

## 117 FOREST AVENUE & 175 CATHARINE STREET SOUTH

HAMILTON, ON

PEDESTRIAN WIND STUDY

RWDI # 2400533

November 16, 2023

### SUBMITTED TO

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## EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 117 Forest Avenue & 175 Catharine Street South in Hamilton, ON. The assessment was based on the wind-tunnel testing conducted for the proposed development under the Existing and Proposed configurations of the site and surroundings. The results were analysed using the regional wind climate records and evaluated against the RWDI Pedestrian Wind Criteria for pedestrian comfort (pertaining to common wind speeds conducive to different levels of human activity) and pedestrian safety (pertaining to infrequent but strong gusts that could affect a person's footing). The predicted wind conditions are presented in Figures 1A through 2B, and Table 1, and are summarized as follows:

- Wind speeds at all locations assessed meet the pedestrian wind safety criterion.
- In the Existing configuration, wind speeds at most locations assessed are comfortable for the intended pedestrian uses throughout the year. Uncomfortable conditions exist at four locations to the west of site near the intersection of Forest Avenue and Catharine Street South during the winter.
- With the proposed development in place, wind conditions remain similar or improve slightly on and around the site and are considered comfortable for the intended use of most pedestrian areas, throughout the year. Uncomfortable conditions are reduced from the existing conditions from four down to two locations along Catharine Street South in the winter.
- Wind speeds on the Level 5 and 7 outdoor amenity areas are observed to be comfortable for patron use at all test locations in the summer and at most locations in the winter. These conditions are considered appropriate.



# TABLE OF CONTENTS

## EXECUTIVE SUMMARY

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Project Description.....	1
1.2	Objectives .....	1
<b>2</b>	<b>BACKGROUND AND APPROACH.....</b>	<b>2</b>
2.1	Wind Tunnel Study Model.....	2
2.2	Wind Climate Data.....	5
2.3	RWDI Pedestrian Wind Criteria .....	6
<b>3</b>	<b>RESULTS AND DISCUSSION .....</b>	<b>7</b>
3.1	Grade Level (Locations 1 through 62) .....	7
3.1.1	Existing Configuration .....	7
3.1.2	Proposed Configuration.....	7
3.2	Level 5 and 7 Outdoor Amenity Areas (Locations 63 through 72).....	8
<b>4</b>	<b>STATEMENT OF LIMITATIONS .....</b>	<b>9</b>
<b>5</b>	<b>REFERENCES.....</b>	<b>11</b>

## LIST OF FIGURES

- Figure 1A: Pedestrian Wind Comfort Conditions – Existing Configuration – Summer
- Figure 1B: Pedestrian Wind Comfort Conditions – Proposed Configuration – Summer
  
- Figure 2A: Pedestrian Wind Comfort Conditions – Existing Configuration – Winter
- Figure 2B: Pedestrian Wind Comfort Conditions – Proposed Configuration – Winter

## LIST OF TABLES

- Table 1: Pedestrian Wind Comfort and Safety Conditions

# 1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 117 Forest Avenue & 175 Catharine Street South in Hamilton, ON. This report presents the project objectives, approach and the main results from RWDI's assessment. Our Statement of Limitations as it pertains to this study can be found in Section 4 of this report.

## 1.1 Project Description

The proposed development site is located at the northeast corner of the intersection of Catharine Street South and Forest Avenue (Image 1). The development will consist of a 24-storey residential tower with connecting 6-storey and 4-storey buildings to the west, which have amenity space on the roofs.

## 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 RWDI criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks and outdoor amenity space.

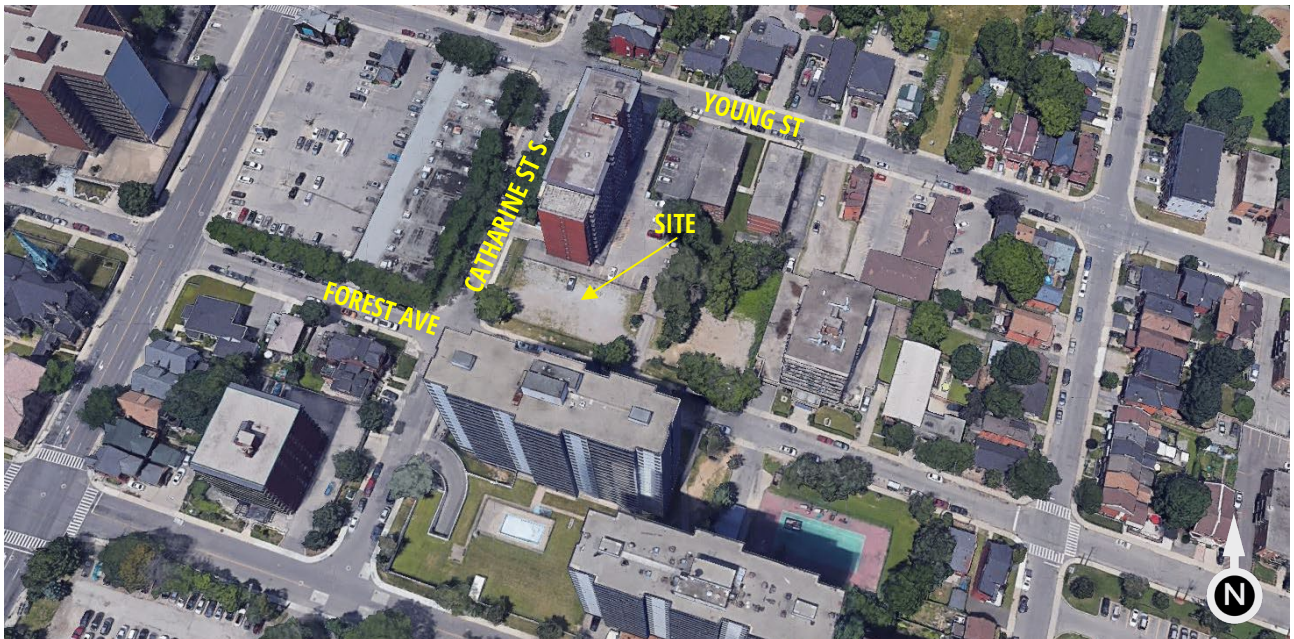


Image 1: Aerial View of Existing Site and Surroundings (Photo Courtesy of Google™ Earth)

## 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 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 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 72 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.



PEDESTRIAN WIND STUDY  
117 FOREST AVENUE & 175 CATHARINE STREET SOUTH

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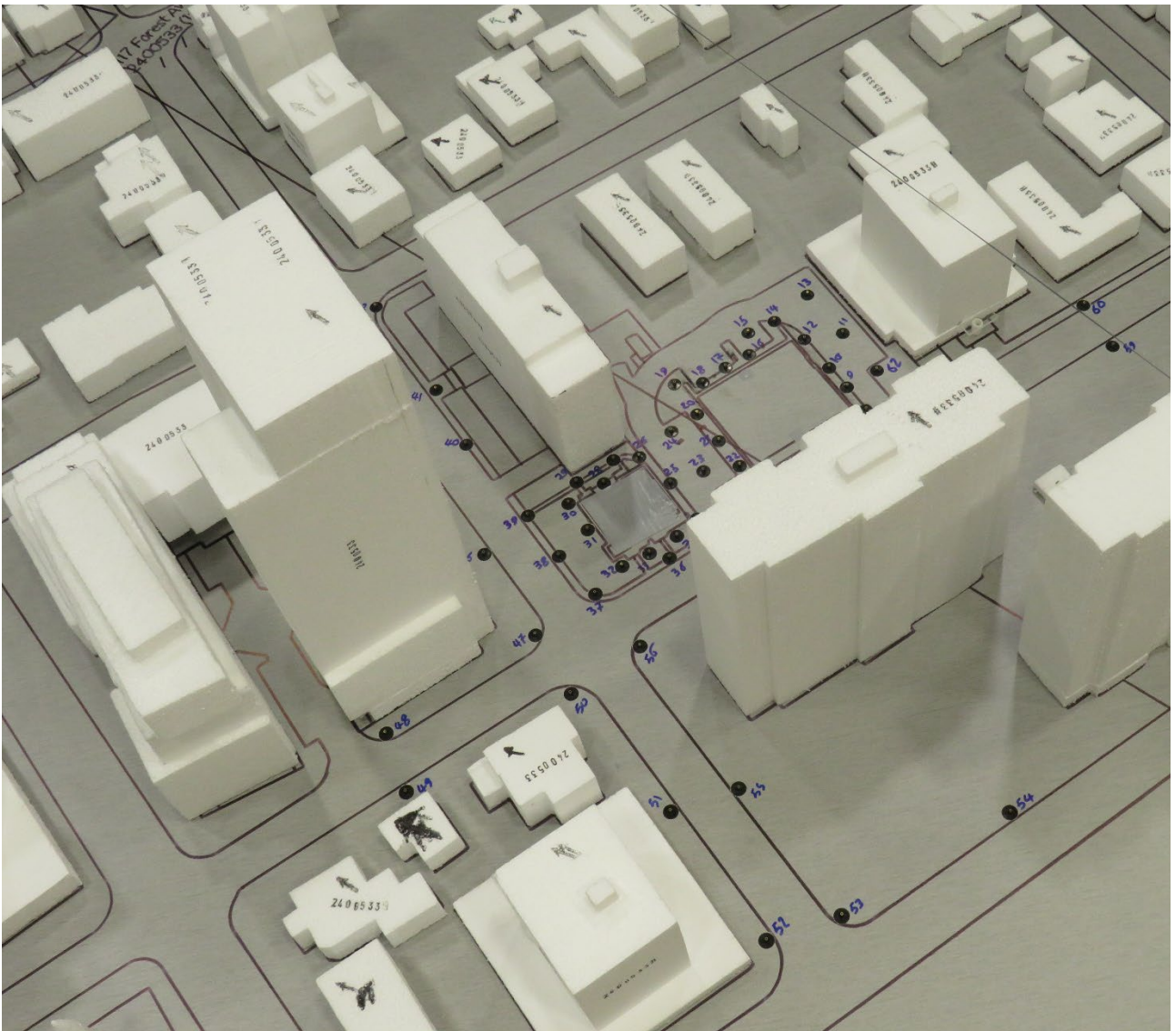
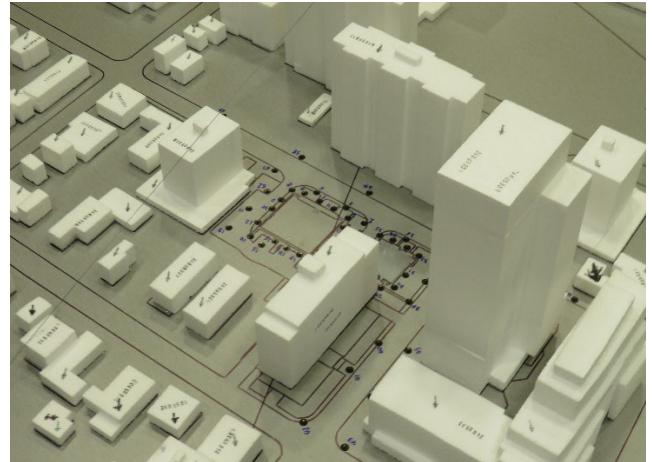


Image 1: Wind Tunnel Study Model – Existing Configuration



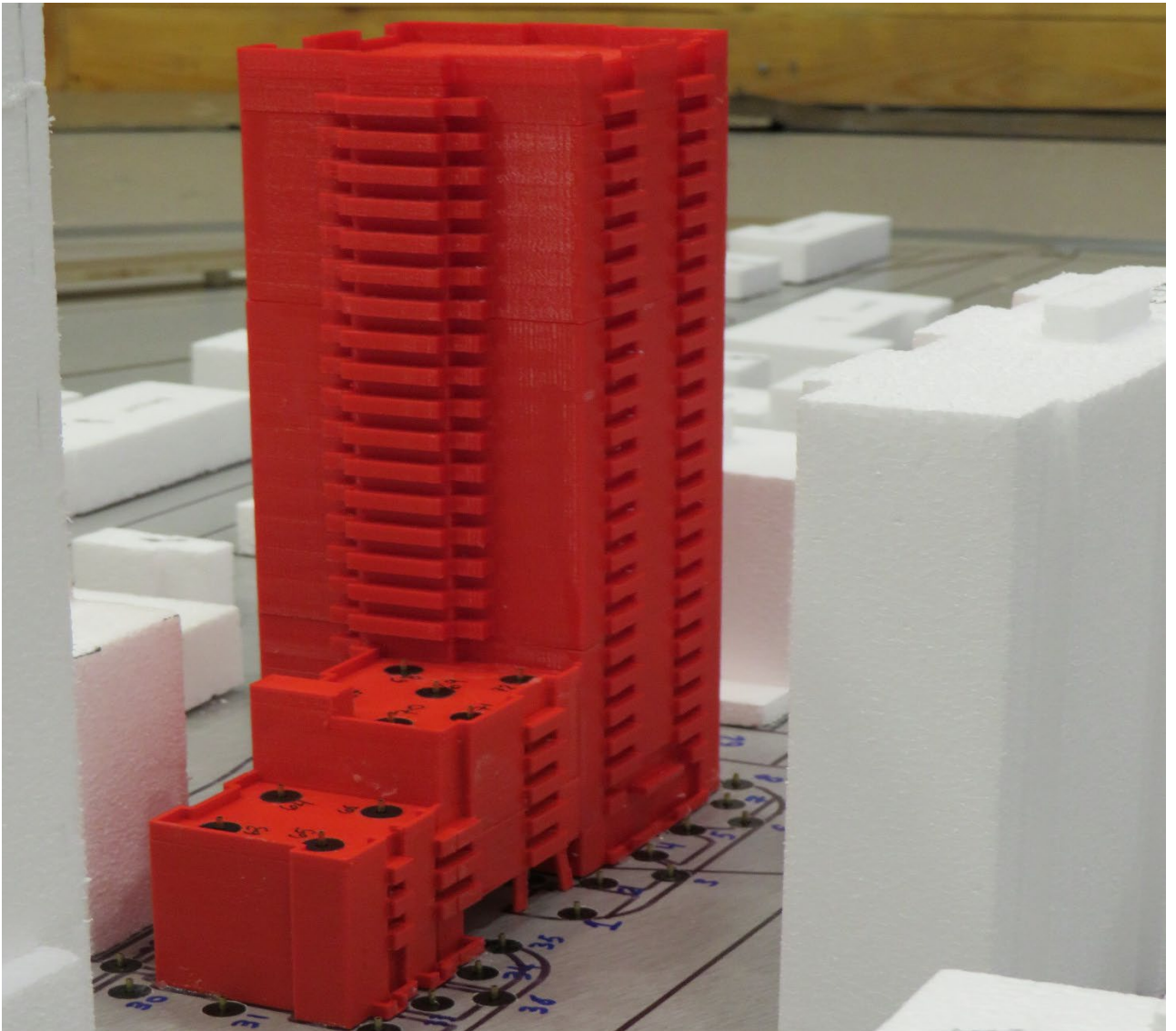
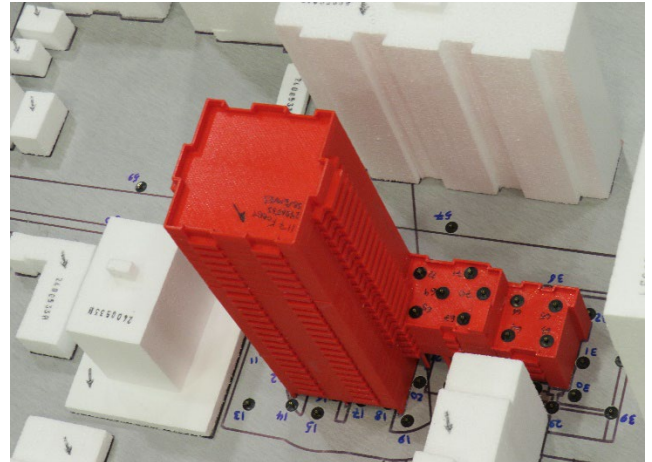


Image 2: Wind Tunnel Study Model – Proposed Configuration

## 2.2 Wind Climate Data

Wind statistics recorded at Hamilton 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. Winds from the southwest quadrant and the northeast direction are predominant in the summer and winter, as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 3.8% and 12.6% 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 RWDI wind criteria for pedestrian comfort and safety.

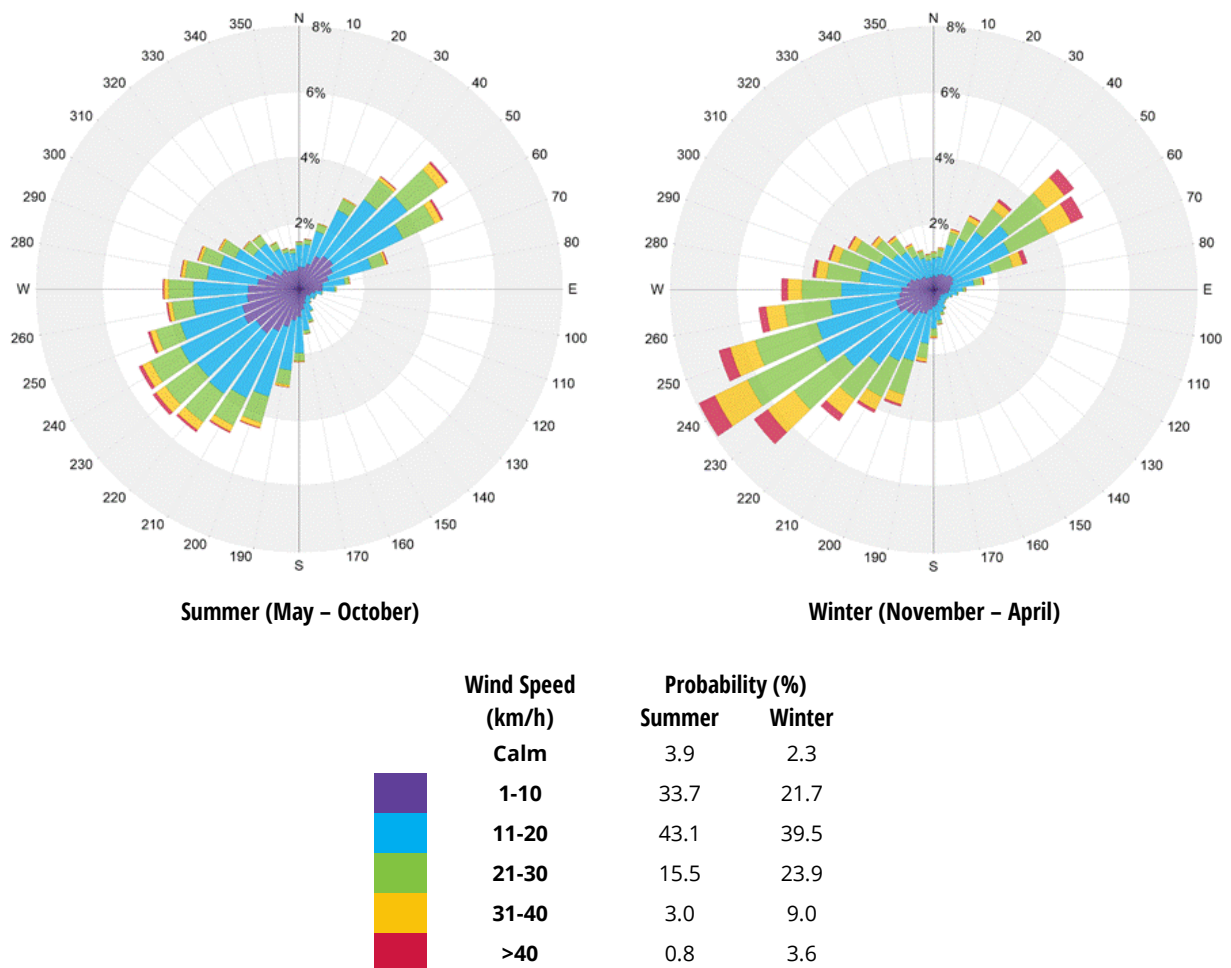


Image 2: Directional Distribution of Winds Approaching Hamilton International Airport between 1990 and 2020





## 2.3 RWDI Pedestrian Wind Criteria

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

Comfort Category	GEM Speed (km/h)	Description
<b>Sitting</b>	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
<b>Standing</b>	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
<b>Strolling</b>	≤ 17	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
<b>Walking</b>	≤ 20	Relatively high speeds that can be tolerated if one’s objective is to walk, run or cycle without lingering
<b>Uncomfortable</b>	> 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 climate such as that found in Hamilton, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

Safety Criterion	Gust Speed (km/h)	Description
<b>Exceeded</b>	> 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 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 both configurations assessed.

### 3.1 Grade Level (Locations 1 through 62)

Wind conditions comfortable for strolling or 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.

#### 3.1.1 Existing Configuration

Wind conditions on and around the existing site are comfortable for sitting or standing at all areas assessed in the summer (Figure 1A). In the winter, slightly elevated wind speeds, comfortable for standing, strolling or walking, are observed at most areas assessed (Figure 2A). These wind conditions are suitable for the intended uses of various pedestrian areas.

Uncomfortable conditions exist at four test locations to the west of site near the intersection of Forest Avenue and Catharine Street South during the winter (Locations 37, 38, 47 and 56 in Figure 2A), due to the prevailing southwest and northeast winds accelerating between the existing tall buildings at the intersection.

#### 3.1.2 Proposed Configuration

With the proposed building in place, similar or slightly lower wind speeds occur on and around the site due to sheltering afforded by the proposed building itself and the built-up surroundings. The stepped form of the proposed design helps to disrupt winds that may potentially downwash off the 24-storey tower.

During the summer, wind conditions on and around the site are comfortable for sitting or standing at most locations (Figure 1B). Exceptions are a few areas along Catharine Street South, where wind conditions are comfortable for strolling (Locations 38, 39, 46 and 47 in Figure 1B). These conditions are considered appropriate for the intended use of the sidewalks and walkways.

In the winter, wind conditions comfortable for walking or calmer are anticipated at most areas assessed, with the exception of two locations with marginally uncomfortable conditions (i.e., 1 km/h above the 20 km/h threshold) near the northwest corner of the site, and across Catharine Street South (Locations 39 and 47 Figure 2B). These locations are pre-existing and are reduced with the addition of the proposed building.

The main entrance of the proposed building is situated near Location 5 in Figures 1B and 2B. Wind speeds comfortable for sitting or standing are anticipated at this location throughout the year, which is appropriate.



Note that landscaping was not considered in our testing. Any existing or proposed landscaping will help reduce wind speeds around them. To extend the wind benefits of landscaping to colder months of the year, coniferous/marcescent species should be considered, if feasible.

### 3.2 Level 5 and 7 Outdoor Amenity Areas (Locations 63 through 72)

It is generally desirable for wind conditions on areas 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, and increased wind activity would be considered appropriate.

Throughout the year, wind conditions comfortable for sitting or standing are shown at most areas assessed on the Level 5 and Level 7 outdoor amenity areas (Figures 1B and 2B). The only exceptions are Locations 69 and 71 where wind conditions are comfortable for strolling in the winter (Figure 2B). These wind conditions are appropriate for the intended pedestrian use.





## 4 STATEMENT OF LIMITATIONS

### Limitations

This report was prepared by Rowan Williams Davies & Irwin, Inc. (“RWDI”) for Representative Holdings Inc. (“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 KNYMH Inc. and used to construct the scale model of the proposed 117 Forest Avenue & 175 Catharine Street South (“**Project Data**”)

File Name	File Type	Date Received (dd/mm/yyyy)
21039- Brockton Apartments _detached	Revit	03/10/2023
21039- Brockton Apartments	PDF	03/10/2023

The recommendations and conclusions are based on the assumption that the Project Data and Climate Data are accurate and complete. RWDI assumes no responsibility for any inaccuracy or deficiency in information it has received from others. In addition, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design,



quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

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

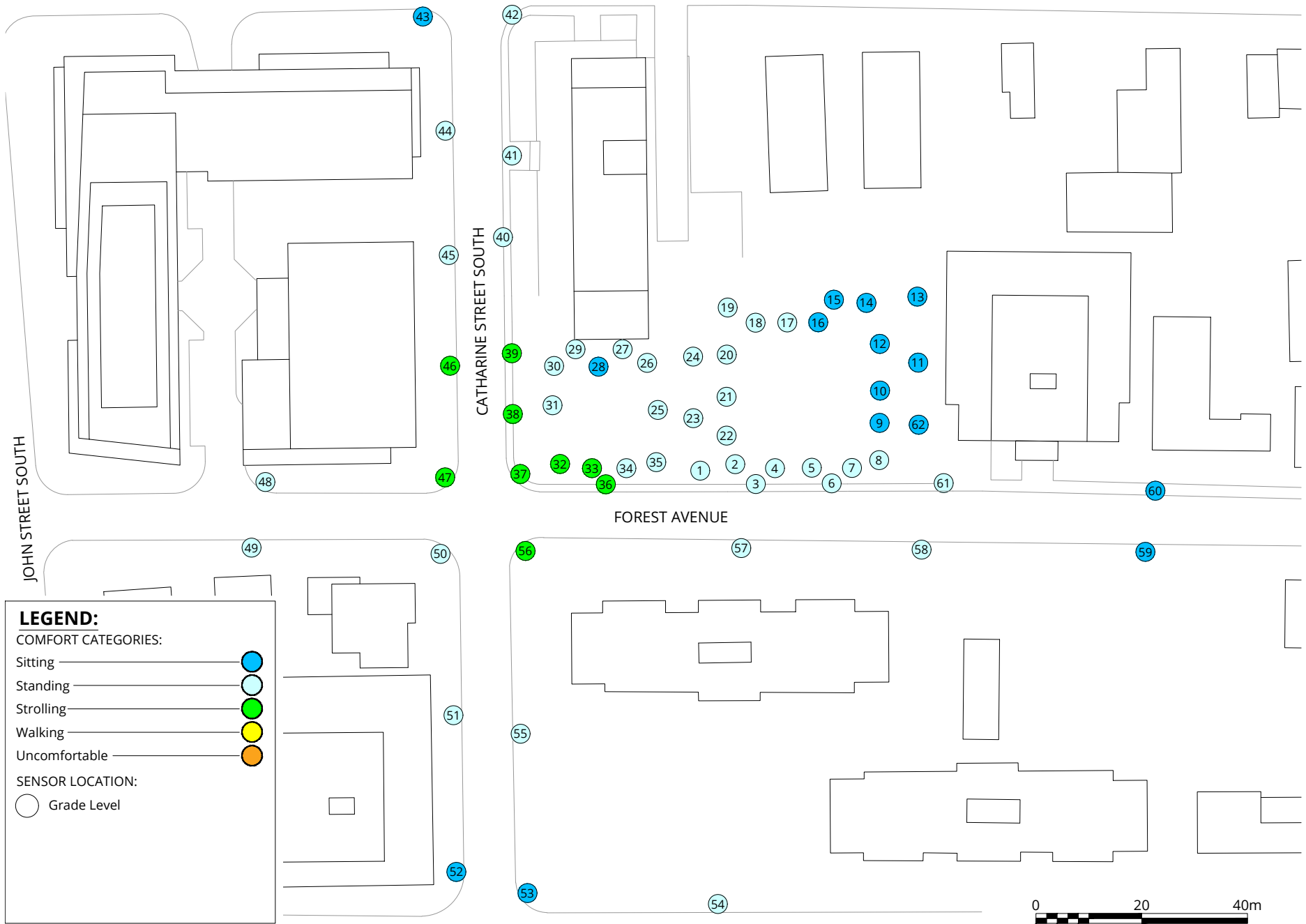
## 5 REFERENCES

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# FIGURES



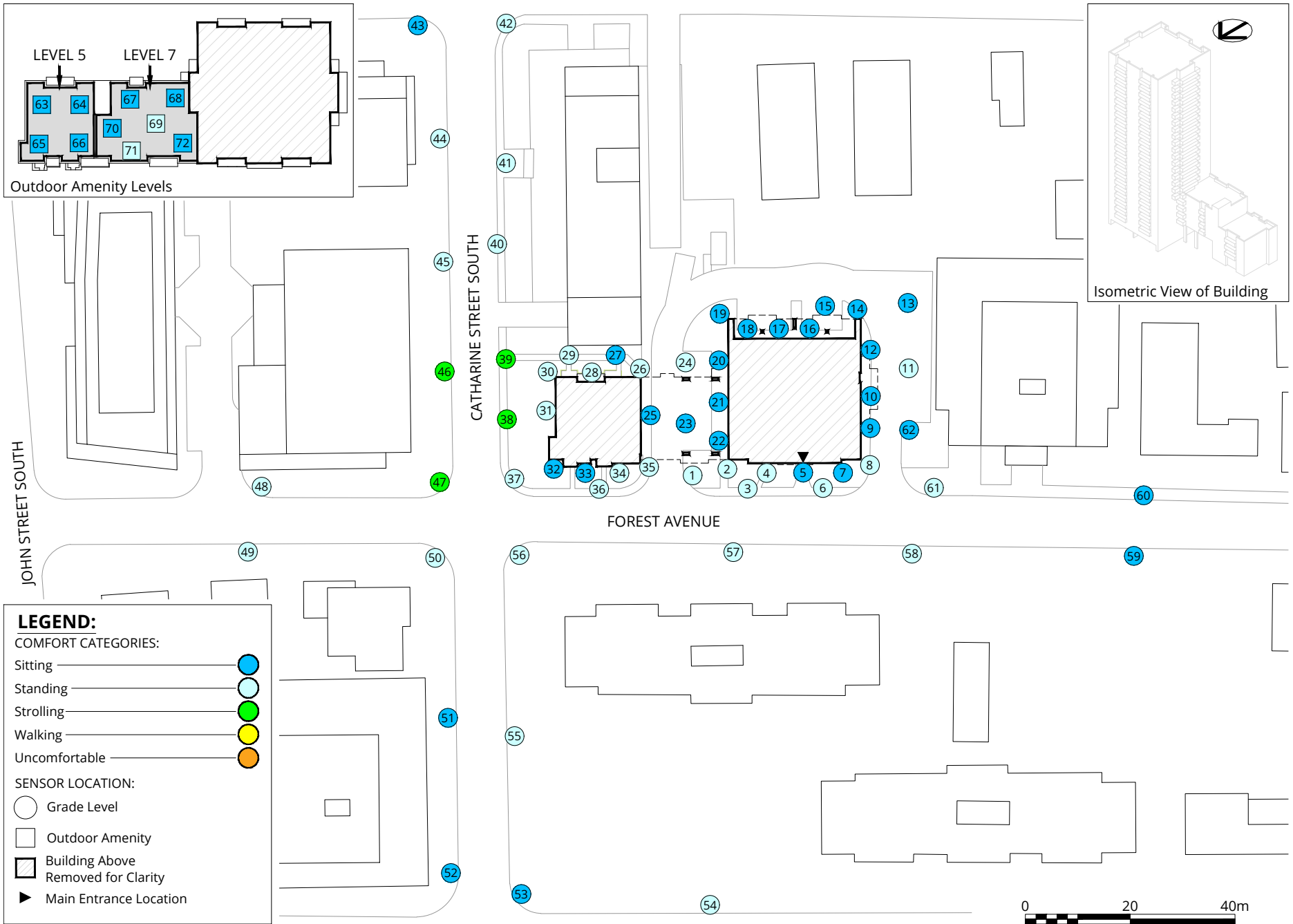
**Pedestrian Wind Comfort Conditions**  
 Existing Configuration  
 Summer (May to October, 6:00 to 23:00)

117 Forest Ave and 175 Catharine Street South - Hamilton, ON

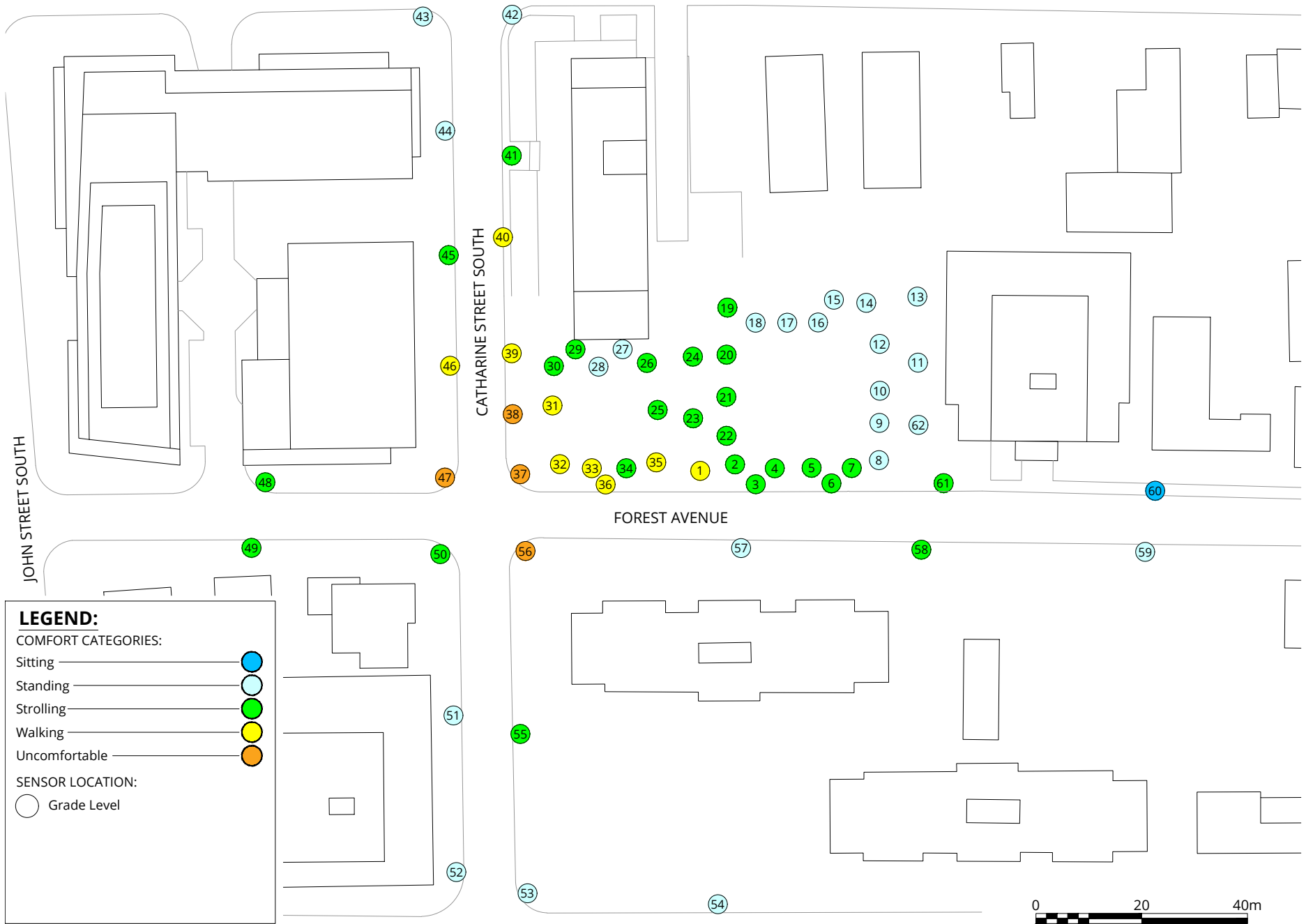
True North  
  
 Project #2400533

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Date Revised: Nov. 6, 2023	










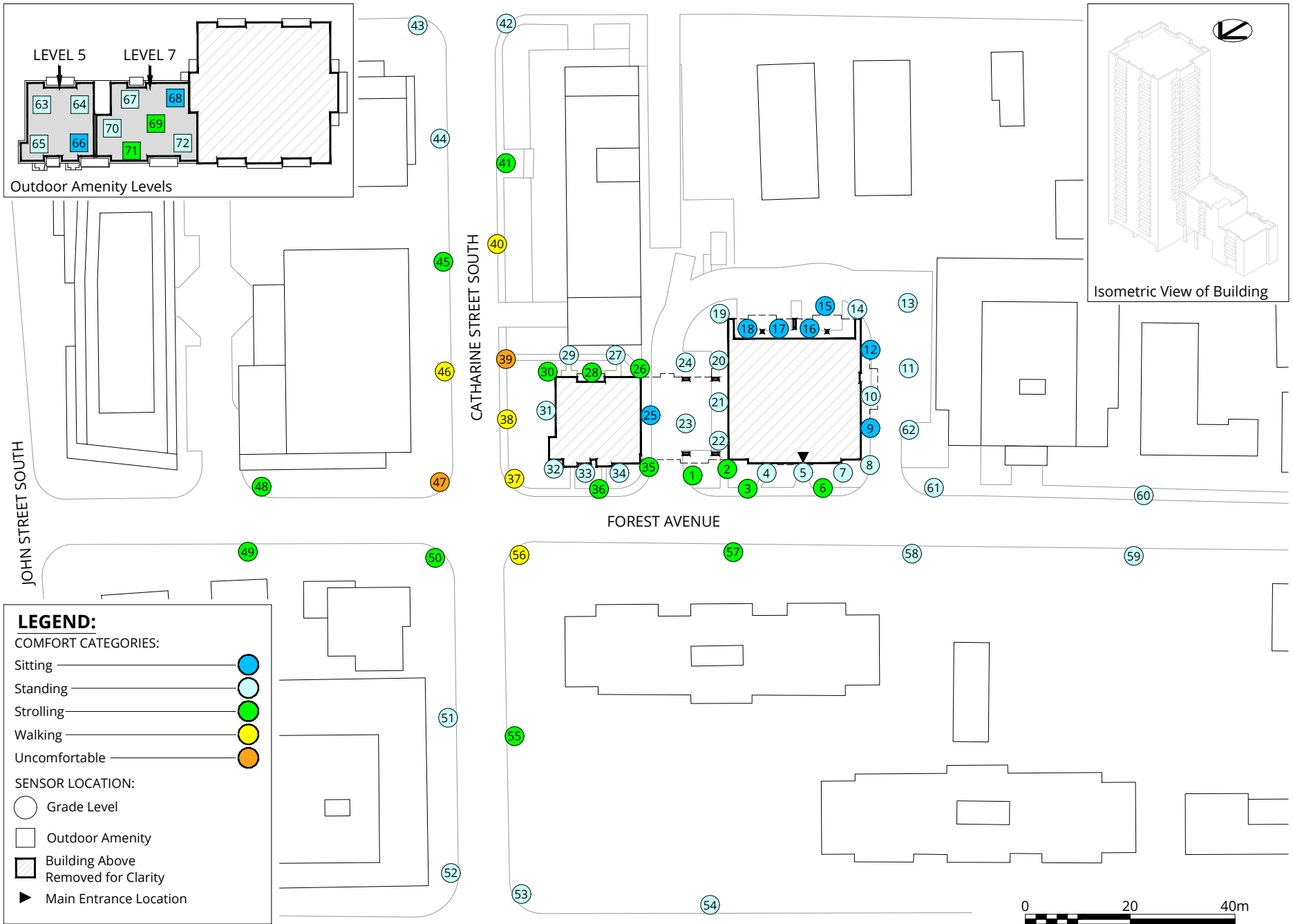
**Pedestrian Wind Comfort Conditions**  
 Existing Configuration  
 Winter (November to April, 6:00 to 23:00)

117 Forest Ave and 175 Catharine Street South - Hamilton, ON

True North  
  
 Project #2400533

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Date Revised: Nov. 6, 2023	





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# 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	14	Standing	18	Walking	76	Pass
	Proposed	12	Standing	16	Strolling	66	Pass
2	Existing	13	Standing	17	Strolling	71	Pass
	Proposed	13	Standing	17	Strolling	73	Pass
3	Existing	13	Standing	17	Strolling	75	Pass
	Proposed	13	Standing	17	Strolling	68	Pass
4	Existing	12	Standing	16	Strolling	70	Pass
	Proposed	11	Standing	14	Standing	62	Pass
5	Existing	12	Standing	15	Strolling	68	Pass
	Proposed	10	Sitting	12	Standing	58	Pass
6	Existing	12	Standing	15	Strolling	71	Pass
	Proposed	13	Standing	17	Strolling	76	Pass
7	Existing	12	Standing	15	Strolling	63	Pass
	Proposed	9	Sitting	12	Standing	52	Pass
8	Existing	11	Standing	14	Standing	59	Pass
	Proposed	11	Standing	14	Standing	74	Pass
9	Existing	10	Sitting	14	Standing	57	Pass
	Proposed	8	Sitting	10	Sitting	63	Pass
10	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	9	Sitting	11	Standing	60	Pass
11	Existing	8	Sitting	11	Standing	45	Pass
	Proposed	11	Standing	14	Standing	66	Pass
12	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	8	Sitting	10	Sitting	49	Pass
13	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	10	Sitting	12	Standing	60	Pass
14	Existing	10	Sitting	13	Standing	56	Pass
	Proposed	9	Sitting	11	Standing	58	Pass
15	Existing	10	Sitting	13	Standing	57	Pass
	Proposed	7	Sitting	9	Sitting	37	Pass
16	Existing	10	Sitting	14	Standing	60	Pass
	Proposed	5	Sitting	7	Sitting	31	Pass
17	Existing	11	Standing	14	Standing	61	Pass
	Proposed	5	Sitting	7	Sitting	30	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	11	Standing	14	Standing	62	Pass
	Proposed	5	Sitting	6	Sitting	24	Pass
19	Existing	12	Standing	15	Strolling	68	Pass
	Proposed	10	Sitting	13	Standing	62	Pass
20	Existing	13	Standing	17	Strolling	68	Pass
	Proposed	9	Sitting	12	Standing	63	Pass
21	Existing	13	Standing	17	Strolling	68	Pass
	Proposed	9	Sitting	12	Standing	52	Pass
22	Existing	13	Standing	17	Strolling	69	Pass
	Proposed	9	Sitting	12	Standing	60	Pass
23	Existing	13	Standing	17	Strolling	65	Pass
	Proposed	10	Sitting	12	Standing	62	Pass
24	Existing	13	Standing	17	Strolling	65	Pass
	Proposed	11	Standing	14	Standing	62	Pass
25	Existing	13	Standing	17	Strolling	66	Pass
	Proposed	8	Sitting	9	Sitting	70	Pass
26	Existing	12	Standing	16	Strolling	66	Pass
	Proposed	12	Standing	15	Strolling	64	Pass
27	Existing	11	Standing	14	Standing	57	Pass
	Proposed	10	Sitting	12	Standing	67	Pass
28	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	12	Standing	16	Strolling	66	Pass
29	Existing	12	Standing	15	Strolling	65	Pass
	Proposed	11	Standing	13	Standing	55	Pass
30	Existing	14	Standing	17	Strolling	70	Pass
	Proposed	13	Standing	17	Strolling	63	Pass
31	Existing	14	Standing	18	Walking	72	Pass
	Proposed	11	Standing	14	Standing	54	Pass
32	Existing	16	Strolling	20	Walking	72	Pass
	Proposed	10	Sitting	12	Standing	53	Pass
33	Existing	15	Strolling	19	Walking	71	Pass
	Proposed	10	Sitting	12	Standing	51	Pass
34	Existing	13	Standing	17	Strolling	69	Pass
	Proposed	11	Standing	14	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
35	Existing	14	Standing	19	Walking	76	Pass
	Proposed	13	Standing	17	Strolling	71	Pass
36	Existing	15	Strolling	20	Walking	75	Pass
	Proposed	12	Standing	15	Strolling	60	Pass
37	Existing	17	Strolling	21	Uncomfortable	80	Pass
	Proposed	14	Standing	18	Walking	78	Pass
38	Existing	17	Strolling	22	Uncomfortable	82	Pass
	Proposed	16	Strolling	20	Walking	75	Pass
39	Existing	16	Strolling	20	Walking	79	Pass
	Proposed	16	Strolling	21	Uncomfortable	74	Pass
40	Existing	14	Standing	18	Walking	71	Pass
	Proposed	14	Standing	18	Walking	68	Pass
41	Existing	12	Standing	15	Strolling	62	Pass
	Proposed	12	Standing	15	Strolling	58	Pass
42	Existing	11	Standing	14	Standing	64	Pass
	Proposed	11	Standing	14	Standing	67	Pass
43	Existing	10	Sitting	12	Standing	57	Pass
	Proposed	9	Sitting	11	Standing	58	Pass
44	Existing	11	Standing	13	Standing	65	Pass
	Proposed	11	Standing	13	Standing	64	Pass
45	Existing	13	Standing	16	Strolling	61	Pass
	Proposed	12	Standing	16	Strolling	60	Pass
46	Existing	15	Strolling	19	Walking	90	Pass
	Proposed	15	Strolling	20	Walking	87	Pass
47	Existing	17	Strolling	21	Uncomfortable	80	Pass
	Proposed	17	Strolling	21	Uncomfortable	83	Pass
48	Existing	12	Standing	15	Strolling	66	Pass
	Proposed	12	Standing	15	Strolling	65	Pass
49	Existing	13	Standing	16	Strolling	90	Pass
	Proposed	13	Standing	16	Strolling	86	Pass
50	Existing	13	Standing	16	Strolling	78	Pass
	Proposed	13	Standing	15	Strolling	83	Pass
51	Existing	11	Standing	14	Standing	69	Pass
	Proposed	10	Sitting	13	Standing	58	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	10	Sitting	13	Standing	64	Pass
	Proposed	10	Sitting	12	Standing	59	Pass
53	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	10	Sitting	12	Standing	51	Pass
54	Existing	11	Standing	13	Standing	66	Pass
	Proposed	11	Standing	13	Standing	64	Pass
55	Existing	12	Standing	16	Strolling	66	Pass
	Proposed	13	Standing	16	Strolling	66	Pass
56	Existing	16	Strolling	21	Uncomfortable	77	Pass
	Proposed	14	Standing	18	Walking	71	Pass
57	Existing	11	Standing	14	Standing	59	Pass
	Proposed	13	Standing	17	Strolling	72	Pass
58	Existing	12	Standing	15	Strolling	69	Pass
	Proposed	11	Standing	14	Standing	57	Pass
59	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	9	Sitting	13	Standing	58	Pass
60	Existing	8	Sitting	10	Sitting	44	Pass
	Proposed	10	Sitting	13	Standing	64	Pass
61	Existing	11	Standing	15	Strolling	59	Pass
	Proposed	11	Standing	14	Standing	58	Pass
62	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	10	Sitting	13	Standing	65	Pass
63	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	47	Pass
64	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	54	Pass
65	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	11	Standing	52	Pass
66	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	40	Pass
67	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	14	Standing	55	Pass
68	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	41	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
69	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Strolling	67	Pass
70	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	48	Pass
71	Existing	-	-	-	-	-	-
	Proposed	12	Standing	15	Strolling	61	Pass
72	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	44	Pass

Season	Months	Hours	Comfort Speed (km/h)	Safety Speed (km/h)
<b>Summer</b>	May - October	6:00 - 23:00 for comfort	(20% Seasonal Exceedance)	(0.1% Annual Exceedance)
<b>Winter</b>	November - April	6:00 - 23:00 for comfort	≤ 10 Sitting	≤ 90 Pass
<b>Annual</b>	January - December	0:00 - 23:00 for safety	11 - 14 Standing	> 90 Exceeded
<b>Configurations</b>			15 - 17 Strolling	
<b>Existing</b>	Existing site and surroundings		18 - 20 Walking	
<b>Proposed</b>	Project with existing surroundings		> 20 Uncomfortable	