REPORT

79 COLLIER STREET

BARRIE, ONTARIO

PEDESTRIAN WIND STUDY
RWDI #2100488
December 8, 2020

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 79 Collier Street in Barrie, Ontario (Image 1). Based on our wind-tunnel testing for the proposed development under the Existing and Proposed configurations (Images 2A and 2B), and the local wind records (Image 3), the potential wind comfort conditions are predicted as shown on site plans in Figures 1A through 2B, while the associated wind speeds are listed in Table 1.

Wind speeds on and around the proposed site are low and appropriate for pedestrian activity. Conditions that meet the safety criterion are predicted at all areas assessed. With the addition of the proposed project, wind speeds immediately around the site are predicted to increase slightly, but continue to be appropriate for the intended pedestrian use.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 79 Collier Street in Barrie, Ontario. This report presents the project objectives, approach and the main results from RWDI's assessment.

1.1 Project Description

The project (site shown in Image 1) is located at the southwest corner of the intersection of Collier St and Mulcaster St. The proposed building is a 15-storey mixed use development that consists primarily of residential units.

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 building entrances and public sidewalks.

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),

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

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 360 m radius of 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 68 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. 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. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and reviewed by design team.

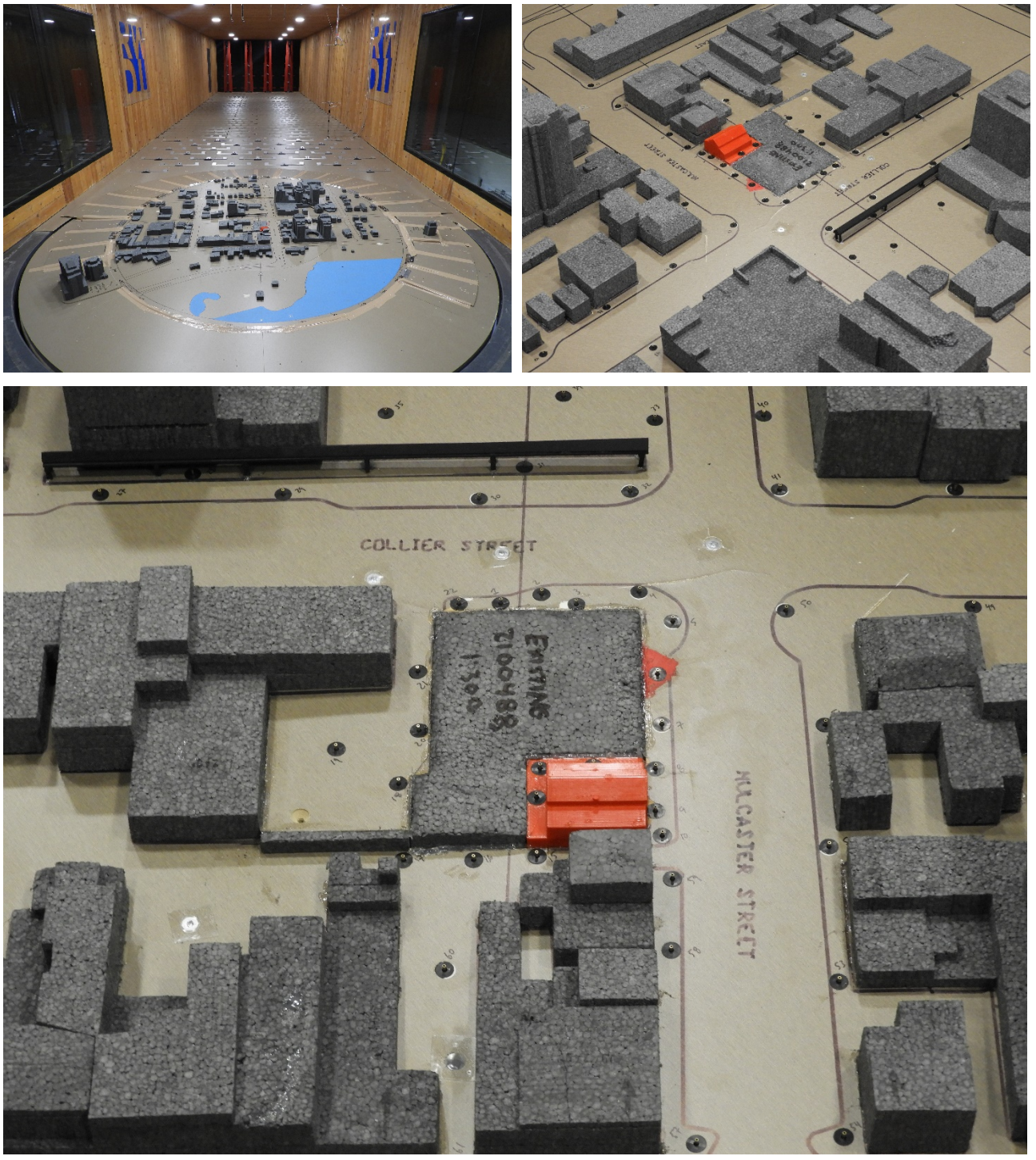
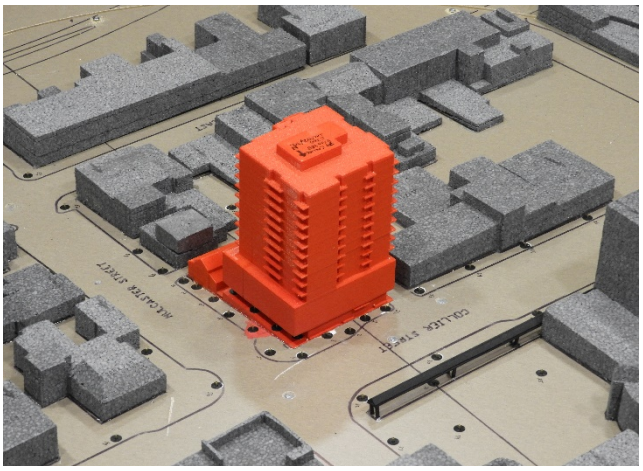


Image 2A: Wind Tunnel Study Model – Existing Configuration



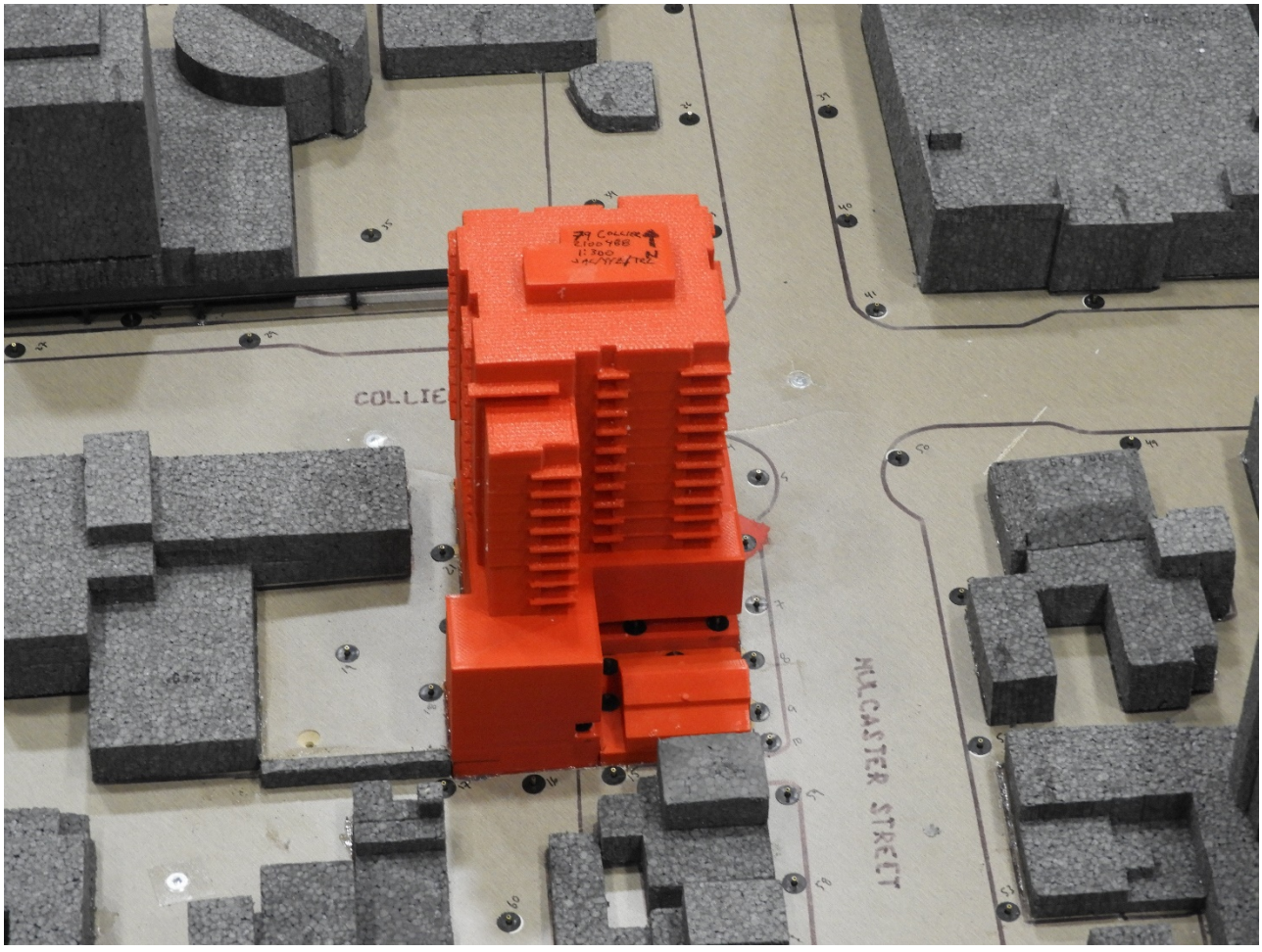
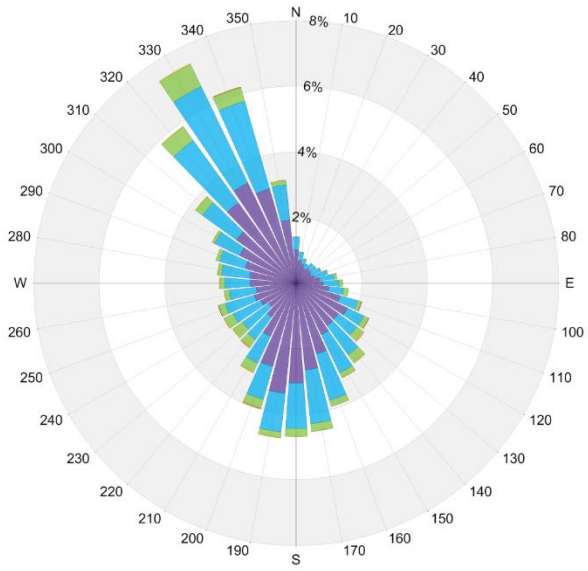


Image 2B: Wind Tunnel Study Model – Proposed Configuration

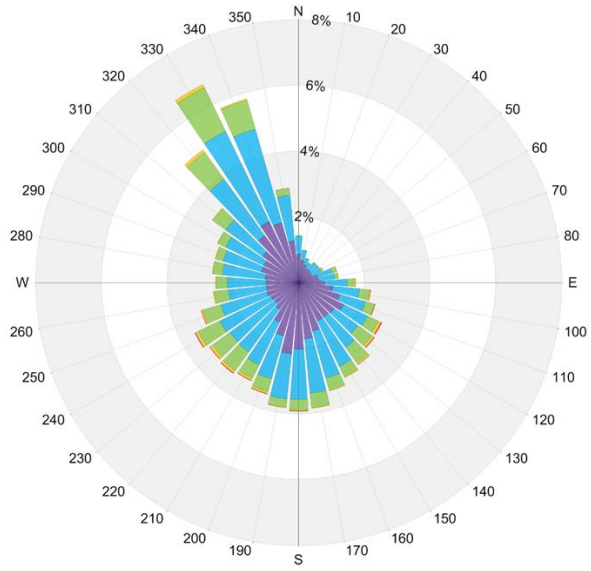
2.2 Meteorological Data

Wind statistics recorded at Egbert Climate Station between 2004 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 northwest are predominant and winds from the southwest and southeast quadrants are also prevalent in both summer and winter, as indicated by the wind roses.

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	1.7	1.0
1-10	57.4	41.9
11-20	33.8	42.0
21-30	6.7	13.7
31-40	0.3	1.2
>40	0.0	0.1

Image 3: Directional Distribution of Winds Approaching Egbert Climate Station between 2004 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 Barrie, 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.

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. These conditions and the associated wind speeds are also presented in Table 1, located in the "Tables" section of this report.

Wind conditions comfortable for walking or strolling 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. Main entrances of the proposed building are situated near Locations 1 and 62 in Figures 1A through 2B.

Wind conditions that meet the safety criterion are predicted at all locations assessed around the existing site, and after the addition of the proposed project.

Wind conditions on and around the existing site are expected to be comfortable for sitting or standing throughout the year (Figures 1A and 2A), which is suitable for pedestrian use. With the addition of the proposed project, wind speeds are predicted to slightly increase immediately around the proposed project site. Wind conditions are expected to continue to be comfortable for sitting or standing on and around the project, including the main entrances, throughout the year (Figures 1B and 2B).

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 79 Collier Street constructed using the drawings and information listed below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
Arch_Wind Analysis Model_79 Collier St.rvt	Revit	01/10/2020

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.

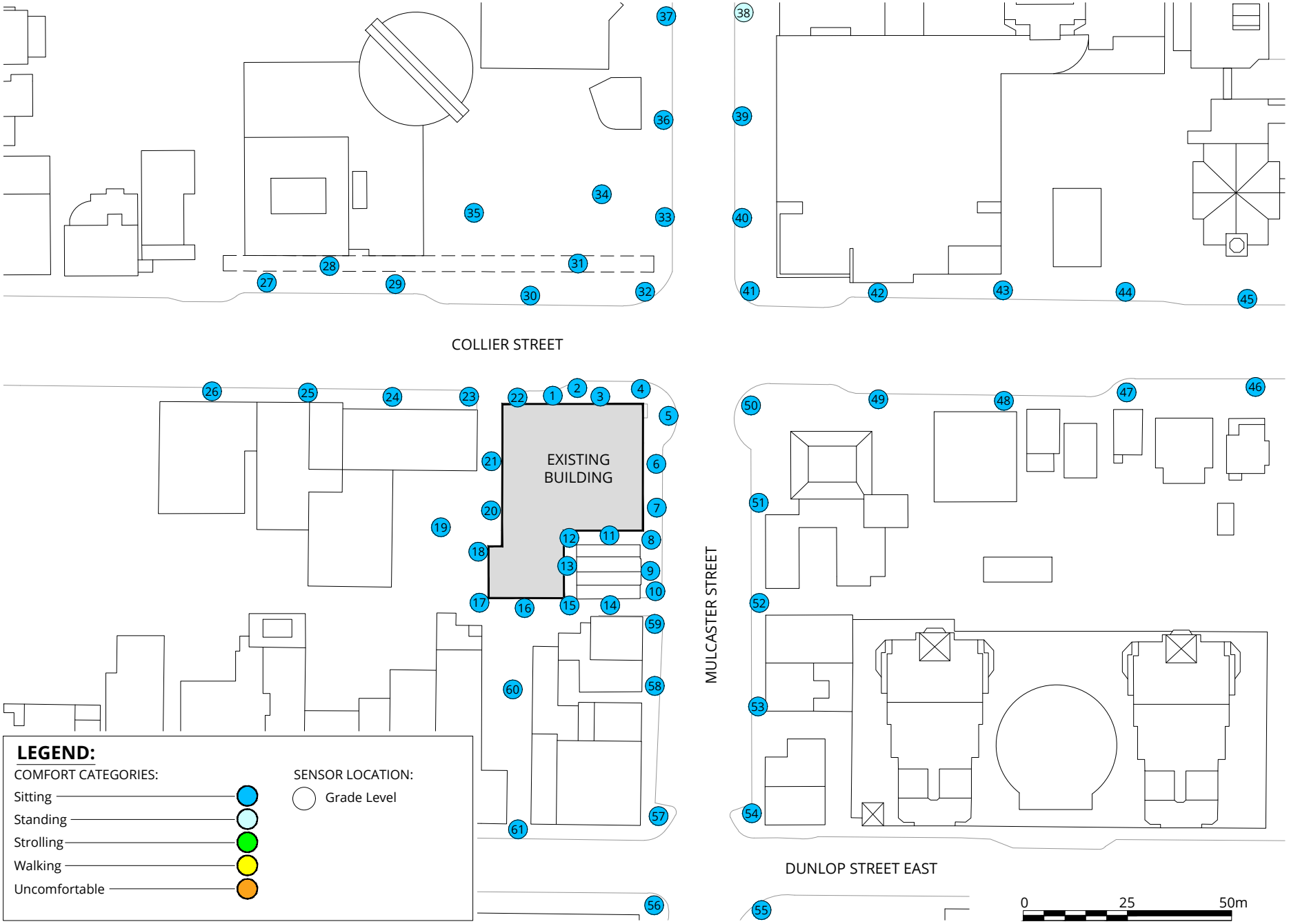
7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

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



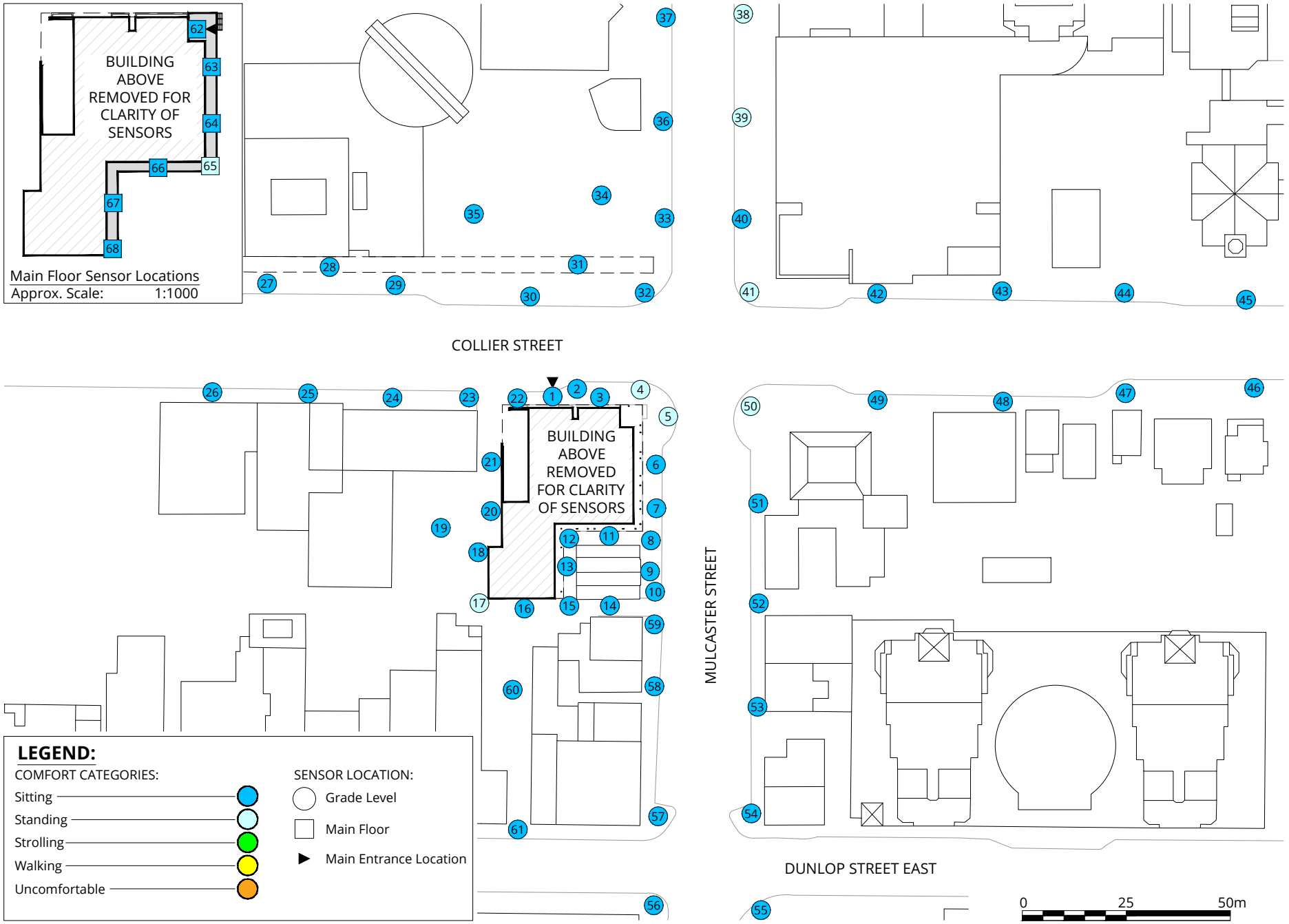
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

79 Collier Street - Barrie, ON

True North

Project #2100488

Drawn by:	DF	Figure:	1A
Approx. Scale:	1:1250		
Date Revised:	Dec. 1, 2020		



Pedestrian Wind Comfort Conditions

Proposed Configuration

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

79 Collier Street - Barrie, ON

True North

Project #2100488

Drawn by: DF	Figure: 1B		
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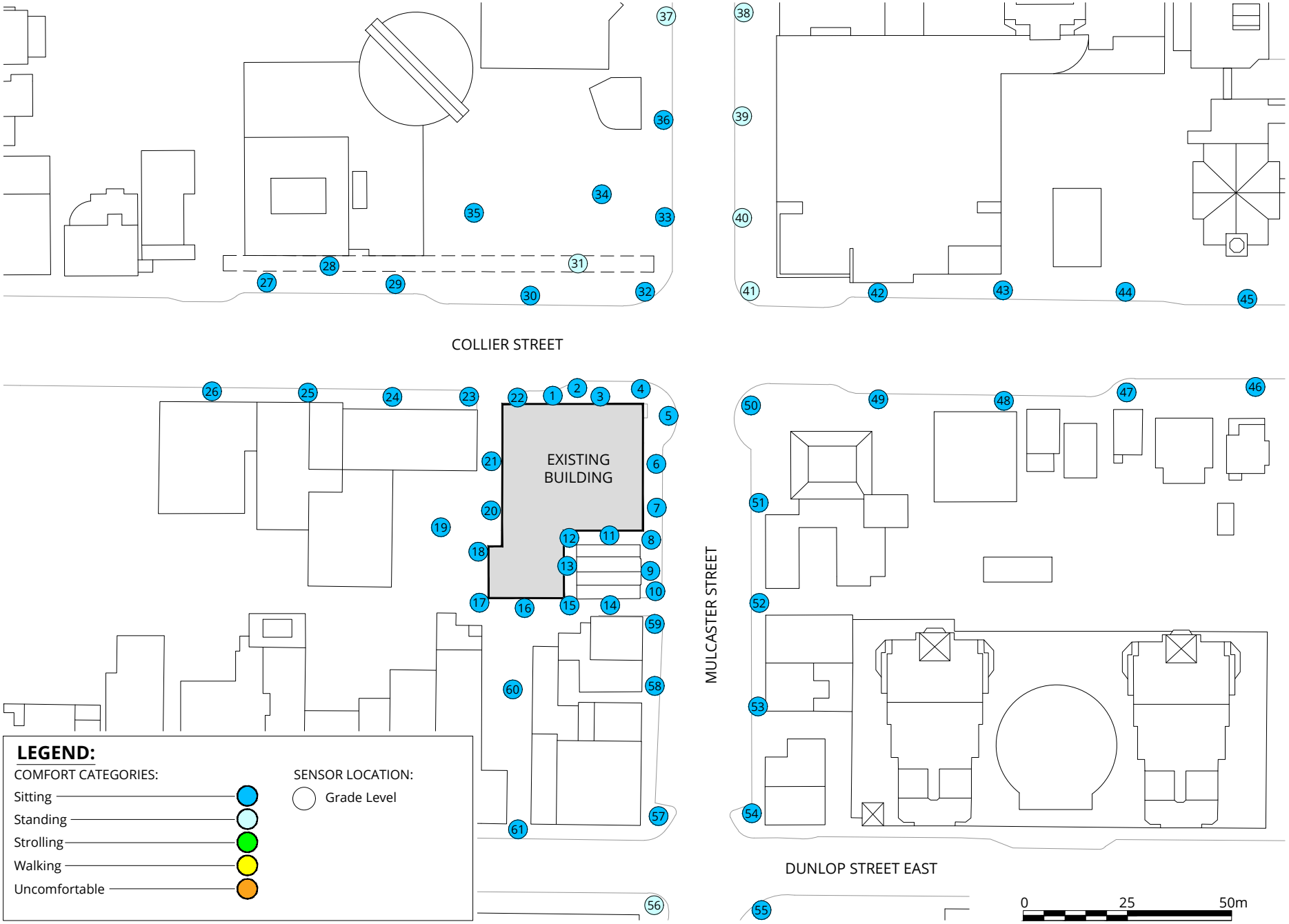


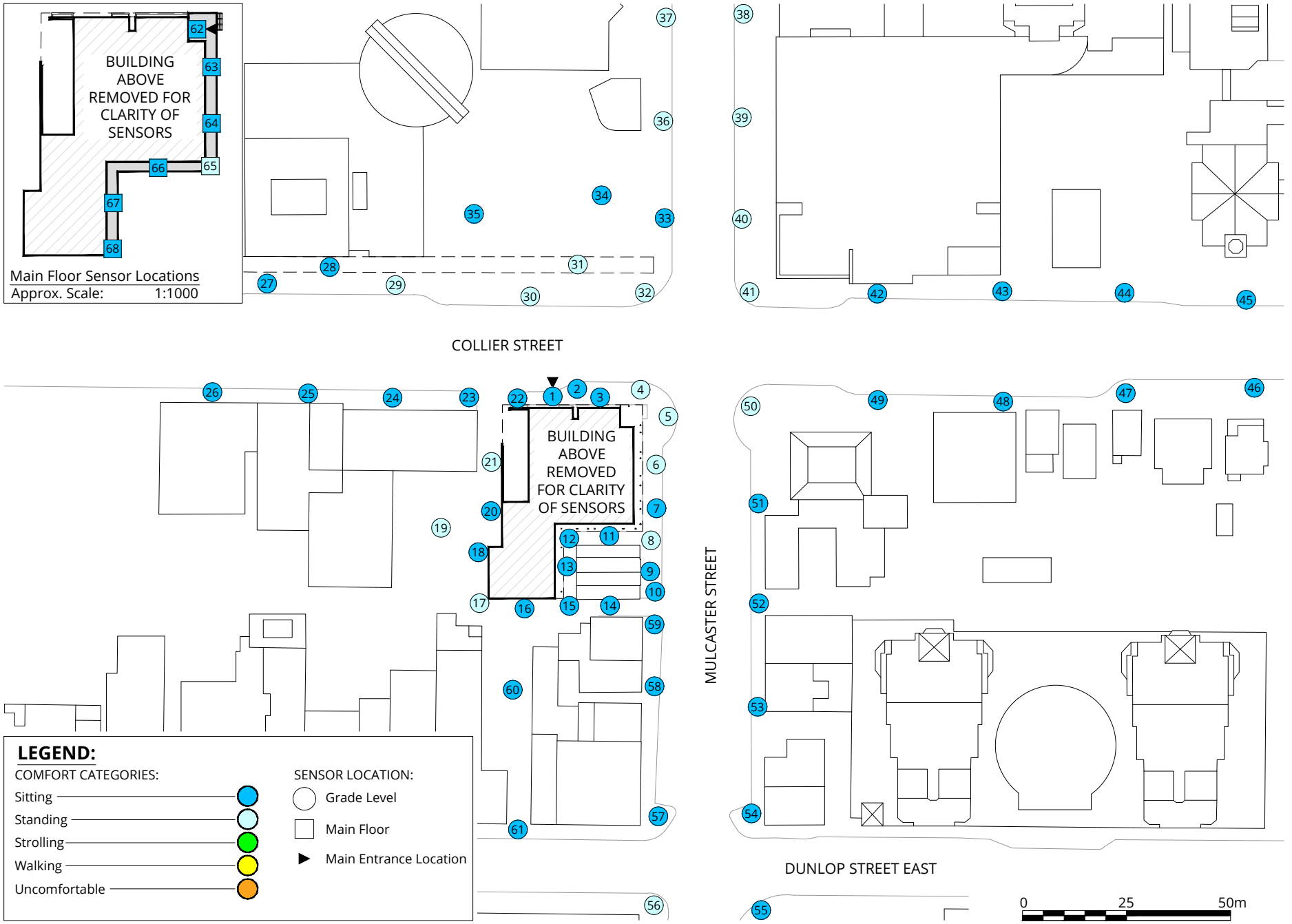
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

79 Collier Street - Barrie, ON

True North

Project #2100488

Drawn by: DF	Figure: 2A
Approx. Scale:	1:1250
Date Revised:	Dec. 1, 2020



Pedestrian Wind Comfort Conditions

Proposed Configuration

Winter (November to April, 6:00 to 23:00)

79 Collier Street - Barrie, ON

True North

Project #2100488

Drawn by: DF	Figure: 2B
Approx. Scale:	1:1250
Date Revised:	Dec. 1, 2020

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	6	Sitting	7	Sitting	30	Pass
	Proposed	6	Sitting	7	Sitting	32	Pass
2	Existing	6	Sitting	7	Sitting	30	Pass
	Proposed	7	Sitting	8	Sitting	48	Pass
3	Existing	6	Sitting	7	Sitting	30	Pass
	Proposed	7	Sitting	8	Sitting	37	Pass
4	Existing	7	Sitting	8	Sitting	35	Pass
	Proposed	11	Standing	13	Standing	47	Pass
5	Existing	8	Sitting	9	Sitting	40	Pass
	Proposed	12	Standing	14	Standing	51	Pass
6	Existing	7	Sitting	8	Sitting	39	Pass
	Proposed	9	Sitting	11	Standing	45	Pass
7	Existing	6	Sitting	7	Sitting	39	Pass
	Proposed	9	Sitting	10	Sitting	45	Pass
8	Existing	7	Sitting	8	Sitting	43	Pass
	Proposed	9	Sitting	11	Standing	55	Pass
9	Existing	6	Sitting	7	Sitting	47	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
10	Existing	7	Sitting	8	Sitting	52	Pass
	Proposed	8	Sitting	10	Sitting	44	Pass
11	Existing	4	Sitting	5	Sitting	22	Pass
	Proposed	6	Sitting	7	Sitting	48	Pass
12	Existing	6	Sitting	7	Sitting	31	Pass
	Proposed	5	Sitting	6	Sitting	31	Pass
13	Existing	6	Sitting	7	Sitting	33	Pass
	Proposed	6	Sitting	8	Sitting	45	Pass
14	Existing	5	Sitting	7	Sitting	33	Pass
	Proposed	7	Sitting	9	Sitting	44	Pass
15	Existing	5	Sitting	6	Sitting	28	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
16	Existing	4	Sitting	5	Sitting	26	Pass
	Proposed	7	Sitting	9	Sitting	37	Pass
17	Existing	5	Sitting	6	Sitting	29	Pass
	Proposed	12	Standing	14	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
18	Existing	6	Sitting	7	Sitting	30	Pass
	Proposed	9	Sitting	10	Sitting	41	Pass
19	Existing	5	Sitting	6	Sitting	27	Pass
	Proposed	9	Sitting	11	Standing	50	Pass
20	Existing	6	Sitting	7	Sitting	31	Pass
	Proposed	7	Sitting	8	Sitting	32	Pass
21	Existing	6	Sitting	7	Sitting	35	Pass
	Proposed	10	Sitting	12	Standing	46	Pass
22	Existing	6	Sitting	7	Sitting	32	Pass
	Proposed	7	Sitting	8	Sitting	35	Pass
23	Existing	6	Sitting	7	Sitting	32	Pass
	Proposed	7	Sitting	8	Sitting	35	Pass
24	Existing	7	Sitting	8	Sitting	35	Pass
	Proposed	8	Sitting	9	Sitting	36	Pass
25	Existing	7	Sitting	8	Sitting	33	Pass
	Proposed	6	Sitting	7	Sitting	29	Pass
26	Existing	7	Sitting	8	Sitting	32	Pass
	Proposed	7	Sitting	8	Sitting	32	Pass
27	Existing	7	Sitting	8	Sitting	42	Pass
	Proposed	6	Sitting	8	Sitting	37	Pass
28	Existing	6	Sitting	8	Sitting	35	Pass
	Proposed	7	Sitting	9	Sitting	38	Pass
29	Existing	8	Sitting	10	Sitting	49	Pass
	Proposed	10	Sitting	12	Standing	52	Pass
30	Existing	8	Sitting	10	Sitting	46	Pass
	Proposed	10	Sitting	12	Standing	55	Pass
31	Existing	10	Sitting	12	Standing	46	Pass
	Proposed	9	Sitting	11	Standing	56	Pass
32	Existing	9	Sitting	10	Sitting	38	Pass
	Proposed	9	Sitting	11	Standing	52	Pass
33	Existing	8	Sitting	10	Sitting	38	Pass
	Proposed	9	Sitting	10	Sitting	45	Pass
34	Existing	8	Sitting	9	Sitting	36	Pass
	Proposed	8	Sitting	9	Sitting	42	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
35	Existing	7	Sitting	8	Sitting	38	Pass
	Proposed	7	Sitting	8	Sitting	36	Pass
36	Existing	9	Sitting	10	Sitting	38	Pass
	Proposed	9	Sitting	11	Standing	42	Pass
37	Existing	10	Sitting	12	Standing	46	Pass
	Proposed	10	Sitting	12	Standing	47	Pass
38	Existing	11	Standing	12	Standing	52	Pass
	Proposed	11	Standing	13	Standing	52	Pass
39	Existing	10	Sitting	12	Standing	47	Pass
	Proposed	11	Standing	12	Standing	50	Pass
40	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	10	Sitting	12	Standing	48	Pass
41	Existing	10	Sitting	12	Standing	50	Pass
	Proposed	11	Standing	13	Standing	48	Pass
42	Existing	6	Sitting	8	Sitting	42	Pass
	Proposed	6	Sitting	8	Sitting	41	Pass
43	Existing	7	Sitting	9	Sitting	45	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
44	Existing	7	Sitting	8	Sitting	41	Pass
	Proposed	7	Sitting	8	Sitting	41	Pass
45	Existing	7	Sitting	8	Sitting	40	Pass
	Proposed	7	Sitting	9	Sitting	42	Pass
46	Existing	7	Sitting	8	Sitting	35	Pass
	Proposed	7	Sitting	8	Sitting	34	Pass
47	Existing	6	Sitting	8	Sitting	34	Pass
	Proposed	6	Sitting	8	Sitting	34	Pass
48	Existing	6	Sitting	7	Sitting	34	Pass
	Proposed	6	Sitting	7	Sitting	32	Pass
49	Existing	8	Sitting	9	Sitting	38	Pass
	Proposed	7	Sitting	9	Sitting	36	Pass
50	Existing	9	Sitting	10	Sitting	39	Pass
	Proposed	12	Standing	14	Standing	50	Pass
51	Existing	7	Sitting	8	Sitting	32	Pass
	Proposed	9	Sitting	10	Sitting	42	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
52	Existing	7	Sitting	8	Sitting	37	Pass
	Proposed	9	Sitting	10	Sitting	41	Pass
53	Existing	6	Sitting	8	Sitting	36	Pass
	Proposed	7	Sitting	8	Sitting	37	Pass
54	Existing	6	Sitting	7	Sitting	31	Pass
	Proposed	6	Sitting	7	Sitting	30	Pass
55	Existing	8	Sitting	9	Sitting	40	Pass
	Proposed	7	Sitting	9	Sitting	39	Pass
56	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	9	Sitting	11	Standing	45	Pass
57	Existing	7	Sitting	8	Sitting	37	Pass
	Proposed	7	Sitting	9	Sitting	38	Pass
58	Existing	7	Sitting	8	Sitting	52	Pass
	Proposed	7	Sitting	9	Sitting	50	Pass
59	Existing	7	Sitting	8	Sitting	52	Pass
	Proposed	7	Sitting	8	Sitting	45	Pass
60	Existing	6	Sitting	7	Sitting	34	Pass
	Proposed	6	Sitting	7	Sitting	31	Pass
61	Existing	7	Sitting	9	Sitting	39	Pass
	Proposed	8	Sitting	9	Sitting	36	Pass
62	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	8	Sitting	39	Pass
63	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	9	Sitting	43	Pass
64	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	7	Sitting	40	Pass
65	Existing	-	-	-	-	-	-
	Proposed	12	Standing	14	Standing	68	Pass
66	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	8	Sitting	39	Pass
67	Existing	-	-	-	-	-	-
	Proposed	3	Sitting	4	Sitting	25	Pass
68	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	8	Sitting	50	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

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