REPORT

WESTMINSTER UNITED CHURCH

4094 TOMKEN ROAD

MISSISSAUGA, ONTARIO

PEDESTRIAN WIND STUDY
RWDI # 2201947
July 22, 2022

SUBMITTED TO

David Constable
Principal
dconstable@kpmbarchitects.com
T: 416.977.5104 x408

KPMB Architects
351 King Street East, Suite 1200
Toronto, ON M5A 0L6

SUBMITTED BY

Shivani Jariwala, M.E.Sc.
Technical Coordinator
Shivani.Jariwala@rwdi.com

Sreeyuth Lal, Ph.D.
Technical Coordinator
Sreeyuth.Lal@rwdi.com

Stefan Gopaul, M.A.Sc., P.Eng.
Project Manager | Senior Engineer
Stefan.Gopaul@rwdi.com
M: 226.962.0029

RWDI
600 Southgate Drive
Guelph, Ontario, Canada N1G 4P6
T: 519.823.1311 x2291

EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Westminster United Church project in Mississauga, Ontario. The assessment was based on the wind-tunnel testing conducted for the proposed development site 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 pedestrian comfort (pertaining to common wind speeds conducive to different levels of human activity) and safety criteria (pertaining to infrequent but strong gusts that could affect a person's footing) adopted by the City of Mississauga. The predicted wind conditions are presented in Figures 1A through 2B, and Table 1, and are summarized as follows:

- The pedestrian wind safety criterion is expected to be met at all assessed grade and above-grade locations for both configurations tested.
- Existing wind speeds at the site and along the surrounding sidewalks are suitable for the intended use in all areas assessed, over the year.
- With the addition of the proposed buildings, grade-level wind speeds are predicted to increase in the immediate vicinity of the buildings. Wind conditions at all assessed off-site areas are anticipated to remain suitable for the intended usage throughout the year. On the project site, locally higher-than-desired wind speeds are anticipated along the walkway between Building 1 and the existing Tomken Grove building, the grade-level outdoor amenity area to the south of Building 1, and along the passageway through Building 2. Wind control measures for these areas are recommended within the report.
- Wind speeds on the amenity terraces are generally predicted to be fit for passive usage throughout the year.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed Westminster United Church project in Mississauga, 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 project site is located to the south of the intersection of Rathburn Road East and Tomken Road. The development consists of the addition of two 12-storey/44 m tall residential buildings on either side of the existing Westminster United Church on the site. The proposed buildings include grade and above-grade level outdoor amenity areas.

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 Mississauga City pedestrian wind comfort and safety criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks, grade and above-grade outdoor amenity areas.

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

2 BACKGROUND AND APPROACH

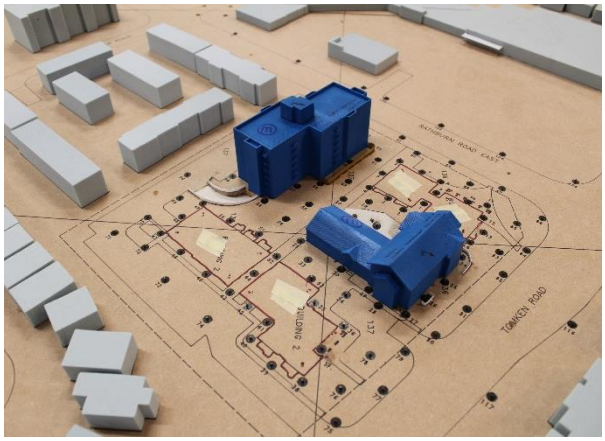
2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 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), and,

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

The wind tunnel model included all relevant surrounding buildings and topography within an approximate 360m 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 135 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.



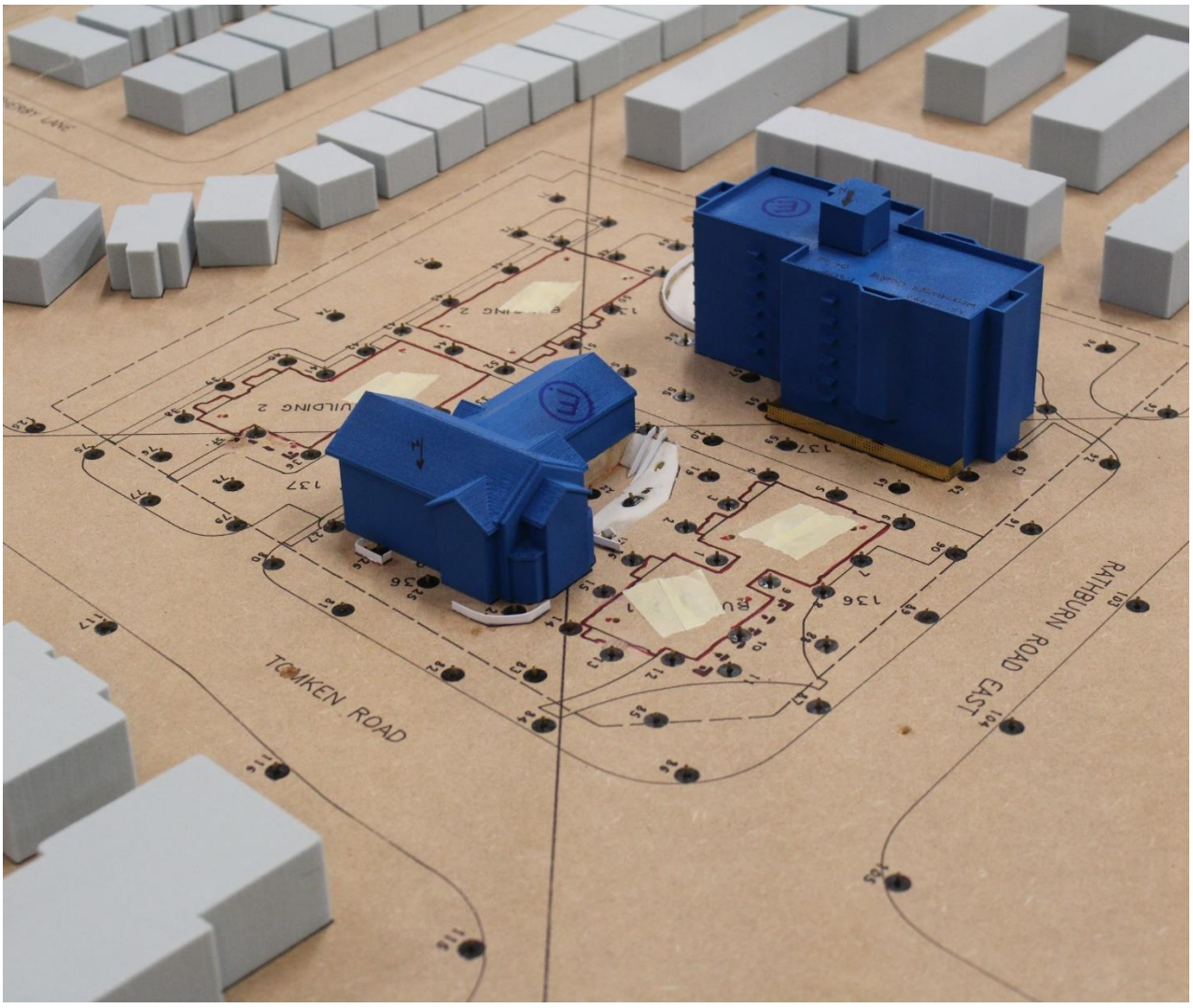


Image 2A: Wind Tunnel Study Model – Existing Configuration

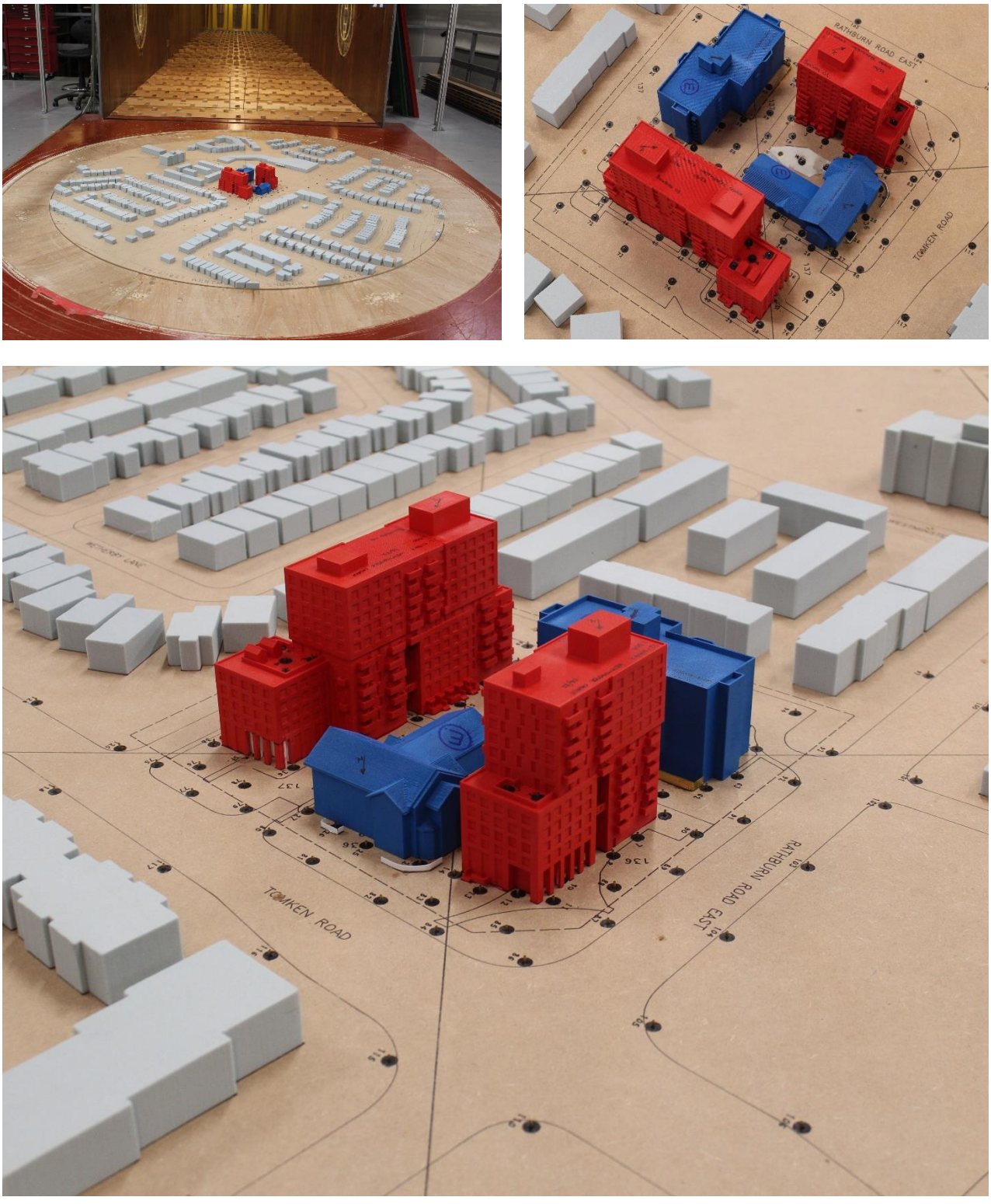
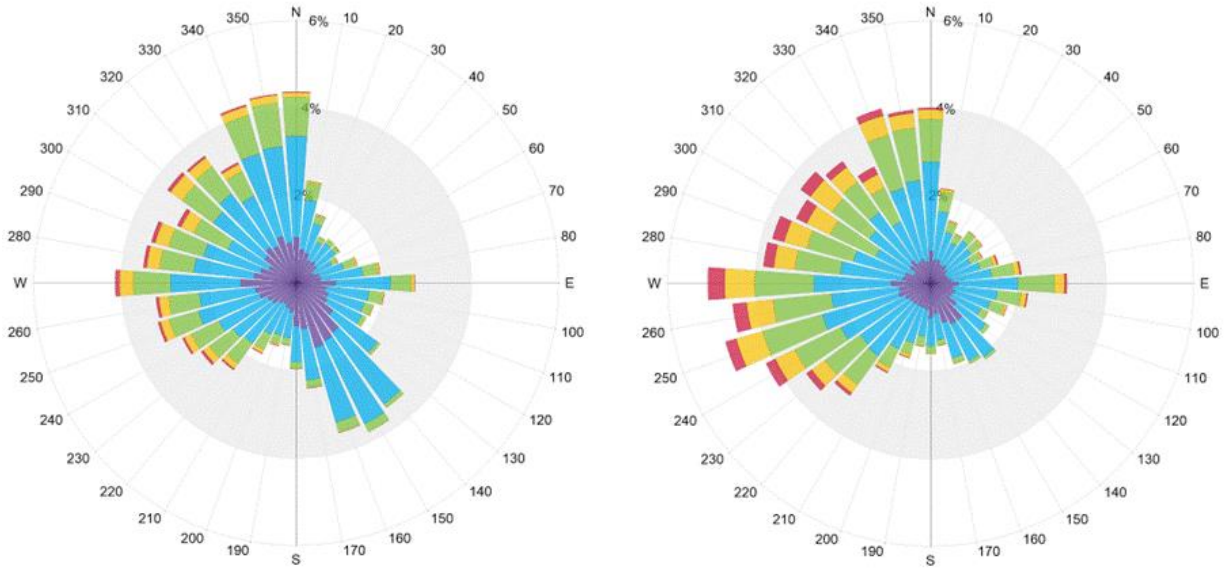


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Wind Climate Data

Wind statistics recorded at Toronto Pearson International 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. As indicated by the wind roses, winds from the east and southwest through north directions are predominant throughout the year, with winds from the southeast also frequent during the summer. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 4.8% and 11.4% of the time during the summer and winter seasons, respectively, and they are primarily from the southwest through north-northwest directions.

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	5.3	3.7
1-10	30.7	22.5
11-20	42.9	39.9
21-30	16.2	22.6
31-40	3.9	8.1
>40	0.9	3.3

Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport between 1990 and 2020.

2.3 Mississauga Pedestrian Wind Criteria

The Mississauga pedestrian wind criteria, developed in June 2014, are specified in the Urban Design Terms of Reference, "Pedestrian Wind Comfort and Safety Studies". The following defines the criteria in detail.

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	≤ 15	Gentle breezes suitable for main building entrances and bus stops
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 most activities, and wind mitigation is typically recommended

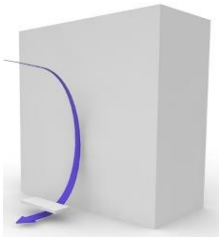
Notes:
(1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and Gust Speed = Mean Speed + 3*RMS Speed;
(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.

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.

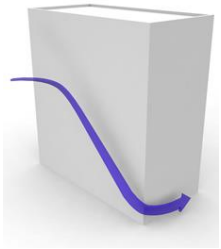
2.4 General Wind Flow Mechanisms

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



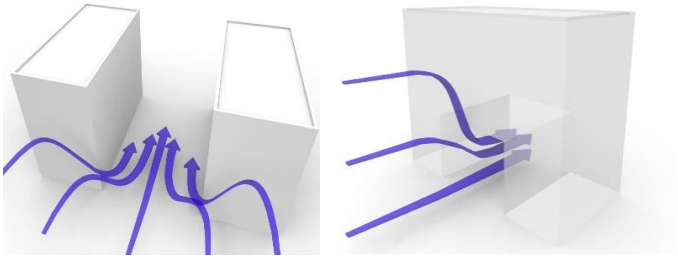
DOWNWASHING

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.



CHANNELING EFFECT

Wind flow tends to accelerate through the space between buildings, under bridges or in passages through buildings due to channeling 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; 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)

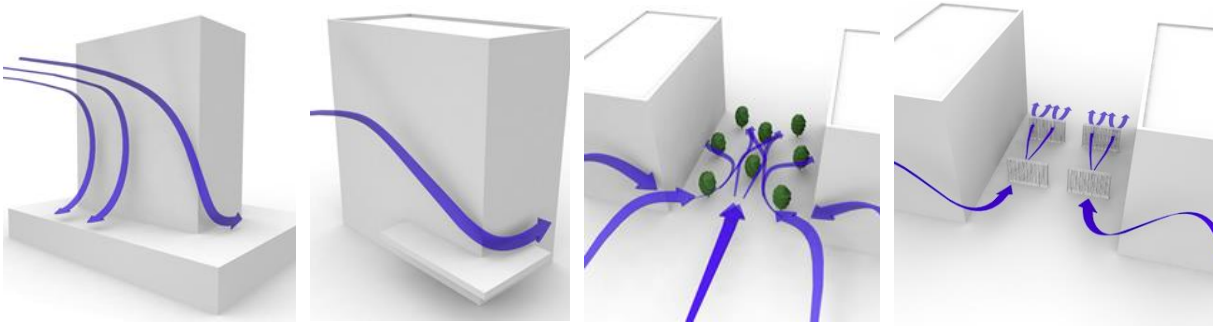


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 2B 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.

Wind conditions that meet the safety criterion are predicted at all locations for the Existing and Proposed configurations.

3.1 Grade Level (Locations 1 through 123)

Wind conditions comfortable for walking are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. Wind speeds comfortable for sitting are preferred for areas intended for prolonged passive activities or relaxed uses like seating and lounging such as the grade level amenity areas.

3.1.1 Existing Configuration

Wind speeds on and around the existing site are comfortable for sitting or standing during the summer (see Figure 1A). Seasonally stronger winds during the winter months are expected to result in slightly increased wind speeds, with conditions comfortable for sitting, standing, or walking around the site and on the nearby sidewalks. Wind speeds comfortable for sitting are predicted at the main entrances for the existing church and the existing residential building (Locations 28, 30, 57, and 66 in Figures 1A and 2A). All of these conditions are appropriate for the intended use of various pedestrian areas.

3.1.2 Proposed Configuration

With the addition of the proposed buildings, wind speeds are expected to increase in their immediate vicinity. However, wind speeds suitable for walking or more passive usage is anticipated at all assessed sidewalk locations on and around the project site throughout the year, which is suitable for the intended use (Figures 1B and 2B).

On the project site, during the summer, locally high wind speeds comfortable for walking are expected in the walkway between Building 1 and the existing Tomken Grove residential building (Locations 20, 59, and 61 in Figure 1B), and also at the passageway through Building 2 (Location 44 in Figure 1B). Wind speeds rated uncomfortable are also anticipated at two of these locations during the winter (Locations 44 and 61 in Figure 2B). These conditions are anticipated due to the channeling of prevailing winds (Image 4) between Building 1 and the existing Tomken Grove residential building and also along the Building 2 passageway. In addition, a localized area along the northeastern corner of Building 1 is also anticipated to have wind speeds rated uncomfortable during the winter (Location 85 in Figure 2B). At the outdoor amenity area to the south of Building 1, wind speeds suitable for standing are predicted during the summer (Locations 4 and 19 in Figure 1B). These conditions may be marginally higher than desired if designated seating spaces are proposed here.

It is recommended to target calmer conditions in the walkway between Building 1 and the existing residential building, the passageway through Building 2, and potentially, the outdoor amenity area, and the northeastern corner of Building 1. Recommendations for wind control are discussed in the next section.

Wind conditions comfortable for sitting or standing throughout the year are predicted at the main entrances of Building 1 (Locations 1, 9, and 12), Building 2 (Locations 35, 37, and 42), the existing church (Location 28), and the existing residential building (Locations 30, 57, and 66), as seen in Figures 1B and 2B. These conditions are apt for the intended usage of the entrance areas.

3.1.3 Recommendations for Wind Control

Although the proposed development includes buildings that are taller than the surrounding buildings, the wind impact expected is low at most areas and high wind speeds are localized to a few locations mainly due to winds channeling between buildings at site. The uncomfortable conditions predicted near Location 61 can be alleviated by introducing coniferous/evergreen landscaping or wind screens at the walkway between Building 1 and the existing residential building which will likely diffuse the intensity of prevailing winds channeling in these areas (see Image 6 for examples). Also, this measure will potentially reduce the intensity of wind speeds in the outdoor amenity located on the south side of Building 1. Similarly, coniferous/evergreen landscaping or addition of wind screens is recommended at the northeast corner of Building 1 near Location 85, if this area is accessible to pedestrians. Distributed planters or wind screens as shown in Image 6 are also recommended along the passageway through Building 2.

If calmer conditions in the summer are desired in the outdoor amenity area to the south of Building 1, vertical wind screens and/or tall planters may be installed around the outdoor seating areas to help reduce wind speeds (see Image 6 for examples).

Image 6: Examples of Wind Control Measures Applicable to the Grade Level Areas

3.2 Level 3, 4, and 7 Terraces (Locations 124 through 135)

It is generally desirable for wind conditions on areas intended for passive activities to be comfortable for sitting more than 80% of the time in the summer. During the winter, the area would not be used frequently and increased wind activity would be considered appropriate.

Wind conditions at all the assessed areas of the Level 3 and Level 4 terraces of Buildings 1 and 2, and the Level 7 terrace of Building 1, are anticipated to be comfortable for sitting during the summer (Figure 1B), which is ideal for the intended passive usage of these areas. The Level 7 amenity terraces on Building 2 are predicted to be comfortable for sitting or standing during the summer (Figure 1B), which is slightly higher than desired for long-term passive usage like sitting, lounging, etc. If desired, wind screens or planters can be installed around designated seating areas to create a localized low-wind zone (see Image 7 for examples). Note that screens or landscaping features should be at least 1.5 m tall and at most 30% open for adequate wind protection. Additionally, parapets or guardrails that are at least 1.5 m tall will likely offer enhanced sheltering to the terrace areas from the incident prevailing winds. The assessed terrace areas are predicted to be comfortable for sitting or standing during the winter season (see Figure 2B); however, slightly higher wind speeds during the winter months may be deemed acceptable considering the limited usage of these areas.

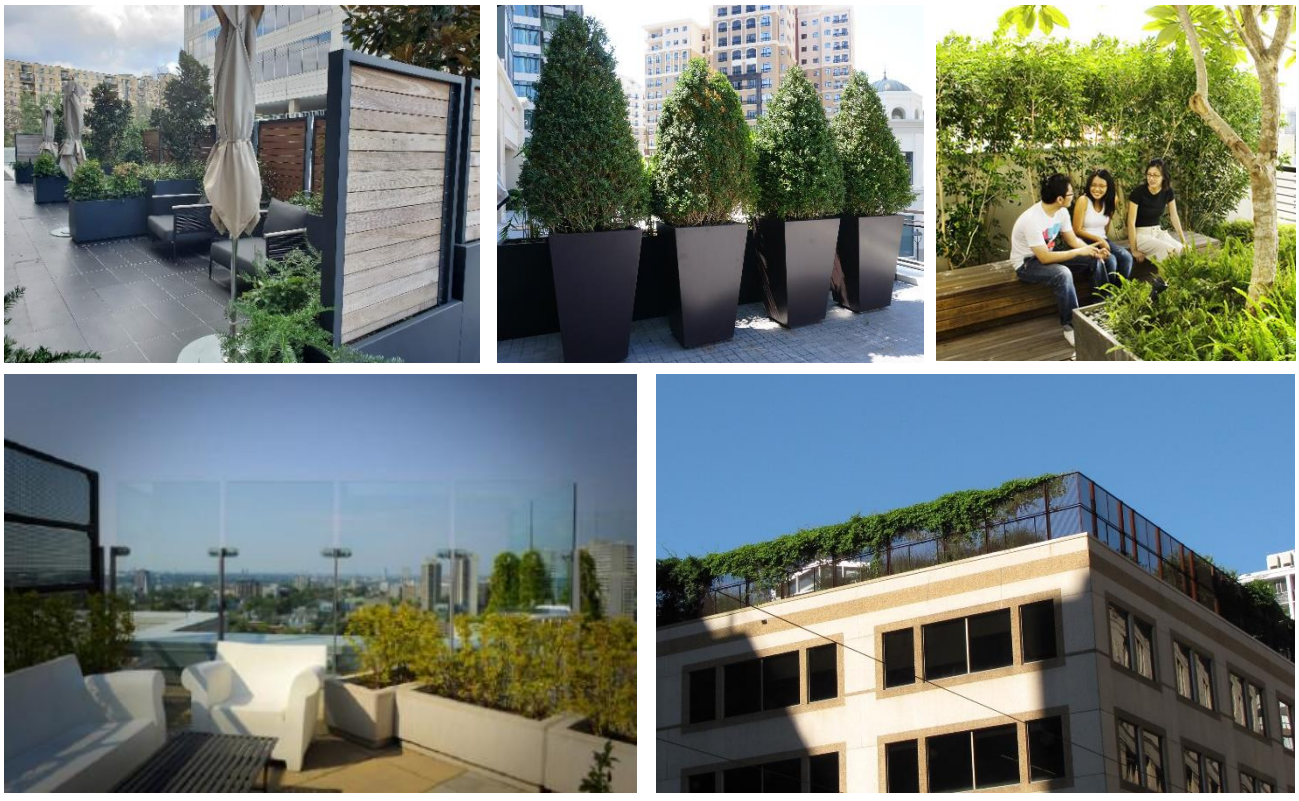


Image 7: Examples of Wind Control Measures Applicable to the Level 7 Terrace Areas

4 STATEMENT OF LIMITATIONS

Limitations

This report was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for Dialog Design ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

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 Dialog Design and used to construct the scale model of the proposed Westminster United Church development **("Project Data**").

File Name	File Type	Date Received (dd/mm/yyyy)
Westminster-Mississauga_20220610	Revit	10/06/2022

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 up on 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.

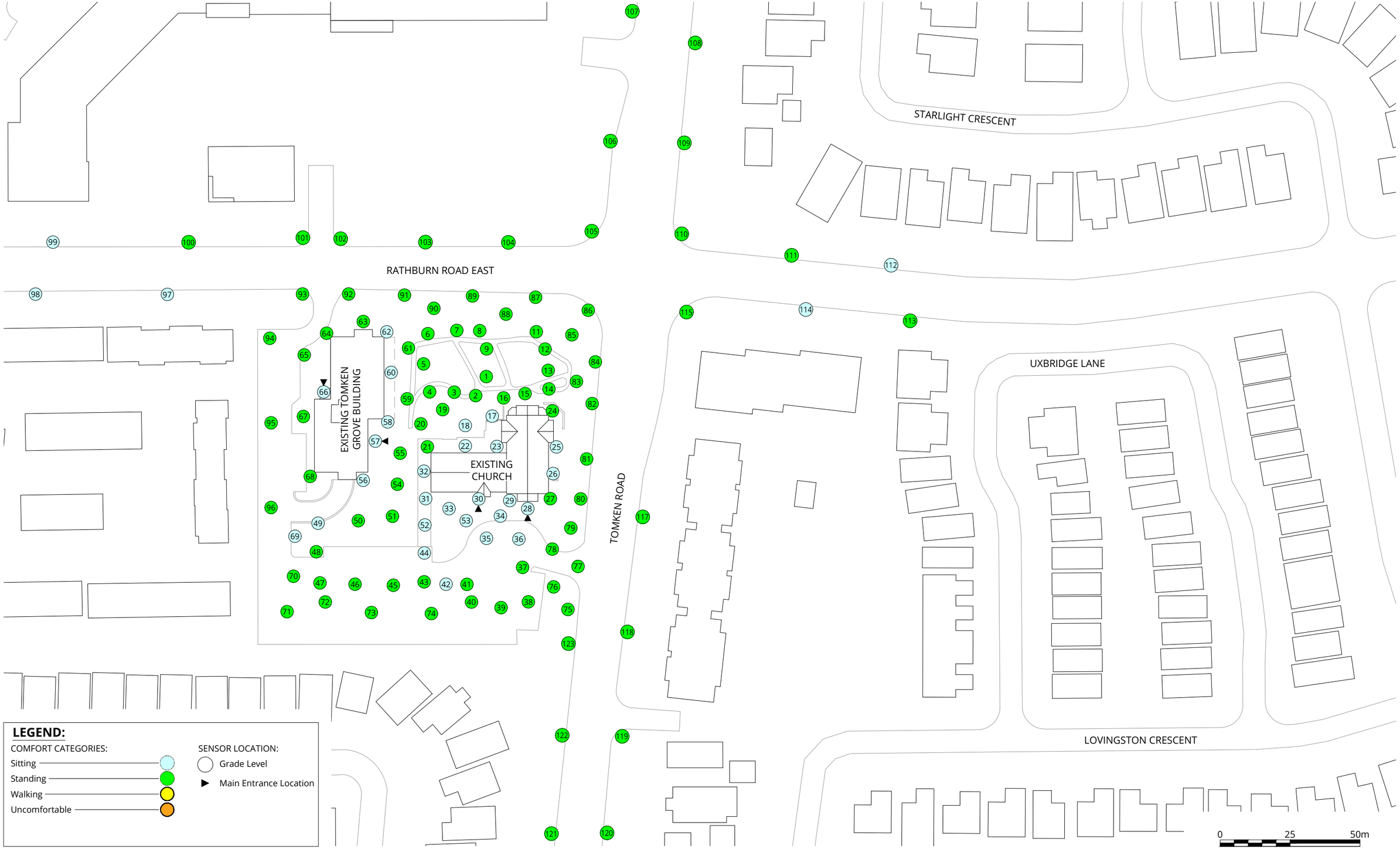
7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

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



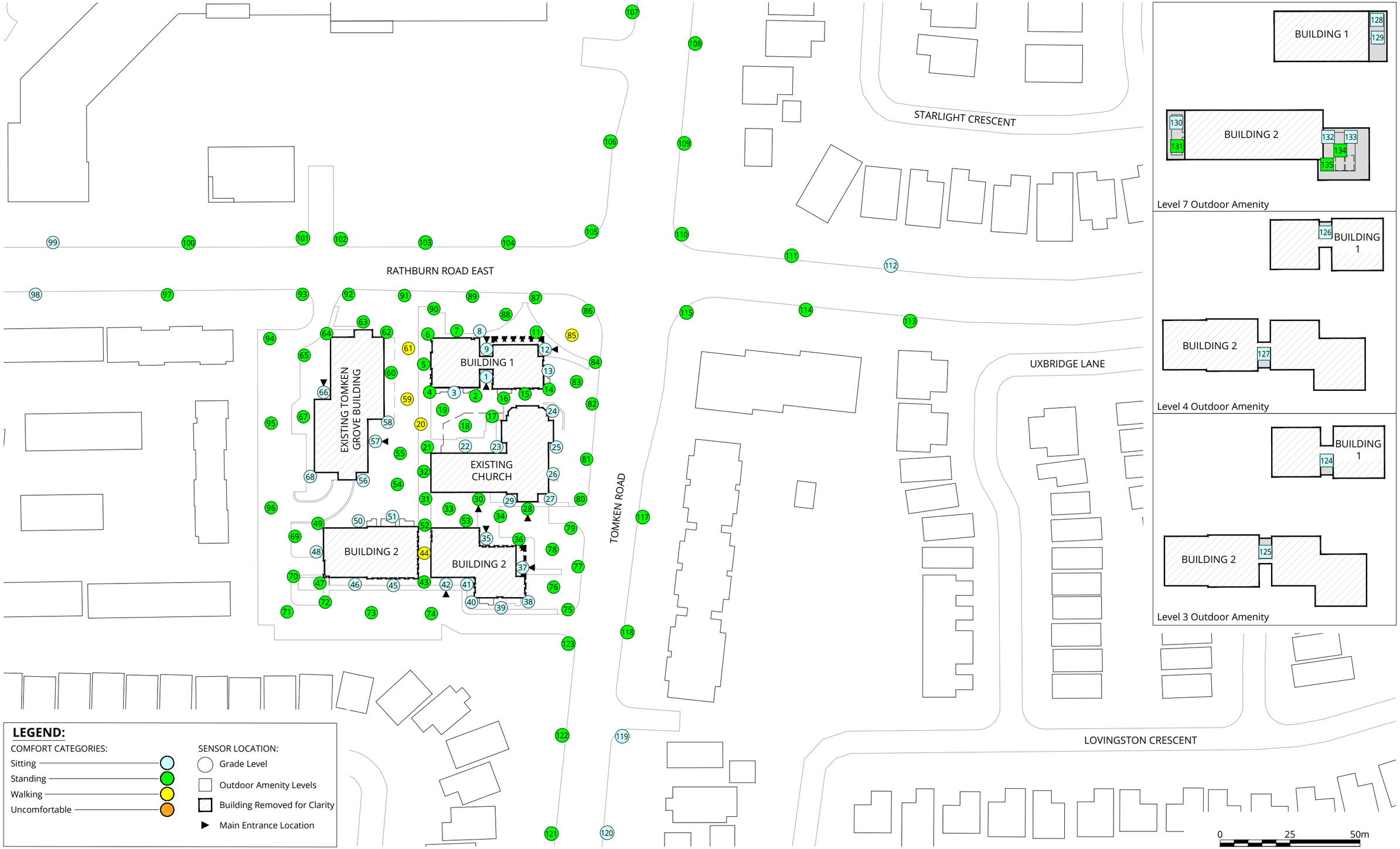
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

Westminster United Church - Mississauga, ON

True North

Project #2201947

Drawn by:	JD	Figure:	1A
Approx. Scale:	1:1250		
Date Revised:	Jul. 22, 2022		



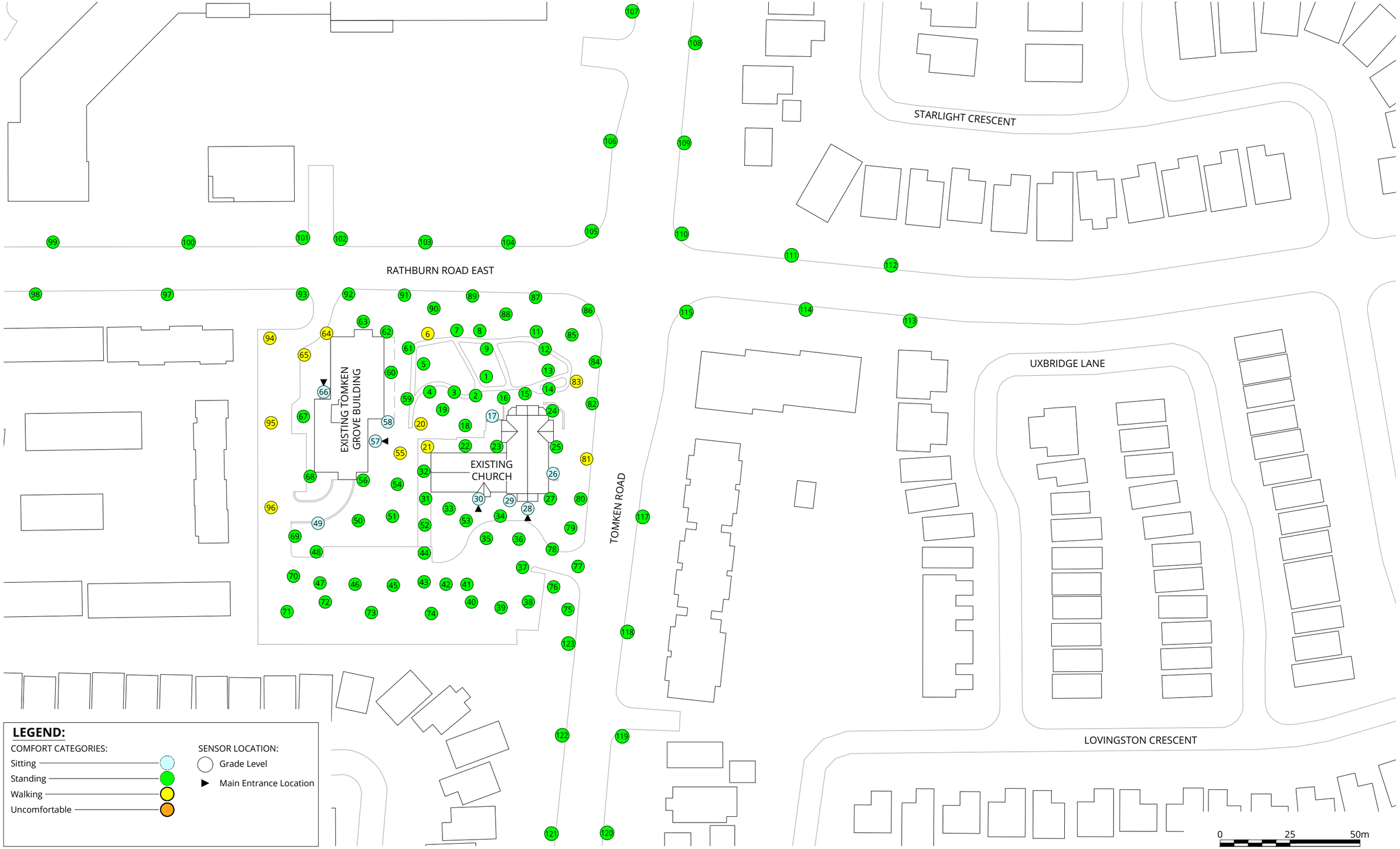
Pedestrian Wind Comfort Conditions
Proposed Configuration
Summer (May to October, 6:00 to 23:00)

Westminster United Church - Mississauga, ON

True North

Project #2201947

Drawn by:	JD	Figure:	1B
Approx. Scale:	1:1250		
Date Revised:	Jul. 22, 2022		



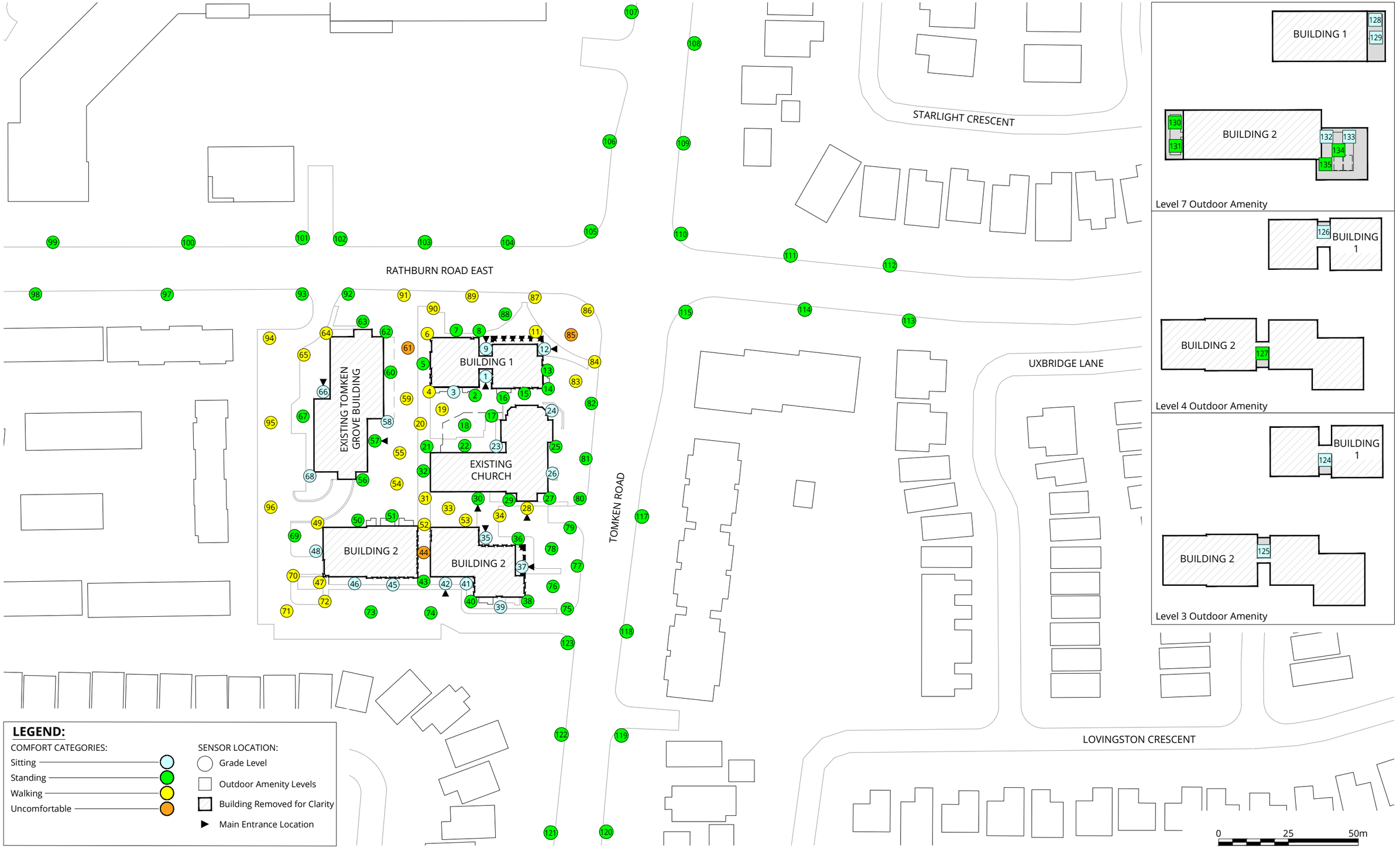
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

Westminster United Church - Mississauga, ON

True North

Project #2201947

Drawn by:	JD	Figure:	2A
Approx. Scale:	1:1250		
Date Revised:	Jul. 22, 2022		



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

Westminster United Church - Mississauga, ON

True North

Project #2201947

Drawn by:	JD	Figure:	2B
Approx. Scale:	1:1250		
Date Revised:	Jul. 22, 2022		

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	11	Standing	14	Standing	54	Pass
	Proposed	4	Sitting	5	Sitting	25	Pass
2	Existing	11	Standing	13	Standing	52	Pass
	Proposed	12	Standing	15	Standing	64	Pass
3	Existing	11	Standing	14	Standing	56	Pass
	Proposed	8	Sitting	10	Sitting	49	Pass
4	Existing	12	Standing	14	Standing	60	Pass
	Proposed	15	Standing	19	Walking	78	Pass
5	Existing	12	Standing	14	Standing	63	Pass
	Proposed	11	Standing	14	Standing	61	Pass
6	Existing	13	Standing	16	Walking	70	Pass
	Proposed	15	Standing	17	Walking	79	Pass
7	Existing	12	Standing	15	Standing	66	Pass
	Proposed	11	Standing	12	Standing	54	Pass
8	Existing	12	Standing	15	Standing	59	Pass
	Proposed	10	Sitting	12	Standing	52	Pass
9	Existing	11	Standing	13	Standing	53	Pass
	Proposed	4	Sitting	5	Sitting	23	Pass
10	Existing	12	Standing	14	Standing	54	Pass
	Proposed	8	Sitting	9	Sitting	40	Pass
11	Existing	12	Standing	15	Standing	60	Pass
	Proposed	13	Standing	17	Walking	79	Pass
12	Existing	12	Standing	14	Standing	57	Pass
	Proposed	9	Sitting	10	Sitting	54	Pass
13	Existing	12	Standing	14	Standing	60	Pass
	Proposed	10	Sitting	12	Standing	68	Pass
14	Existing	11	Standing	14	Standing	61	Pass
	Proposed	12	Standing	13	Standing	64	Pass
15	Existing	11	Standing	13	Standing	59	Pass
	Proposed	13	Standing	15	Standing	63	Pass
16	Existing	11	Standing	13	Standing	54	Pass
	Proposed	12	Standing	15	Standing	68	Pass
17	Existing	9	Sitting	10	Sitting	41	Pass
	Proposed	11	Standing	14	Standing	71	Pass
18	Existing	9	Sitting	11	Standing	55	Pass
	Proposed	12	Standing	15	Standing	68	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	11	Standing	13	Standing	57	Pass
	Proposed	14	Standing	17	Walking	78	Pass
20	Existing	14	Standing	16	Walking	62	Pass
	Proposed	16	Walking	19	Walking	80	Pass
21	Existing	14	Standing	17	Walking	69	Pass
	Proposed	13	Standing	15	Standing	62	Pass
22	Existing	9	Sitting	11	Standing	51	Pass
	Proposed	10	Sitting	12	Standing	58	Pass
23	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	8	Sitting	10	Sitting	46	Pass
24	Existing	11	Standing	15	Standing	73	Pass
	Proposed	9	Sitting	10	Sitting	56	Pass
25	Existing	10	Sitting	12	Standing	59	Pass
	Proposed	9	Sitting	11	Standing	57	Pass
26	Existing	6	Sitting	7	Sitting	32	Pass
	Proposed	6	Sitting	7	Sitting	31	Pass
27	Existing	11	Standing	13	Standing	52	Pass
	Proposed	9	Sitting	11	Standing	47	Pass
28	Existing	8	Sitting	9	Sitting	45	Pass
	Proposed	13	Standing	16	Walking	66	Pass
29	Existing	6	Sitting	7	Sitting	34	Pass
	Proposed	10	Sitting	11	Standing	47	Pass
30	Existing	8	Sitting	9	Sitting	48	Pass
	Proposed	13	Standing	15	Standing	59	Pass
31	Existing	10	Sitting	12	Standing	56	Pass
	Proposed	14	Standing	16	Walking	62	Pass
32	Existing	9	Sitting	11	Standing	45	Pass
	Proposed	12	Standing	14	Standing	68	Pass
33	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	14	Standing	16	Walking	63	Pass
34	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	15	Standing	18	Walking	72	Pass
35	Existing	10	Sitting	12	Standing	49	Pass
	Proposed	8	Sitting	10	Sitting	46	Pass
36	Existing	10	Sitting	12	Standing	49	Pass
	Proposed	11	Standing	13	Standing	57	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	11	Standing	13	Standing	53	Pass
	Proposed	6	Sitting	7	Sitting	33	Pass
38	Existing	11	Standing	13	Standing	55	Pass
	Proposed	9	Sitting	11	Standing	62	Pass
39	Existing	11	Standing	13	Standing	54	Pass
	Proposed	8	Sitting	9	Sitting	42	Pass
40	Existing	11	Standing	13	Standing	53	Pass
	Proposed	10	Sitting	11	Standing	50	Pass
41	Existing	11	Standing	13	Standing	54	Pass
	Proposed	6	Sitting	7	Sitting	38	Pass
42	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	7	Sitting	8	Sitting	33	Pass
43	Existing	11	Standing	13	Standing	55	Pass
	Proposed	13	Standing	15	Standing	67	Pass
44	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	19	Walking	22	Uncomfortable	82	Pass
45	Existing	11	Standing	14	Standing	57	Pass
	Proposed	9	Sitting	10	Sitting	44	Pass
46	Existing	11	Standing	13	Standing	60	Pass
	Proposed	8	Sitting	10	Sitting	52	Pass
47	Existing	11	Standing	14	Standing	60	Pass
	Proposed	14	Standing	17	Walking	79	Pass
48	Existing	11	Standing	13	Standing	57	Pass
	Proposed	9	Sitting	10	Sitting	57	Pass
49	Existing	8	Sitting	9	Sitting	46	Pass
	Proposed	15	Standing	17	Walking	72	Pass
50	Existing	11	Standing	13	Standing	57	Pass
	Proposed	9	Sitting	11	Standing	50	Pass
51	Existing	12	Standing	15	Standing	61	Pass
	Proposed	10	Sitting	12	Standing	55	Pass
52	Existing	10	Sitting	12	Standing	51	Pass
	Proposed	14	Standing	16	Walking	64	Pass
53	Existing	10	Sitting	12	Standing	48	Pass
	Proposed	12	Standing	16	Walking	71	Pass
54	Existing	12	Standing	14	Standing	58	Pass
	Proposed	14	Standing	16	Walking	75	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	15	Standing	17	Walking	66	Pass
	Proposed	14	Standing	17	Walking	69	Pass
56	Existing	10	Sitting	11	Standing	48	Pass
	Proposed	10	Sitting	12	Standing	59	Pass
57	Existing	8	Sitting	9	Sitting	41	Pass
	Proposed	10	Sitting	12	Standing	50	Pass
58	Existing	8	Sitting	9	Sitting	42	Pass
	Proposed	8	Sitting	10	Sitting	42	Pass
59	Existing	13	Standing	15	Standing	64	Pass
	Proposed	17	Walking	20	Walking	84	Pass
60	Existing	9	Sitting	11	Standing	50	Pass
	Proposed	13	Standing	15	Standing	64	Pass
61	Existing	12	Standing	14	Standing	64	Pass
	Proposed	18	Walking	22	Uncomfortable	80	Pass
62	Existing	10	Sitting	13	Standing	64	Pass
	Proposed	11	Standing	13	Standing	58	Pass
63	Existing	12	Standing	15	Standing	71	Pass
	Proposed	13	Standing	15	Standing	69	Pass
64	Existing	15	Standing	17	Walking	72	Pass
	Proposed	14	Standing	16	Walking	69	Pass
65	Existing	14	Standing	17	Walking	72	Pass
	Proposed	14	Standing	16	Walking	70	Pass
66	Existing	7	Sitting	8	Sitting	35	Pass
	Proposed	6	Sitting	7	Sitting	34	Pass
67	Existing	11	Standing	13	Standing	66	Pass
	Proposed	11	Standing	12	Standing	59	Pass
68	Existing	11	Standing	14	Standing	60	Pass
	Proposed	9	Sitting	10	Sitting	46	Pass
69	Existing	10	Sitting	12	Standing	50	Pass
	Proposed	12	Standing	13	Standing	56	Pass
70	Existing	11	Standing	13	Standing	54	Pass
	Proposed	14	Standing	16	Walking	68	Pass
71	Existing	11	Standing	12	Standing	52	Pass
	Proposed	14	Standing	16	Walking	66	Pass
72	Existing	11	Standing	13	Standing	57	Pass
	Proposed	14	Standing	17	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
73	Existing	11	Standing	14	Standing	59	Pass
	Proposed	13	Standing	15	Standing	75	Pass
74	Existing	11	Standing	13	Standing	54	Pass
	Proposed	12	Standing	14	Standing	57	Pass
75	Existing	11	Standing	14	Standing	53	Pass
	Proposed	13	Standing	14	Standing	54	Pass
76	Existing	12	Standing	14	Standing	60	Pass
	Proposed	11	Standing	13	Standing	55	Pass
77	Existing	12	Standing	14	Standing	57	Pass
	Proposed	13	Standing	15	Standing	60	Pass
78	Existing	13	Standing	15	Standing	61	Pass
	Proposed	13	Standing	15	Standing	65	Pass
79	Existing	12	Standing	14	Standing	59	Pass
	Proposed	13	Standing	15	Standing	64	Pass
80	Existing	13	Standing	15	Standing	59	Pass
	Proposed	12	Standing	14	Standing	60	Pass
81	Existing	13	Standing	16	Walking	63	Pass
	Proposed	12	Standing	14	Standing	60	Pass
82	Existing	12	Standing	15	Standing	61	Pass
	Proposed	13	Standing	15	Standing	66	Pass
83	Existing	12	Standing	16	Walking	61	Pass
	Proposed	13	Standing	16	Walking	77	Pass
84	Existing	12	Standing	15	Standing	59	Pass
	Proposed	14	Standing	18	Walking	82	Pass
85	Existing	12	Standing	15	Standing	60	Pass
	Proposed	17	Walking	21	Uncomfortable	87	Pass
86	Existing	13	Standing	15	Standing	59	Pass
	Proposed	13	Standing	17	Walking	69	Pass
87	Existing	12	Standing	14	Standing	58	Pass
	Proposed	15	Standing	18	Walking	76	Pass
88	Existing	11	Standing	14	Standing	58	Pass
	Proposed	12	Standing	15	Standing	64	Pass
89	Existing	12	Standing	15	Standing	63	Pass
	Proposed	13	Standing	16	Walking	66	Pass
90	Existing	12	Standing	14	Standing	60	Pass
	Proposed	14	Standing	17	Walking	72	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	12	Standing	15	Standing	66	Pass
	Proposed	13	Standing	16	Walking	64	Pass
92	Existing	12	Standing	14	Standing	58	Pass
	Proposed	12	Standing	14	Standing	62	Pass
93	Existing	13	Standing	14	Standing	57	Pass
	Proposed	13	Standing	14	Standing	59	Pass
94	Existing	14	Standing	16	Walking	61	Pass
	Proposed	14	Standing	16	Walking	62	Pass
95	Existing	15	Standing	18	Walking	71	Pass
	Proposed	13	Standing	16	Walking	67	Pass
96	Existing	13	Standing	16	Walking	71	Pass
	Proposed	13	Standing	16	Walking	65	Pass
97	Existing	10	Sitting	12	Standing	53	Pass
	Proposed	11	Standing	13	Standing	53	Pass
98	Existing	10	Sitting	12	Standing	50	Pass
	Proposed	10	Sitting	12	Standing	51	Pass
99	Existing	10	Sitting	12	Standing	53	Pass
	Proposed	10	Sitting	12	Standing	53	Pass
100	Existing	12	Standing	14	Standing	57	Pass
	Proposed	12	Standing	14	Standing	58	Pass
101	Existing	12	Standing	14	Standing	55	Pass
	Proposed	12	Standing	14	Standing	55	Pass
102	Existing	12	Standing	14	Standing	56	Pass
	Proposed	12	Standing	13	Standing	53	Pass
103	Existing	12	Standing	15	Standing	58	Pass
	Proposed	11	Standing	13	Standing	54	Pass
104	Existing	12	Standing	15	Standing	60	Pass
	Proposed	11	Standing	14	Standing	60	Pass
105	Existing	12	Standing	14	Standing	57	Pass
	Proposed	11	Standing	13	Standing	57	Pass
106	Existing	13	Standing	15	Standing	60	Pass
	Proposed	12	Standing	15	Standing	59	Pass
107	Existing	12	Standing	14	Standing	57	Pass
	Proposed	11	Standing	14	Standing	55	Pass
108	Existing	12	Standing	14	Standing	56	Pass
	Proposed	11	Standing	13	Standing	54	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
109	Existing	12	Standing	14	Standing	57	Pass
	Proposed	11	Standing	14	Standing	57	Pass
110	Existing	12	Standing	14	Standing	55	Pass
	Proposed	12	Standing	14	Standing	58	Pass
111	Existing	11	Standing	13	Standing	57	Pass
	Proposed	11	Standing	13	Standing	58	Pass
112	Existing	10	Sitting	12	Standing	54	Pass
	Proposed	10	Sitting	12	Standing	55	Pass
113	Existing	11	Standing	13	Standing	56	Pass
	Proposed	11	Standing	13	Standing	58	Pass
114	Existing	10	Sitting	13	Standing	55	Pass
	Proposed	11	Standing	13	Standing	57	Pass
115	Existing	12	Standing	14	Standing	55	Pass
	Proposed	12	Standing	14	Standing	58	Pass
116	Existing	13	Standing	15	Standing	60	Pass
	Proposed	12	Standing	15	Standing	60	Pass
117	Existing	12	Standing	14	Standing	57	Pass
	Proposed	12	Standing	14	Standing	60	Pass
118	Existing	12	Standing	14	Standing	61	Pass
	Proposed	13	Standing	15	Standing	62	Pass
119	Existing	11	Standing	13	Standing	58	Pass
	Proposed	10	Sitting	12	Standing	51	Pass
120	Existing	11	Standing	13	Standing	56	Pass
	Proposed	10	Sitting	11	Standing	46	Pass
121	Existing	12	Standing	14	Standing	61	Pass
	Proposed	11	Standing	12	Standing	55	Pass
122	Existing	12	Standing	15	Standing	61	Pass
	Proposed	11	Standing	13	Standing	55	Pass
123	Existing	12	Standing	15	Standing	60	Pass
	Proposed	13	Standing	14	Standing	61	Pass
124	Existing	-	-	-	-	-	-
	Proposed	4	Sitting	5	Sitting	21	Pass
125	Existing	-	-	-	-	-	-
	Proposed	4	Sitting	5	Sitting	21	Pass
126	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	49	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
127	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	54	Pass
128	Existing	-	-	-	-	-	-
	Proposed	5	Sitting	6	Sitting	27	Pass
129	Existing	-	-	-	-	-	-
	Proposed	4	Sitting	5	Sitting	20	Pass
130	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	11	Standing	51	Pass
131	Existing	-	-	-	-	-	-
	Proposed	11	Standing	14	Standing	66	Pass
132	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	8	Sitting	52	Pass
133	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	50	Pass
134	Existing	-	-	-	-	-	-
	Proposed	11	Standing	11	Standing	57	Pass
135	Existing	-	-	-	-	-	-
	Proposed	13	Standing	14	Standing	64	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 - 15	Standing
16 - 20	Walking
> 20	Uncomfortable

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