REPORT

30 QUEEN STREET EAST

MISSISSAUGA, ON

PEDESTRIAN WIND STUDY
RWDI # 2200904
January 19, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 30 Queen Street project in Port Credit, Mississauga, ON (Image 1). Based on our wind-tunnel testing for the proposed project under the Existing and Proposed configurations (Images 2A and 2B, respectively) and the local wind records (Image 3), the potential wind comfort and safety conditions are predicted as shown on site plans in Figures 1A through 3B, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- The existing wind conditions on and around the site are generally comfortable for the intended pedestrian use throughout the year. High wind speeds and uncomfortable conditions occur at localized areas on the site and along the sidewalks of Ann Street and along Park Street East.
- With the proposed project in place, wind conditions are expected to be comfortable for the intended pedestrian use at most grade-level areas throughout the year. In the winter, due to the seasonally stronger winds, higher wind speeds and uncomfortable conditions are predicted at multiple areas on site. The wind conditions at these locations can be improved with the use localized wind control features such as wind breaks (hard or softscape features).
- Wind speeds at most areas on the Level 2 outdoor amenity area of Tower B, are predicted to be comfortable for passive patron use during the summer, when outdoor spaces are mainly used. Wind speeds at most locations on the Level 11 amenity area of Tower A, are expected to be higher than desired throughout the year.
- Existing wind speeds meet the safety criterion at all locations assessed. With the addition of the proposed project, the wind safety criterion is expected to be exceeded at grade-level locations between the towers, the northwest corner of Tower A and the southwest corner of Tower B. This criterion will also be exceeded at all areas on the Level 11 amenity area of Tower A.
- Suitable wind conditions can be achieved throughout the site with the implementation of localized hard and/or softscape features. Additional wind tunnel testing will be conducted as the design progresses to develop appropriate wind mitigation measures and to confirm their efficacy.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 30 Queen Street East project in Port Credit, Mississauga, ON. This report presents the project objectives, background and approach, and a discussion of results. It also provides conceptual wind control measures, where necessary.

1.1 Project Description

The project (site shown in Image 1) is located on the south side of Queen Street East between Ann Street to the west and Hurontario Street to the east. It consists of two towers, Tower A at 40 stories on the south side of the site and Tower B at 42 stories on the north side of the site.

1.2 Objectives

The objective of the study was to assess the effect of the proposed project on local wind 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 Mississauga Pedestrian Wind Criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian spaces including public sidewalks around the site and outdoor amenity areas on the second floor of Tower B and the eleventh floor of Tower A.

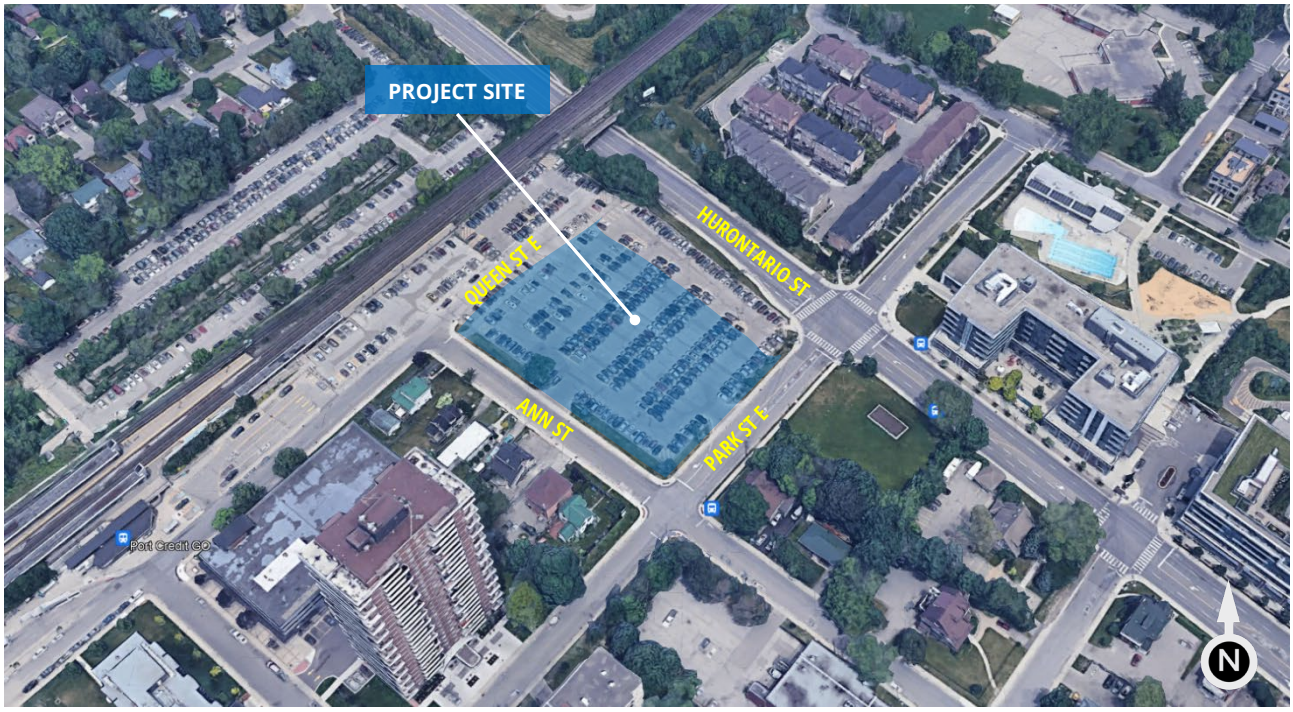


Image 1: Aerial View of Existing Site and Surroundings (Photo Courtesy of Google™ Earth)

2 BACKGROUND AND APPROACH

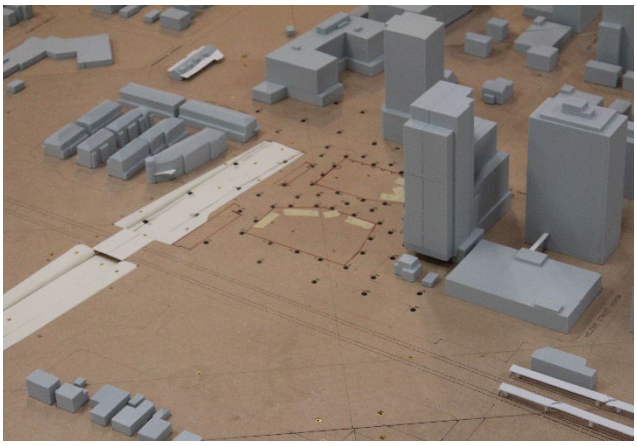
2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the 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 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 87 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 increment. 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.



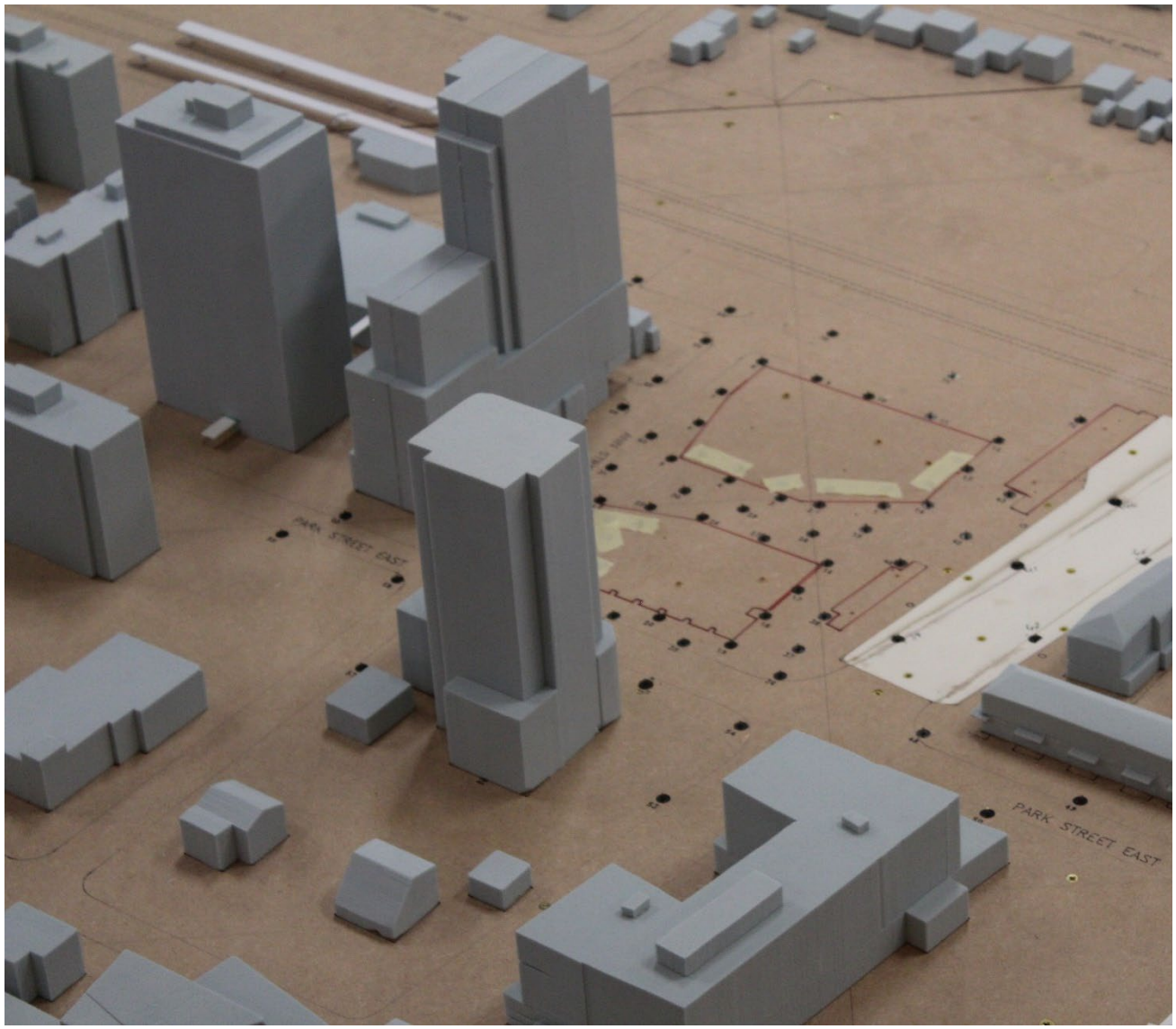


Image 2A: Wind Tunnel Study Model – Existing Configuration

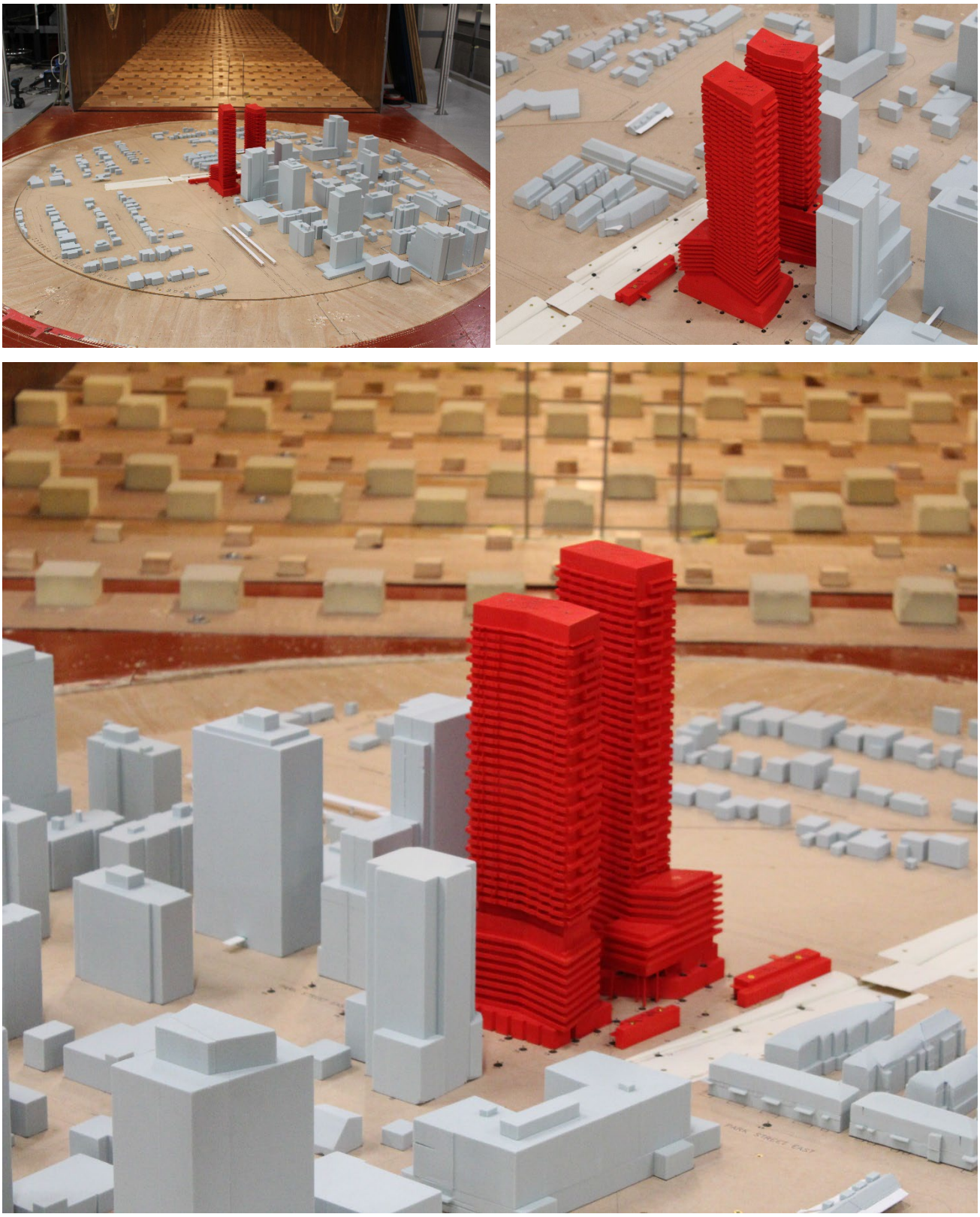
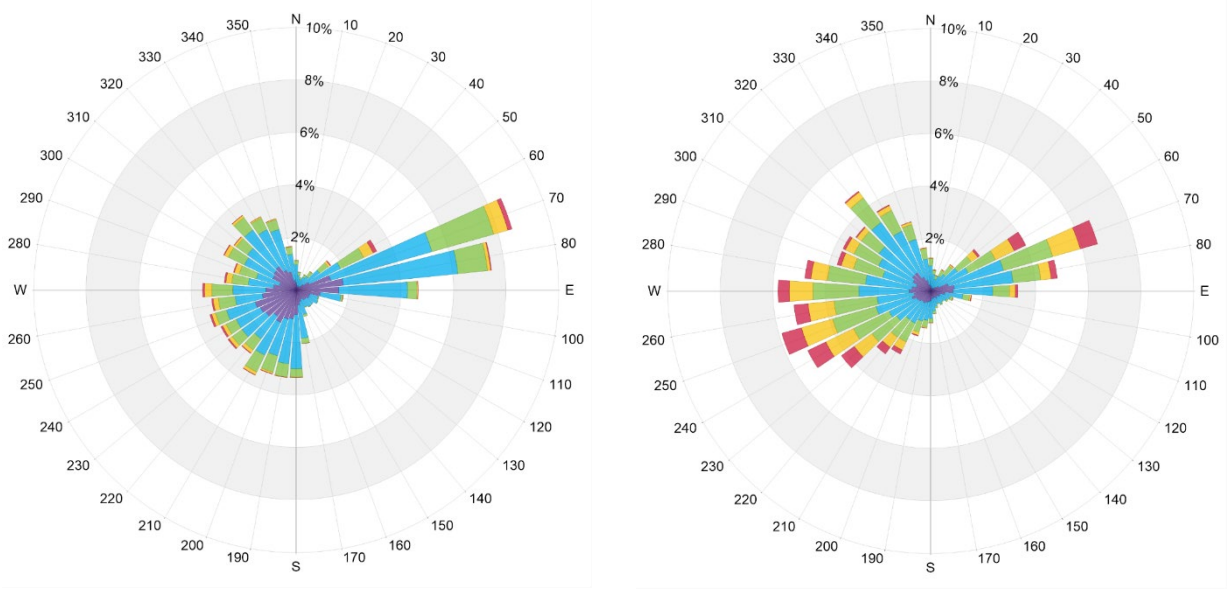


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Billy Bishop Toronto City Airport between 1989 and 2019, 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 southwest through northwest and east-northeast directions are predominant during both the summer and winter. 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 17.3%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 Mississauga Pedestrian Wind Criteria for pedestrian comfort and safety.



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

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	5.8	2.6
1-10	30.4	17.2
11-20	43.4	37.8
21-30	16.2	25.0
31-40	3.4	11.4
>40	0.9	5.9

Image 3: Directional Distribution of Winds Approaching Billy Bishop Toronto City Airport between 1989 and 2019

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.

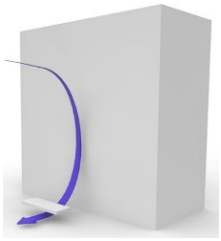
Notes:
(1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and Gust Speed = Mean Speed + 3*RMS Speed;
(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.

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.

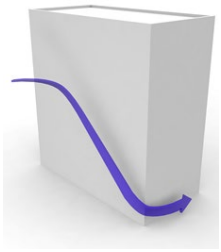
2.4 Generalized Wind Flows

In our discussion of wind conditions, reference may be made to the following generalized wind flows (Image 4):



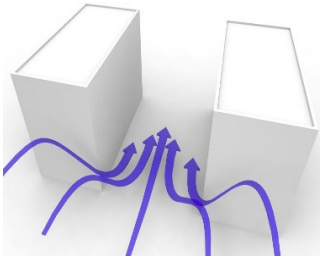
DOWNWASHING

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 winds approach at an oblique angle to a tall façade and are deflected down, a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level.



CHANNELLING EFFECT

When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channelling effect caused by the narrow gap.

Image 4: Generalized Wind Flows

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)

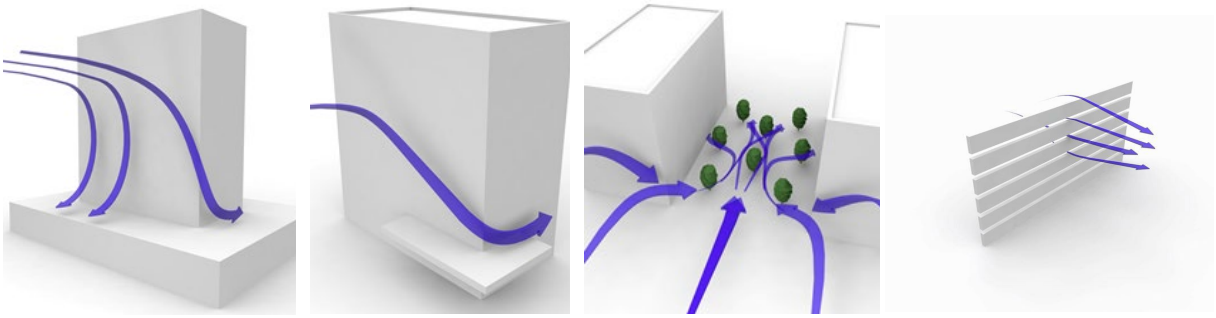


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on a site plan in Figures 1A through 3B 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.

In general, 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 sitting or standing are preferred at building entrances where pedestrians are apt to linger. These low wind speeds are also suitable for areas such as outdoor amenities where passive patron activities are anticipated during the summer. 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

Existing wind speeds at most areas on and around the site are comfortable for standing in the summer (Figure 1A) and for walking in the winter (Figure 2A), which are considered appropriate for the intended pedestrian usage. During the winter, higher wind speeds and uncomfortable conditions occur at localized areas on the site and along the sidewalks of Ann Street and Park Street East (See Locations 4, 6, 59, 60 and 68 in Figure 2A).

Wind speeds meet the safety criterion at all areas assessed in the Existing configuration (Figure 3A).

3.2 Proposed Configuration

3.2.1 Grade Level (Locations 1 through 75)

The addition of the proposed project to the site is generally expected to cause higher wind speeds, compared to the Existing configuration, which is primarily due to the height of the proposed towers and the low surroundings in the predominant wind directions. Downwashing of the prevailing winds off the tall building façades will redirect them to the ground level; these redirected winds can be relatively strong and turbulent, especially around exposed building corners and in areas between buildings where winds accelerate due to the channelling effect (see Image 4).

During the summer, wind conditions on and around the site are predicted to be comfortable for walking or better (Figure 1B), which is suitable for the intended use. Wind speeds around the perimeter of the towers are expected to be generally comfortable for sitting or standing, especially along the south and east façades of both towers and the north façade of Tower B, which is appropriate for passive pedestrian use and entrance locations, if applicable.

During the winter, the seasonally stronger winds are expected to cause increased wind speeds throughout the site (Figure 2B). Wind conditions comfortable for walking are expected in most areas, except for areas around the exposed tower corners, through the narrow space between the towers and along sidewalks to the west, where uncomfortable conditions are predicted. These conditions are caused by a combination of downwashing, corner acceleration and channelling of wind flows between the towers, as previously described in Section 2.4.

Wind speeds at most locations assessed meet the pedestrian wind safety criterion (Figure 3B), except for areas near the northwest corner of Tower A (Locations 24 and 32), southwest corner of Tower B (Locations 5 and 66), and between the two towers (Locations 26, 27, 29 and 30).

To help improve the wind conditions, the design team may consider increasing the podium/tower setbacks on the west, north and east sides to deflect the downwashing winds away from the ground level. Alternatively, wide canopies along the exposed façades and wrapped around the corners can help divert the wind downdrafts and moderate the wind impact of the towers. For areas between the towers, where the wind flow channelling occurs, strategic use of vertical wind control elements in the form of porous screens, art features and evergreen/marcescent landscaping can be explored. Such features can also be implemented near the exposed building corners to diffuse the energy of accelerating winds. Wind control examples are shown in Image 6. Additional wind tunnel testing will be conducted as the design progresses, to further develop the above mitigation measures and to quantify their efficacy.

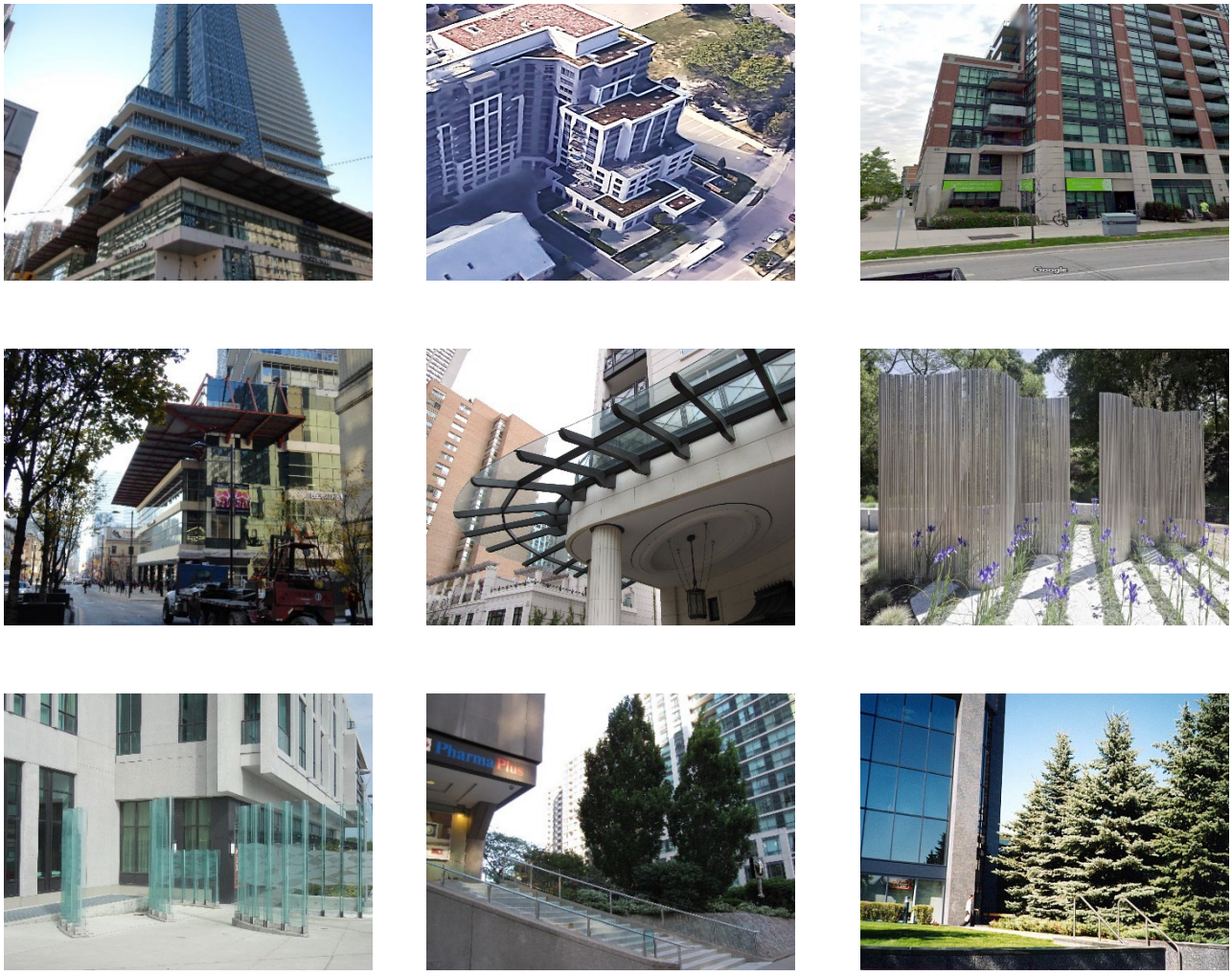


Image 6: Examples of Wind Control Solutions Applicable to the Grade Level

3.2.2 Above-Grade Levels (Locations 76 to 87)

It is generally desirable for wind conditions on outdoor amenities intended for passive activities to be comfortable for sitting or standing more than 80% of the time in the summer. During the winter, these areas would not be used frequently, thus, increased wind activity would be considered acceptable.

Wind conditions comfortable for sitting or standing are generally predicted on the Level 2 amenity area of Tower B during the summer (Locations 76-82 in Figure 1B). Slightly higher wind speeds are predicted at the south corner (see conditions comfortable for walking at Location 78). During the winter, wind speeds at the south and east sides of the amenity are anticipated to be comfortable for standing (Figure 2B).

Higher than desired wind speeds are expected at most areas of the Level 11 amenity area of Tower A during the summer (Locations 83 to 87 in Figure 1B), with wind conditions becoming uncomfortable at all areas in the winter (Figure 2B).

Wind speeds that meet the safety criterion are predicated at all locations on the Level 2 amenity of Tower B, but this criterion will be exceeded at all locations on the Level 11 amenity area of Tower A (Figure 3B).

Depending on the programming of the amenity areas, additional landscaping/hardscaping elements can be used around designated seating and gathering spaces to further reduce wind speeds and create sheltered zones. These elements may take the form of porous or impermeable screens, partitions, landscaping, and trellises/canopies. RWDI can provide further guidance on the placement of wind control measures as the design and programming evolves. Examples of wind control measures are shown in Image 7 below.

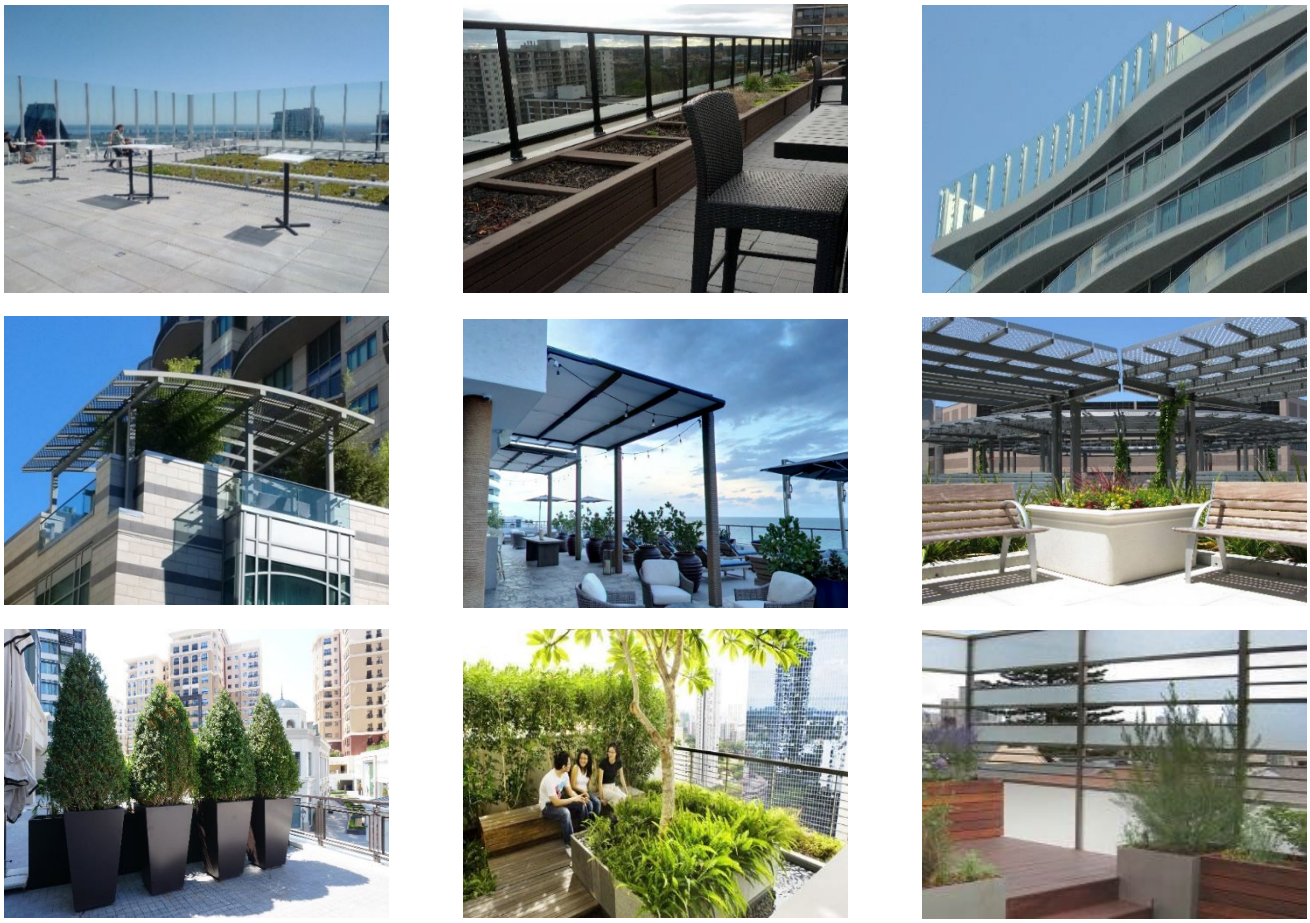


Image 7: Examples of Wind Control Measures Applicable to the Amenity Areas

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 30 Queen Street East project 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 be affected. 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)
2021.11.08 - Option 8 (39-36)	Sketchup	24/11/2021

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.
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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.
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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

QUEEN STREET EAST

ANN STREET

HURONTARIO STREET

PARK STREET EAST

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level

0 10 30m

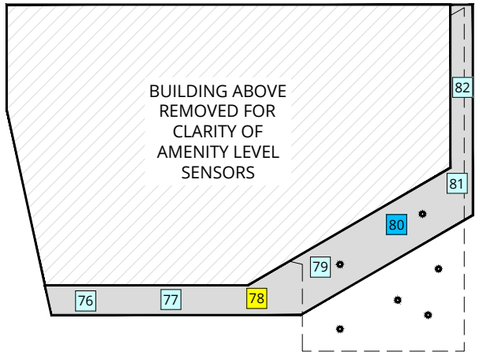
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

30 Queen Street East - Mississauga, ON

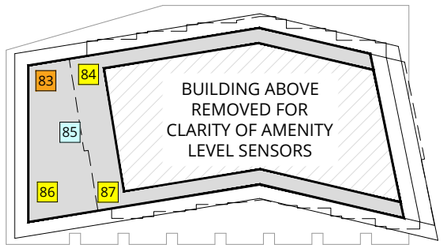
True North

Project #2200904

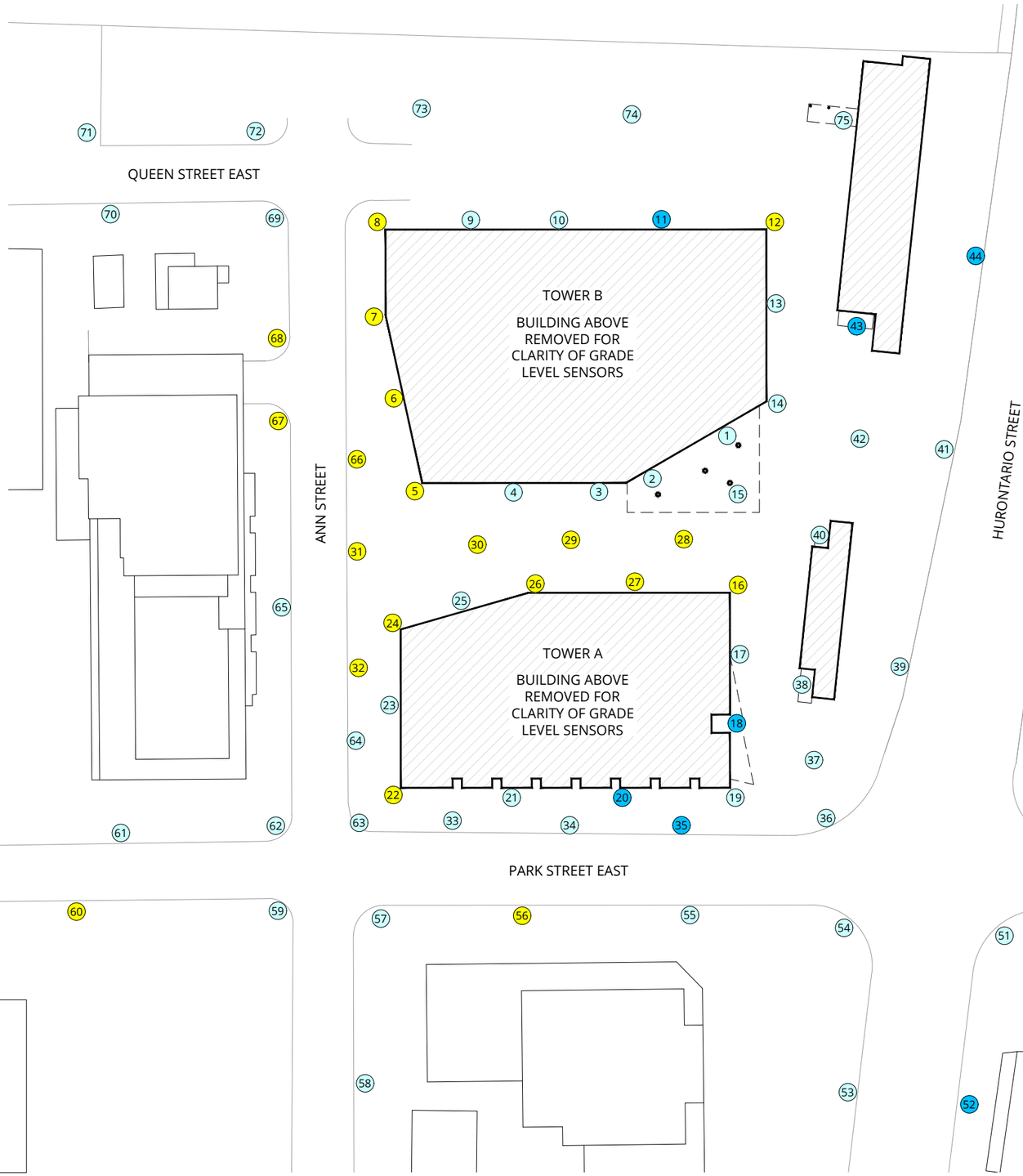
Drawn by: GRE	Figure: 1A
Approx. Scale:	1:800
Date Revised:	Jan. 17, 2022

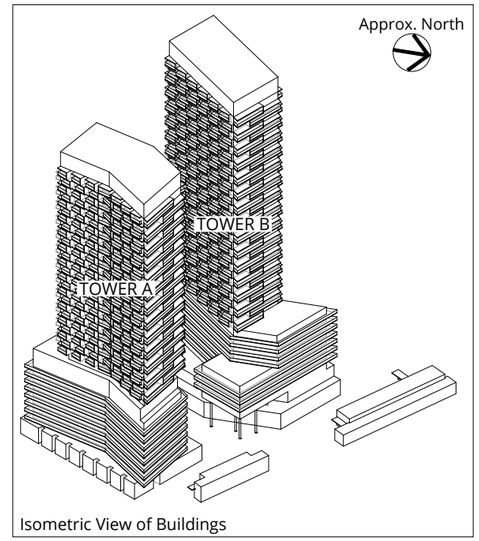


Tower B - Level 2 Outdoor Amenity



Tower A - Level 11 Outdoor Amenity





Isometric View of Buildings

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Outdoor Amenity

0 10 30m

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

30 Queen Street East - Mississauga, ON

True North

Project #2200904

Drawn by:	GRE	Figure:	1B
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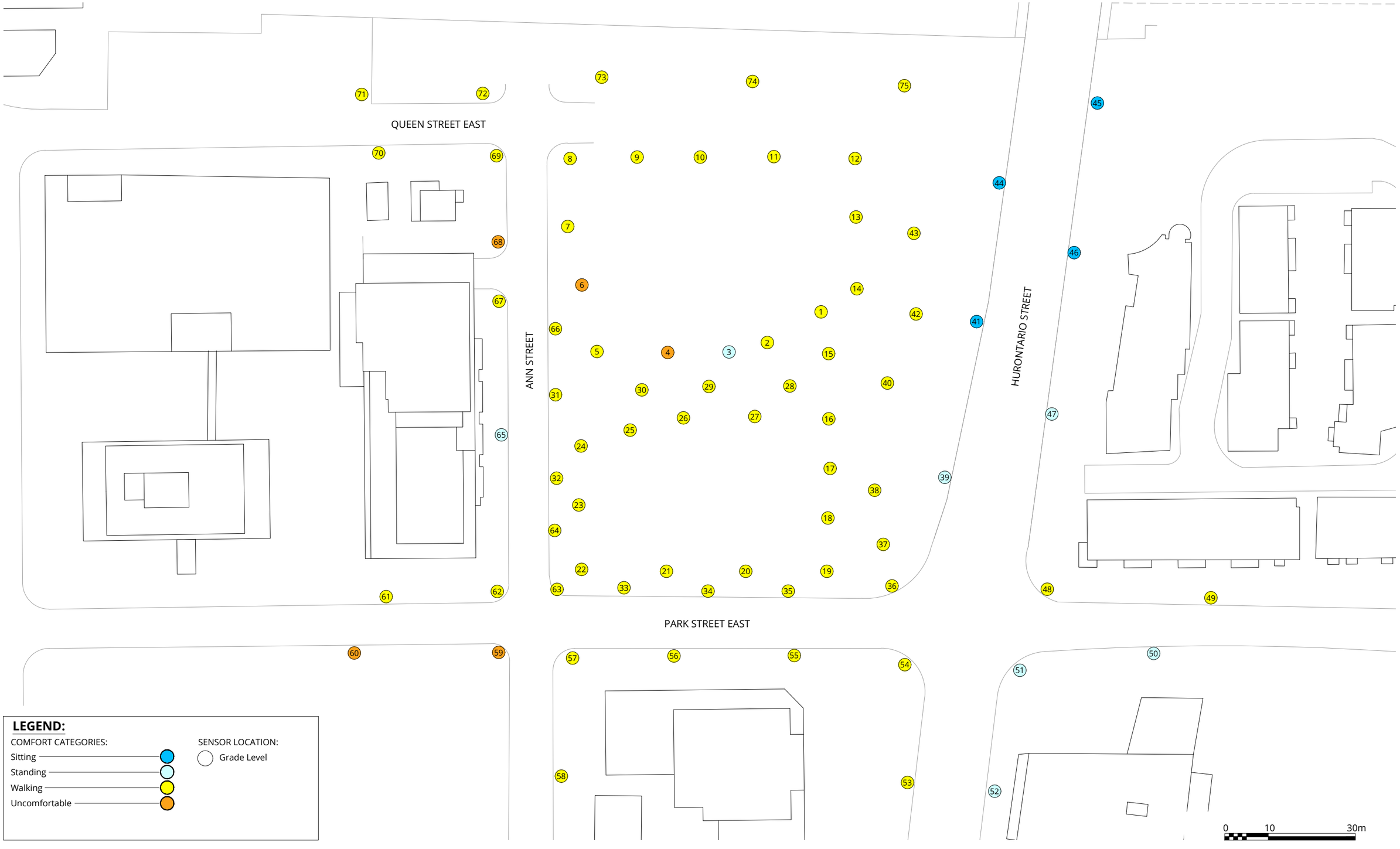
Date Revised:	Jan. 17, 2022		



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level

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

30 Queen Street East - Mississauga, ON

True North

Project #2200904

Drawn by:	GRE	Figure:	2A
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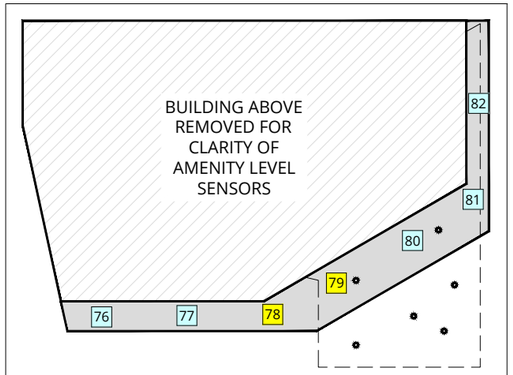
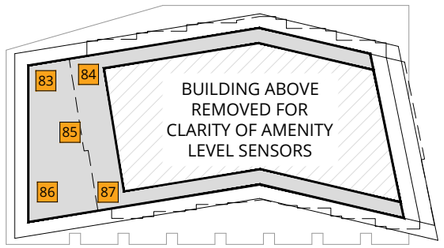
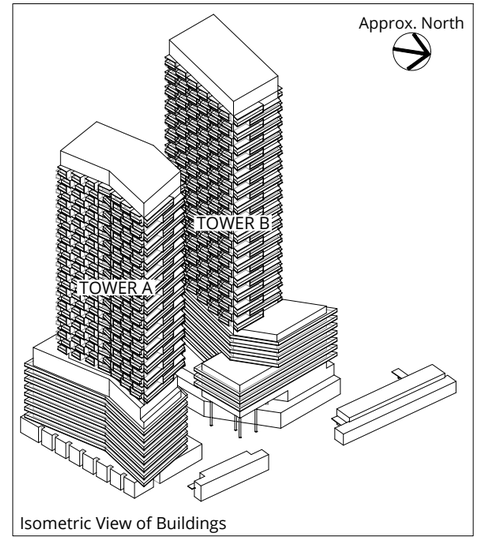


Tower B - Level 2 Outdoor Amenity



Tower A - Level 11 Outdoor Amenity



Isometric View of Buildings

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Outdoor Amenity

0 10 30m

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

30 Queen Street East - Mississauga, ON

True North

Project #2200904

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1:800		
Date Revised:	Jan. 17, 2022		

QUEEN STREET EAST

ANN STREET

HURONTARIO STREET

PARK STREET EAST

LEGEND:

SAFETY CATEGORIES:
- Pass
- Exceeded

SENSOR LOCATION:
- Grade Level

0 10 30m

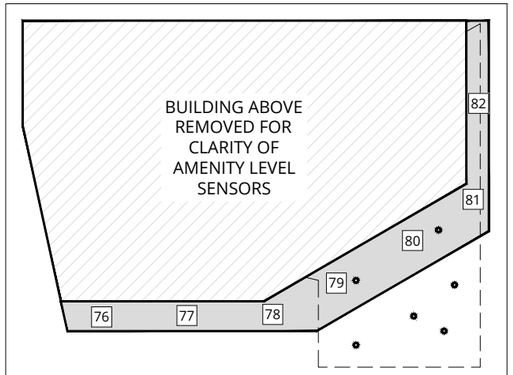
Pedestrian Wind Safety Conditions
Existing Configuration
Annual (January to December, 0:00 to 23:00)

30 Queen Street East - Mississauga, ON

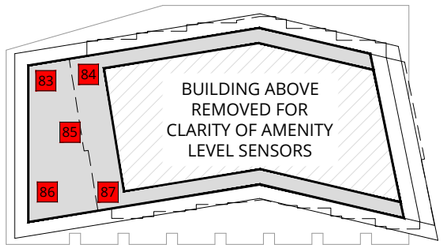
True North

Project #2200904

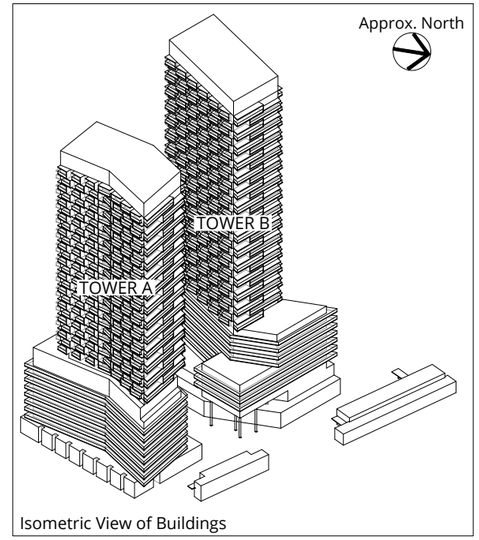
Drawn by:	GRE	Figure:	3A
Approx. Scale:		1:800	
Date Revised:		Jan. 17, 2022	



Tower B - Level 2 Outdoor Amenity



Tower A - Level 11 Outdoor Amenity



Isometric View of Buildings

LEGEND:

SAFETY CATEGORIES:
- Pass
- Exceeded

SENSOR LOCATION:
- Grade Level
- Outdoor Amenity

0 10 30m

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

30 Queen Street East - Mississauga, ON

True North

Project #2200904

Drawn by:	GRE	Figure:	3B
Approx. Scale:	1:800		
Date Revised:	Jan. 17, 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	12	Standing	17	Walking	70	Pass
	Proposed	11	Standing	12	Standing	52	Pass
2	Existing	13	Standing	20	Walking	83	Pass
	Proposed	15	Standing	18	Walking	74	Pass
3	Existing	11	Standing	15	Standing	55	Pass
	Proposed	11	Standing	14	Standing	59	Pass
4	Existing	14	Standing	21	Uncomfortable	84	Pass
	Proposed	13	Standing	16	Walking	73	Pass
5	Existing	14	Standing	20	Walking	83	Pass
	Proposed	18	Walking	28	Uncomfortable	94	Exceeded
6	Existing	16	Walking	24	Uncomfortable	87	Pass
	Proposed	16	Walking	23	Uncomfortable	79	Pass
7	Existing	14	Standing	20	Walking	77	Pass
	Proposed	16	Walking	20	Walking	79	Pass
8	Existing	14	Standing	20	Walking	88	Pass
	Proposed	17	Walking	20	Walking	87	Pass
9	Existing	13	Standing	18	Walking	77	Pass
	Proposed	11	Standing	15	Standing	59	Pass
10	Existing	13	Standing	18	Walking	68	Pass
	Proposed	11	Standing	16	Walking	68	Pass
11	Existing	12	Standing	17	Walking	65	Pass
	Proposed	10	Sitting	15	Standing	59	Pass
12	Existing	11	Standing	17	Walking	62	Pass
	Proposed	19	Walking	27	Uncomfortable	90	Pass
13	Existing	12	Standing	17	Walking	65	Pass
	Proposed	12	Standing	15	Standing	65	Pass
14	Existing	12	Standing	17	Walking	66	Pass
	Proposed	13	Standing	17	Walking	71	Pass
15	Existing	12	Standing	17	Walking	73	Pass
	Proposed	15	Standing	18	Walking	66	Pass
16	Existing	13	Standing	17	Walking	77	Pass
	Proposed	17	Walking	23	Uncomfortable	87	Pass
17	Existing	13	Standing	18	Walking	81	Pass
	Proposed	11	Standing	14	Standing	62	Pass
18	Existing	13	Standing	16	Walking	83	Pass
	Proposed	10	Sitting	12	Standing	60	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	16	Walking	85	Pass
	Proposed	15	Standing	19	Walking	74	Pass
20	Existing	13	Standing	16	Walking	82	Pass
	Proposed	9	Sitting	12	Standing	47	Pass
21	Existing	13	Standing	16	Walking	75	Pass
	Proposed	11	Standing	14	Standing	61	Pass
22	Existing	13	Standing	18	Walking	72	Pass
	Proposed	16	Walking	20	Walking	82	Pass
23	Existing	14	Standing	18	Walking	80	Pass
	Proposed	14	Standing	18	Walking	74	Pass
24	Existing	13	Standing	17	Walking	74	Pass
	Proposed	18	Walking	25	Uncomfortable	91	Exceeded
25	Existing	14	Standing	18	Walking	80	Pass
	Proposed	14	Standing	18	Walking	73	Pass
26	Existing	14	Standing	18	Walking	77	Pass
	Proposed	19	Walking	26	Uncomfortable	93	Exceeded
27	Existing	13	Standing	18	Walking	79	Pass
	Proposed	19	Walking	26	Uncomfortable	93	Exceeded
28	Existing	13	Standing	18	Walking	80	Pass
	Proposed	18	Walking	23	Uncomfortable	82	Pass
29	Existing	13	Standing	20	Walking	83	Pass
	Proposed	19	Walking	27	Uncomfortable	95	Exceeded
30	Existing	14	Standing	20	Walking	88	Pass
	Proposed	16	Walking	20	Walking	91	Exceeded
31	Existing	12	Standing	16	Walking	73	Pass
	Proposed	16	Walking	23	Uncomfortable	87	Pass
32	Existing	13	Standing	17	Walking	65	Pass
	Proposed	17	Walking	24	Uncomfortable	94	Exceeded
33	Existing	13	Standing	17	Walking	73	Pass
	Proposed	12	Standing	15	Standing	70	Pass
34	Existing	13	Standing	16	Walking	84	Pass
	Proposed	11	Standing	15	Standing	62	Pass
35	Existing	13	Standing	16	Walking	85	Pass
	Proposed	10	Sitting	14	Standing	65	Pass
36	Existing	13	Standing	16	Walking	83	Pass
	Proposed	14	Standing	17	Walking	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
37	Existing	13	Standing	17	Walking	80	Pass
	Proposed	13	Standing	16	Walking	62	Pass
38	Existing	13	Standing	17	Walking	78	Pass
	Proposed	13	Standing	17	Walking	66	Pass
39	Existing	10	Sitting	12	Standing	61	Pass
	Proposed	12	Standing	14	Standing	64	Pass
40	Existing	12	Standing	17	Walking	73	Pass
	Proposed	11	Standing	16	Walking	63	Pass
41	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	11	Standing	14	Standing	61	Pass
42	Existing	11	Standing	16	Walking	65	Pass
	Proposed	12	Standing	16	Walking	62	Pass
43	Existing	11	Standing	16	Walking	60	Pass
	Proposed	7	Sitting	9	Sitting	36	Pass
44	Existing	7	Sitting	9	Sitting	47	Pass
	Proposed	10	Sitting	14	Standing	57	Pass
45	Existing	6	Sitting	9	Sitting	34	Pass
	Proposed	8	Sitting	12	Standing	47	Pass
46	Existing	8	Sitting	10	Sitting	40	Pass
	Proposed	11	Standing	15	Standing	59	Pass
47	Existing	8	Sitting	13	Standing	54	Pass
	Proposed	11	Standing	14	Standing	68	Pass
48	Existing	11	Standing	16	Walking	67	Pass
	Proposed	12	Standing	16	Walking	69	Pass
49	Existing	11	Standing	16	Walking	63	Pass
	Proposed	11	Standing	13	Standing	53	Pass
50	Existing	11	Standing	15	Standing	62	Pass
	Proposed	11	Standing	14	Standing	57	Pass
51	Existing	12	Standing	14	Standing	67	Pass
	Proposed	12	Standing	16	Walking	62	Pass
52	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	9	Sitting	12	Standing	45	Pass
53	Existing	15	Standing	18	Walking	78	Pass
	Proposed	14	Standing	17	Walking	78	Pass
54	Existing	13	Standing	17	Walking	84	Pass
	Proposed	14	Standing	18	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	14	Standing	17	Walking	76	Pass
	Proposed	14	Standing	19	Walking	69	Pass
56	Existing	14	Standing	17	Walking	88	Pass
	Proposed	16	Walking	20	Walking	77	Pass
57	Existing	14	Standing	20	Walking	79	Pass
	Proposed	15	Standing	19	Walking	73	Pass
58	Existing	13	Standing	16	Walking	68	Pass
	Proposed	11	Standing	15	Standing	60	Pass
59	Existing	15	Standing	21	Uncomfortable	81	Pass
	Proposed	15	Standing	18	Walking	75	Pass
60	Existing	15	Standing	22	Uncomfortable	84	Pass
	Proposed	16	Walking	23	Uncomfortable	84	Pass
61	Existing	11	Standing	16	Walking	73	Pass
	Proposed	13	Standing	15	Standing	82	Pass
62	Existing	15	Standing	19	Walking	80	Pass
	Proposed	15	Standing	19	Walking	76	Pass
63	Existing	14	Standing	18	Walking	82	Pass
	Proposed	15	Standing	20	Walking	77	Pass
64	Existing	14	Standing	18	Walking	86	Pass
	Proposed	15	Standing	21	Uncomfortable	84	Pass
65	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	13	Standing	16	Walking	77	Pass
66	Existing	14	Standing	20	Walking	85	Pass
	Proposed	18	Walking	28	Uncomfortable	93	Exceeded
67	Existing	13	Standing	18	Walking	77	Pass
	Proposed	18	Walking	26	Uncomfortable	90	Pass
68	Existing	15	Standing	22	Uncomfortable	79	Pass
	Proposed	17	Walking	22	Uncomfortable	83	Pass
69	Existing	14	Standing	18	Walking	89	Pass
	Proposed	15	Standing	18	Walking	89	Pass
70	Existing	11	Standing	16	Walking	79	Pass
	Proposed	11	Standing	15	Standing	59	Pass
71	Existing	12	Standing	17	Walking	86	Pass
	Proposed	12	Standing	16	Walking	68	Pass
72	Existing	14	Standing	19	Walking	84	Pass
	Proposed	14	Standing	18	Walking	80	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	13	Standing	18	Walking	73	Pass
	Proposed	14	Standing	18	Walking	68	Pass
74	Existing	12	Standing	18	Walking	64	Pass
	Proposed	15	Standing	20	Walking	83	Pass
75	Existing	11	Standing	17	Walking	60	Pass
	Proposed	14	Standing	18	Walking	73	Pass
76	Existing	-	-	-	-	-	-
	Proposed	12	Standing	14	Standing	75	Pass
77	Existing	-	-	-	-	-	-
	Proposed	13	Standing	15	Standing	66	Pass
78	Existing	-	-	-	-	-	-
	Proposed	16	Walking	20	Walking	84	Pass
79	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Walking	80	Pass
80	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	12	Standing	64	Pass
81	Existing	-	-	-	-	-	-
	Proposed	11	Standing	14	Standing	68	Pass
82	Existing	-	-	-	-	-	-
	Proposed	13	Standing	14	Standing	71	Pass
83	Existing	-	-	-	-	-	-
	Proposed	21	Uncomfortable	30	Uncomfortable	100	Exceeded
84	Existing	-	-	-	-	-	-
	Proposed	19	Walking	28	Uncomfortable	114	Exceeded
85	Existing	-	-	-	-	-	-
	Proposed	14	Standing	22	Uncomfortable	98	Exceeded
86	Existing	-	-	-	-	-	-
	Proposed	19	Walking	25	Uncomfortable	98	Exceeded
87	Existing	-	-	-	-	-	-
	Proposed	19	Walking	24	Uncomfortable	95	Exceeded

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