walking	61	Pass
	Proposed	13	Standing	17	Strolling	64	Pass
51	Existing	14	Standing	20	Walking	64	Pass
	Proposed	12	Standing	17	Strolling	60	Pass
52	Existing	14	Standing	20	Walking	65	Pass
	Proposed	13	Standing	17	Strolling	59	Pass
53	Existing	14	Standing	20	Walking	64	Pass
	Proposed	14	Standing	18	Walking	66	Pass
54	Existing	14	Standing	20	Walking	66	Pass
	Proposed	15	Strolling	18	Walking	76	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
55	Existing	14	Standing	20	Walking	66	Pass
	Proposed	12	Standing	16	Strolling	62	Pass
56	Existing	12	Standing	18	Walking	59	Pass
	Proposed	10	Sitting	13	Standing	49	Pass
57	Existing	12	Standing	17	Strolling	57	Pass
	Proposed	18	Walking	22	Uncomfortable	84	Pass
58	Existing	13	Standing	19	Walking	61	Pass
	Proposed	15	Strolling	19	Walking	77	Pass
59	Existing	14	Standing	19	Walking	64	Pass
	Proposed	13	Standing	17	Strolling	62	Pass
60	Existing	14	Standing	20	Walking	65	Pass
	Proposed	13	Standing	17	Strolling	63	Pass
61	Existing	14	Standing	19	Walking	64	Pass
	Proposed	15	Strolling	19	Walking	78	Pass
62	Existing	13	Standing	18	Walking	58	Pass
	Proposed	18	Walking	23	Uncomfortable	84	Pass
63	Existing	12	Standing	17	Strolling	58	Pass
	Proposed	16	Strolling	22	Uncomfortable	89	Pass
64	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	16	Strolling	73	Pass
65	Existing	10	Sitting	15	Strolling	55	Pass
	Proposed	18	Walking	25	Uncomfortable	96	Exceeded
66	Existing	-	-	-	-	-	-
	Proposed	13	Standing	23	Uncomfortable	88	Pass
67	Existing	13	Standing	17	Strolling	61	Pass
	Proposed	20	Walking	28	Uncomfortable	84	Pass
68	Existing	13	Standing	17	Strolling	61	Pass
	Proposed	16	Strolling	23	Uncomfortable	81	Pass
69	Existing	14	Standing	19	Walking	65	Pass
	Proposed	19	Walking	26	Uncomfortable	84	Pass
70	Existing	13	Standing	18	Walking	62	Pass
	Proposed	19	Walking	26	Uncomfortable	83	Pass
71	Existing	13	Standing	18	Walking	61	Pass
	Proposed	16	Strolling	22	Uncomfortable	73	Pass
72	Existing	12	Standing	17	Strolling	57	Pass
	Proposed	14	Standing	20	Walking	64	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
73	Existing	11	Standing	15	Strolling	52	Pass
	Proposed	11	Standing	15	Strolling	54	Pass
74	Existing	13	Standing	16	Strolling	59	Pass
	Proposed	17	Strolling	24	Uncomfortable	80	Pass
75	Existing	12	Standing	16	Strolling	56	Pass
	Proposed	15	Strolling	22	Uncomfortable	79	Pass
76	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	17	Strolling	22	Uncomfortable	86	Pass
77	Existing	12	Standing	15	Strolling	55	Pass
	Proposed	17	Strolling	23	Uncomfortable	86	Pass
78	Existing	14	Standing	18	Walking	65	Pass
	Proposed	15	Strolling	19	Walking	67	Pass
79	Existing	13	Standing	16	Strolling	59	Pass
	Proposed	15	Strolling	19	Walking	74	Pass
80	Existing	13	Standing	19	Walking	71	Pass
	Proposed	16	Strolling	21	Uncomfortable	89	Pass
81	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	46	Pass
82	Existing	-	-	-	-	-	-
	Proposed	12	Standing	17	Strolling	61	Pass
83	Existing	-	-	-	-	-	-
	Proposed	16	Strolling	18	Walking	86	Pass
84	Existing	-	-	-	-	-	-
	Proposed	12	Standing	15	Strolling	60	Pass
85	Existing	-	-	-	-	-	-
	Proposed	11	Standing	18	Walking	81	Pass
86	Existing	-	-	-	-	-	-
	Proposed	12	Standing	16	Strolling	56	Pass
87	Existing	-	-	-	-	-	-
	Proposed	20	Walking	29	Uncomfortable	96	Exceeded
88	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	39	Pass
89	Existing	-	-	-	-	-	-
	Proposed	11	Standing	16	Strolling	62	Pass
90	Existing	-	-	-	-	-	-
	Proposed	12	Standing	19	Walking	82	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
91	Existing	-	-	-	-	-	-
	Proposed	11	Standing	12	Standing	65	Pass
92	Existing	-	-	-	-	-	-
	Proposed	11	Standing	17	Strolling	73	Pass
93	Existing	-	-	-	-	-	-
	Proposed	11	Standing	18	Walking	74	Pass
94	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	46	Pass
95	Existing	-	-	-	-	-	-
	Proposed	12	Standing	15	Strolling	61	Pass
96	Existing	-	-	-	-	-	-
	Proposed	15	Strolling	18	Walking	85	Pass
97	Existing	-	-	-	-	-	-
	Proposed	12	Standing	18	Walking	65	Pass
98	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	18	Walking	73	Pass
99	Existing	-	-	-	-	-	-
	Proposed	13	Standing	18	Walking	88	Pass
100	Existing	-	-	-	-	-	-
	Proposed	12	Standing	20	Walking	74	Pass
101	Existing	-	-	-	-	-	-
	Proposed	11	Standing	17	Strolling	86	Pass

Season	Months	Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	6:00 - 23:00 for comfort
Annual	January - December	0:00 - 23:00 for safety

Configurations	
Existing	Existing site and surroundings
Proposed	Project with existing surroundings

Comfort Speed (km/h) (20% Seasonal Exceedance)	
≤ 10	Sitting
11 - 14	Standing
15 - 17	Strolling
18 - 20	Walking
> 20	Uncomfortable

Safety Speed (km/h) (0.1% Annual Exceedance)	
≤ 90	Pass
> 90	Exceeded