

## 1842 KING STREET EAST

HAMILTON, ONTARIO

PEDESTRIAN WIND STUDY

RWDI # 2004825

March 3, 2022

### SUBMITTED TO

**Michelle Mattern**  
Development Manager  
[michelle@nhdg.ca](mailto:michelle@nhdg.ca)

**New Horizon Development Group Inc.**  
200-3170 Harvester Road  
Burlington, ON L7N 3W8  
T: 905.777.0000 x105

### SUBMITTED BY

**Maryam Al Labbad, M.A.Sc.**  
Technical Coordinator  
[Maryam.Allabbad@rwdi.com](mailto:Maryam.Allabbad@rwdi.com)

**Hanqing Wu, Ph.D., P.Eng.**  
Senior Technical Director / Principal  
[Hanqing.Wu@rwdi.com](mailto:Hanqing.Wu@rwdi.com)

**Dan Bacon**  
Senior Project Manager / Principal  
[Dan.Bacon@rwdi.com](mailto:Dan.Bacon@rwdi.com)

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



## EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 1842 King Street East project in Hamilton, ON (Image 1). Based on our wind tunnel testing for the project under the Existing and Proposed configurations (Images 2A and 2B, respectively), and the local wind records (Image 3), the potential wind comfort conditions are predicted, and the results are shown on site plans in Figures 1A through 2B, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- All locations studied at grade and above-grade levels for both tested configurations are predicted to meet the criterion used to assess pedestrian wind safety.
- The existing wind conditions on and around the project site are comfortable for the intended use throughout the year.
- With the addition of the proposed buildings to the project site, wind conditions at grade level are predicted to remain comfortable for the intended use during the summer. In the winter, wind speeds increase slightly in the areas between the proposed buildings, and to the northwest of Building A, and southeast of Building D, but these conditions remain comfortable for the intended pedestrian uses.
- The wind conditions expected on the above-grade outdoor amenities of Buildings B and D are generally considered appropriate for passive use during the summer, with the exception of the northwest corner of Building B amenity level. Wind control measures, such as tall guardrails, planters, screens, trellises and other landscaping elements, may be considered if lower wind activity is desired.



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# 1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 1842 King Street East in Hamilton, ON. This report presents the project objectives, approach and the main results from RWDI's assessment and provides conceptual wind control measures, where necessary.

## 1.1 Project Description

The project (site shown in Image 1) is located on the west side of Rosedale Avenue between King Street East and Lawrence Road. The proposed project consists of four 8-storey U-shaped apartment buildings with above-grade outdoor amenities, and two 3-storey townhouse blocks to east and south of the buildings.

## 1.2 Objectives

The objectives of the study were to assess the effect of the proposed project 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 appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including buildings entrances, walkways, public sidewalks around the site and upper-level outdoor amenities.

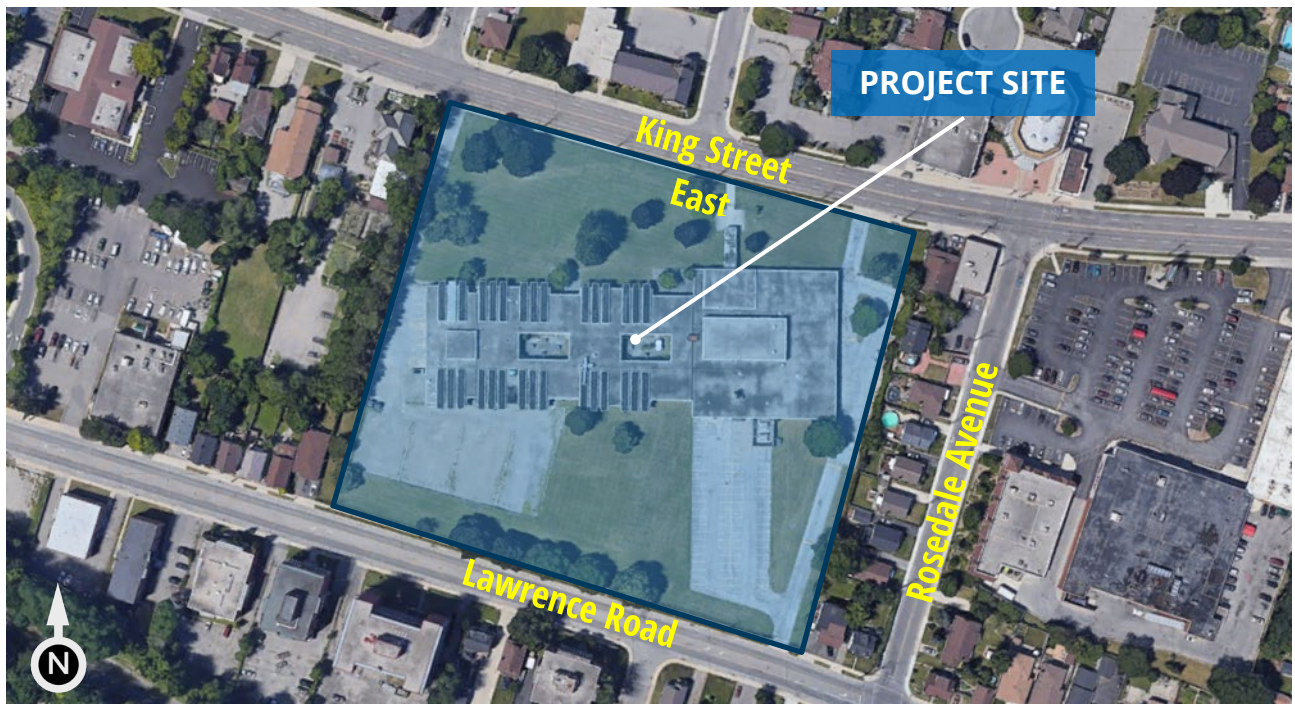


Image 1: Aerial View of Site and Existing Surroundings (Photo Courtesy of Google™ Earth)



## 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 existing surroundings was constructed for the wind tunnel tests of the following configurations:

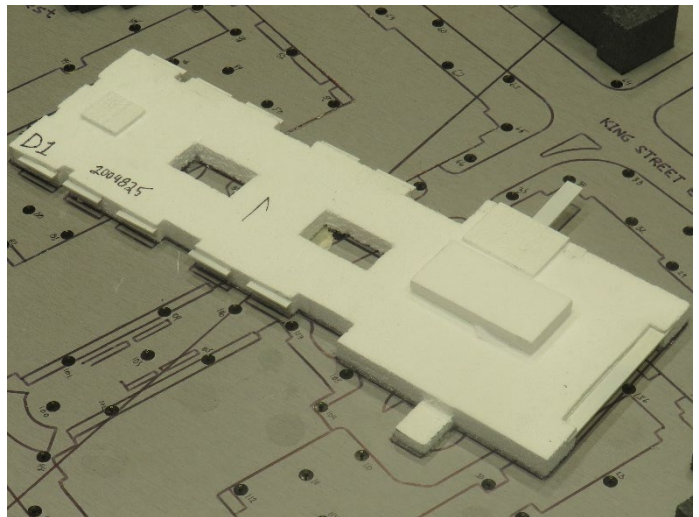
A - Existing: Existing site with existing surroundings (Image 2A), and

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 145 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 a 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.

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**Image 2A: Wind Tunnel Study Model – Existing Configuration**

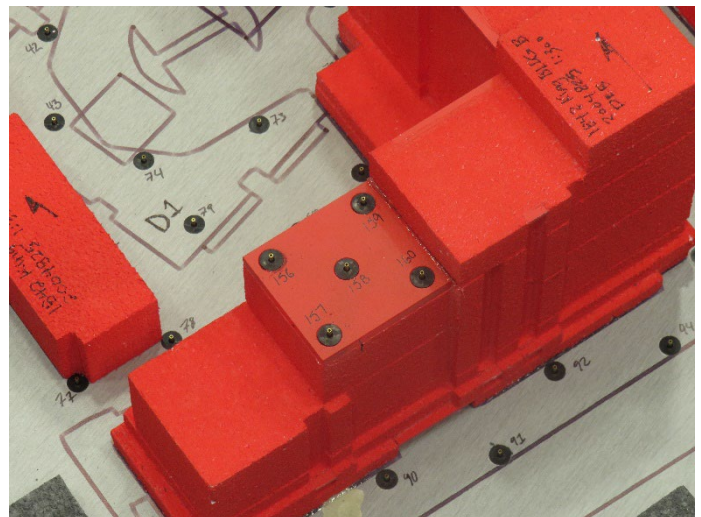
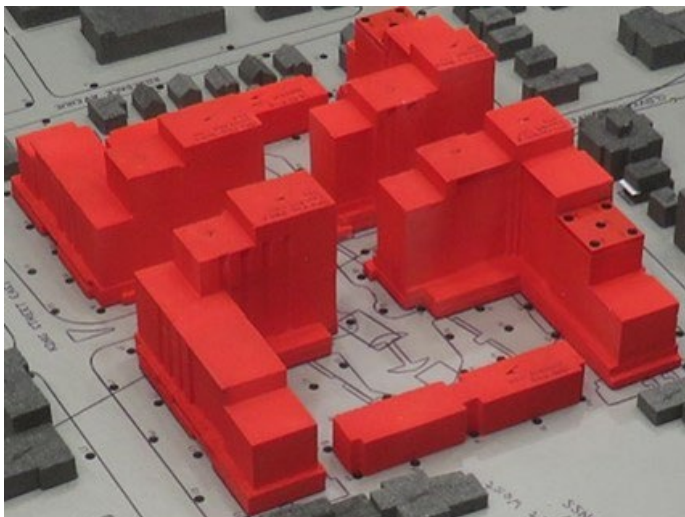
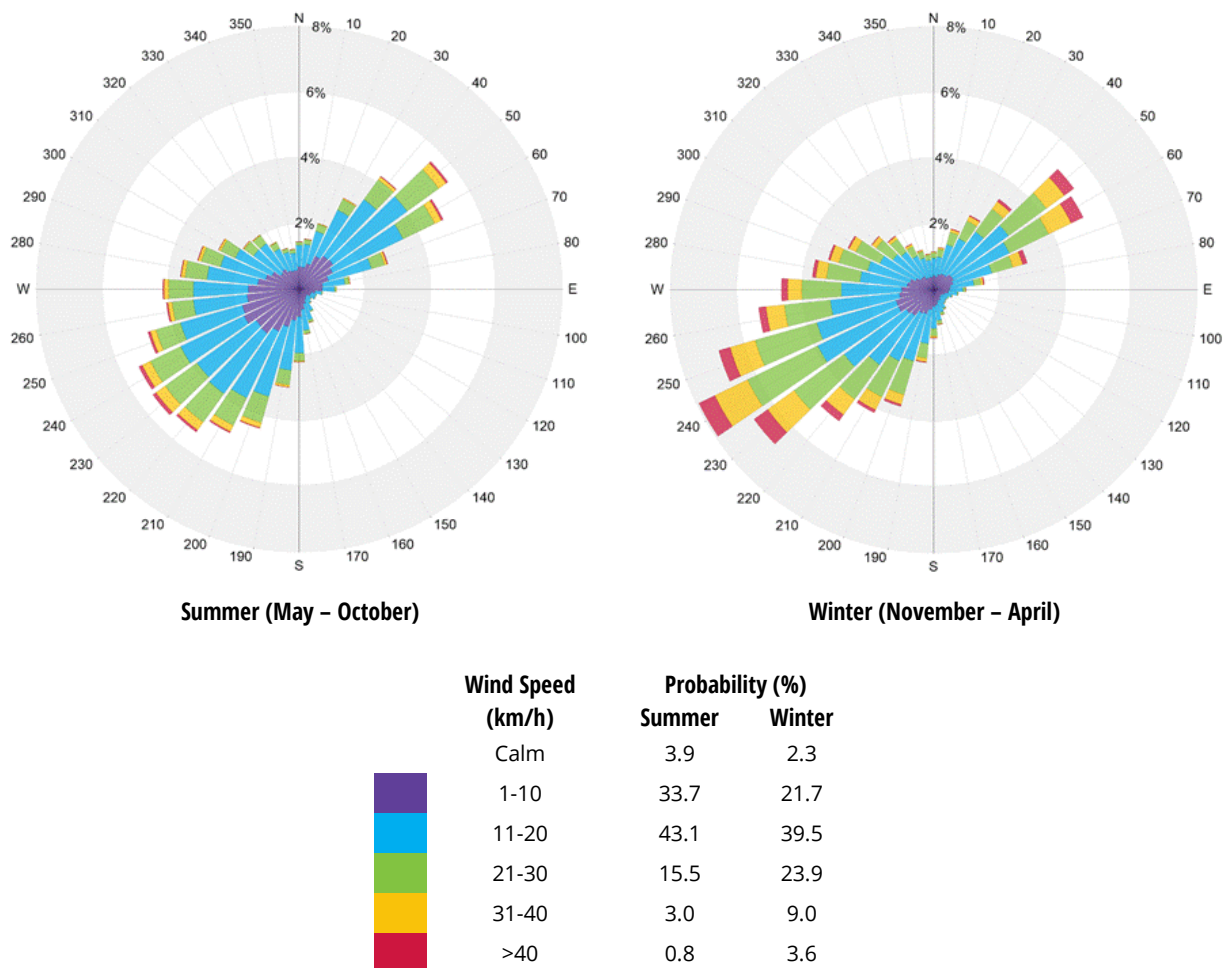


Image 2B: Wind Tunnel Study Model – Proposed Configuration

## 2.2 Meteorological 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 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 wind criteria for pedestrian comfort and safety.



**Image 3: 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 are 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 cold climate such as that found in Hamilton, ON, 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. These conditions and the associated wind speeds are also represented 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 speeds that meet the safety criterion are predicted at all locations assessed for both the Existing and Proposed configurations (Table 1).**

### 3.1 Grade Level (Locations 1 through 135)

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 sitting or standing are preferred at main entrances where pedestrians are apt to linger.

#### 3.1.1 Existing Configuration

The existing wind conditions on and around the project site are generally comfortable for sitting in the summer (Figure 1A). Due to seasonally stronger winds during the winter months, wind speeds increase slightly on and around the project site, with the conditions being comfortable for standing or sitting at most locations (Figure 2A). These conditions are suitable for the intended pedestrian use.

#### 3.1.2 Proposed Configuration

With the addition of the proposed buildings, wind speeds are measured on and around the project site in the summer to be comfortable for sitting and standing at most locations assessed and strolling near the northwest corner of Building A (Location 53 in Figure 1B). In the winter, slightly elevated wind speeds that are comfortable for strolling and walking are measured between the four apartment buildings, and on the northwest side of Building A, and the southeast side of Building D (Figure 2B). These conditions remain comfortable for the intended sidewalk and walkway usage.

The main entrances of the proposed buildings are situated near Locations 1, 38, 70, and 107 in Figures 1B and 2B. Wind conditions at these entrances are predicted to be comfortable for sitting or standing throughout the year, which is suitable for the intended use.

### **3.2 Above-Grade Levels (Locations 136 through 145)**

It is generally desirable for wind conditions on terraces intended for passive activities to be comfortable for sitting or standing more than 80% of the time in the summer. During the winter, it is anticipated that the area would not be used as frequently, and increased wind activity may be considered acceptable.

Wind conditions on the Level 12 outdoor amenity of Building D are comfortable for sitting or standing throughout the year, with the exception of the southwest corner (Location 145 in Figure 2B), where wind conditions are predicted to be comfortable for strolling during the winter months. The wind conditions on the Level 12 outdoor amenity of Building B are predicted to be comfortable for standing (Locations 137 – 140 in Figure 1B), which is suitable for passive use, and strolling (Location 136 in Figure 1B) in the summer. During the winter months, higher wind speeds conducive for strolling or walking are predicted (Figure 2B).

Wind control measures may need to be considered for the amenity areas on Building B and, to a lesser degree, on Building D. These may include tall parapets/guardrails can be incorporated along the perimeters of the amenity areas. Moreover, landscaping/hardscaping features in the form of planters, screens and trellises can also be considered around the designated areas throughout the amenity. Examples are shown in Image 4 for reference.



**Image 4: Examples of Wind Control Options Applicable to the Level 12 Amenity Areas**

## 4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 1842 King 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 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.

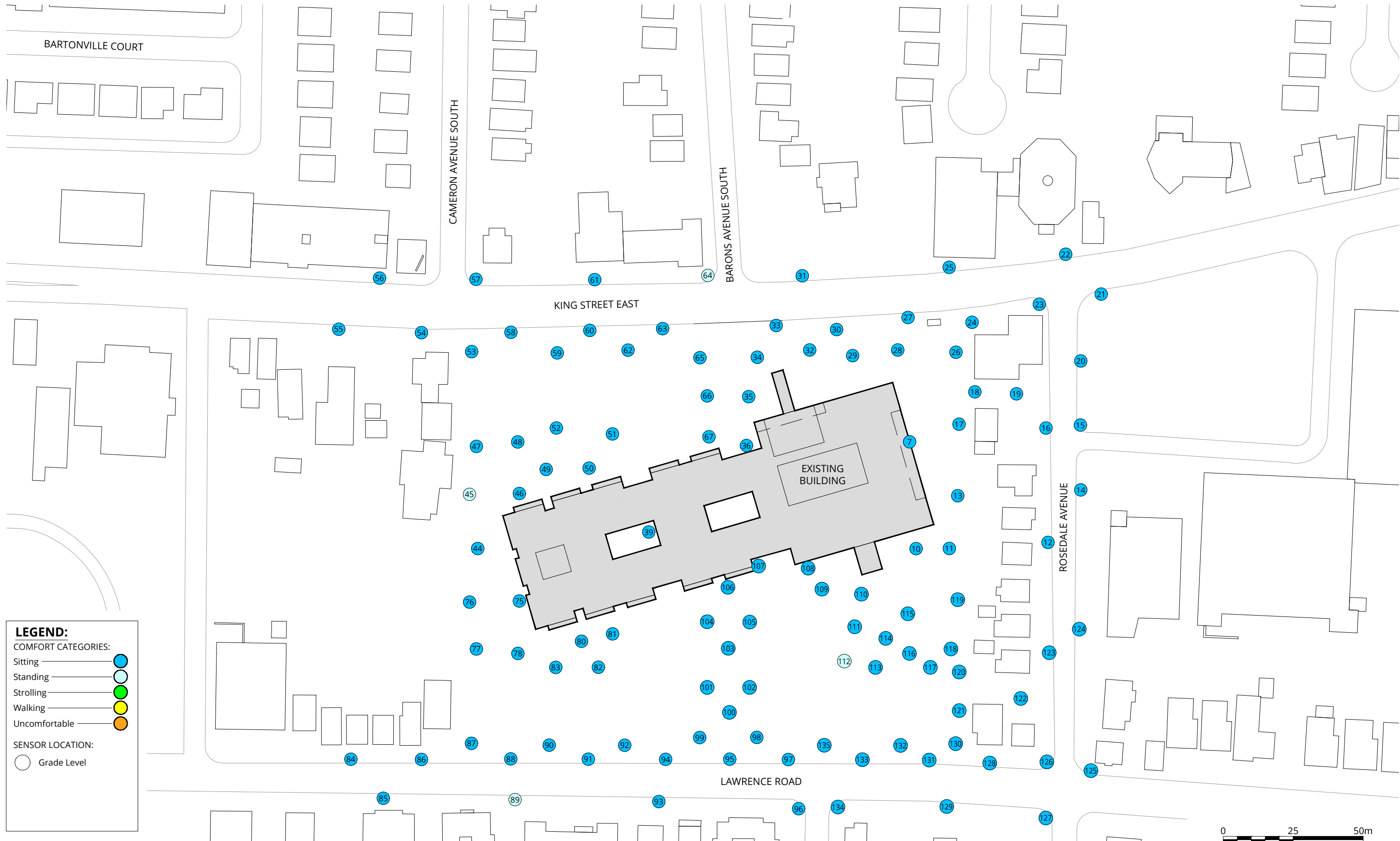
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1804-20-1842 King Street-Model - 3D View - Jan.20.2022.dwg	AutoCAD drawing	26/01/2022

## 5 REFERENCES

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# FIGURES



**Pedestrian Wind Comfort Conditions**

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

1842 King Street East - Hamilton, ON



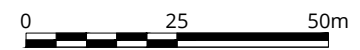
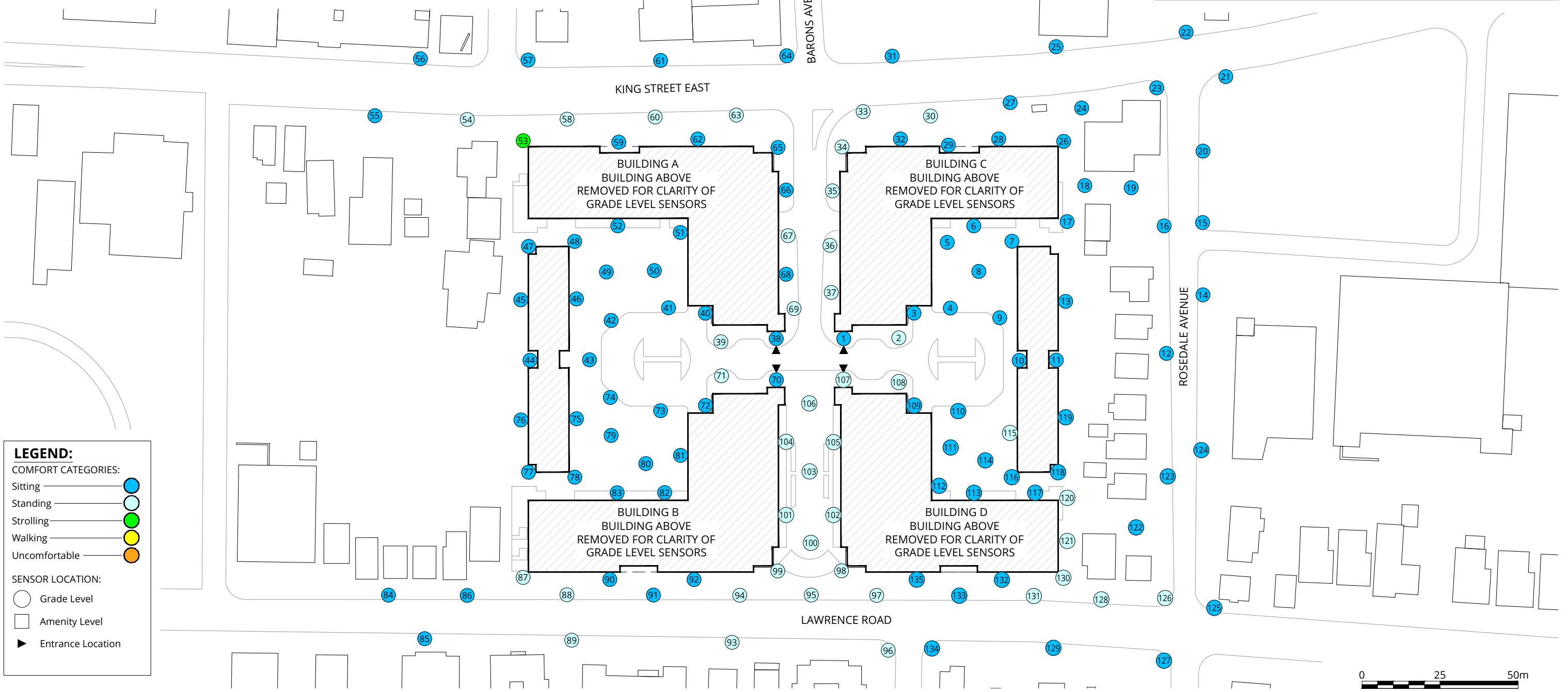
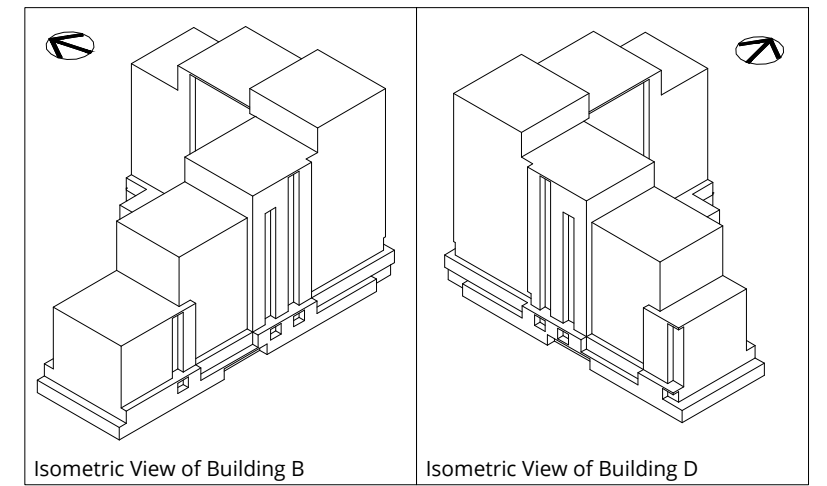
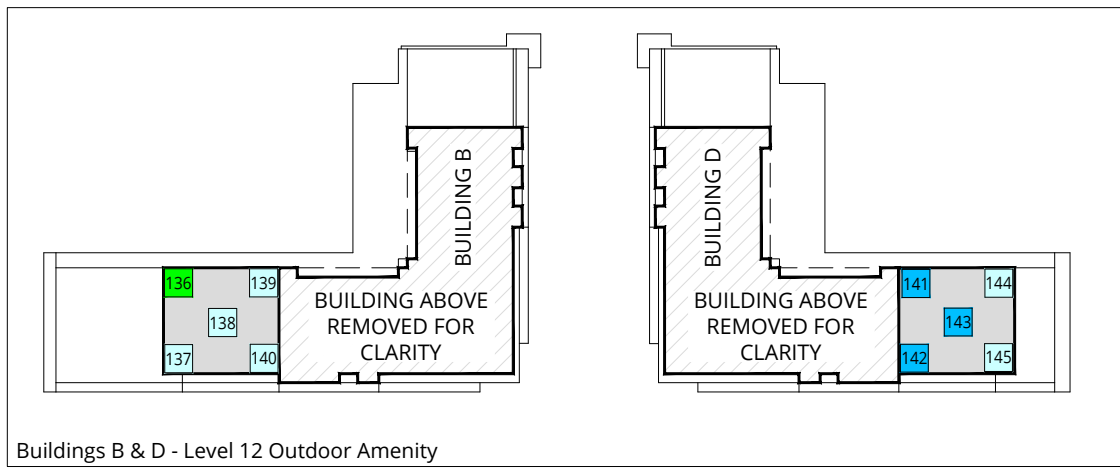
Drawn by: GRE Figure: 1A

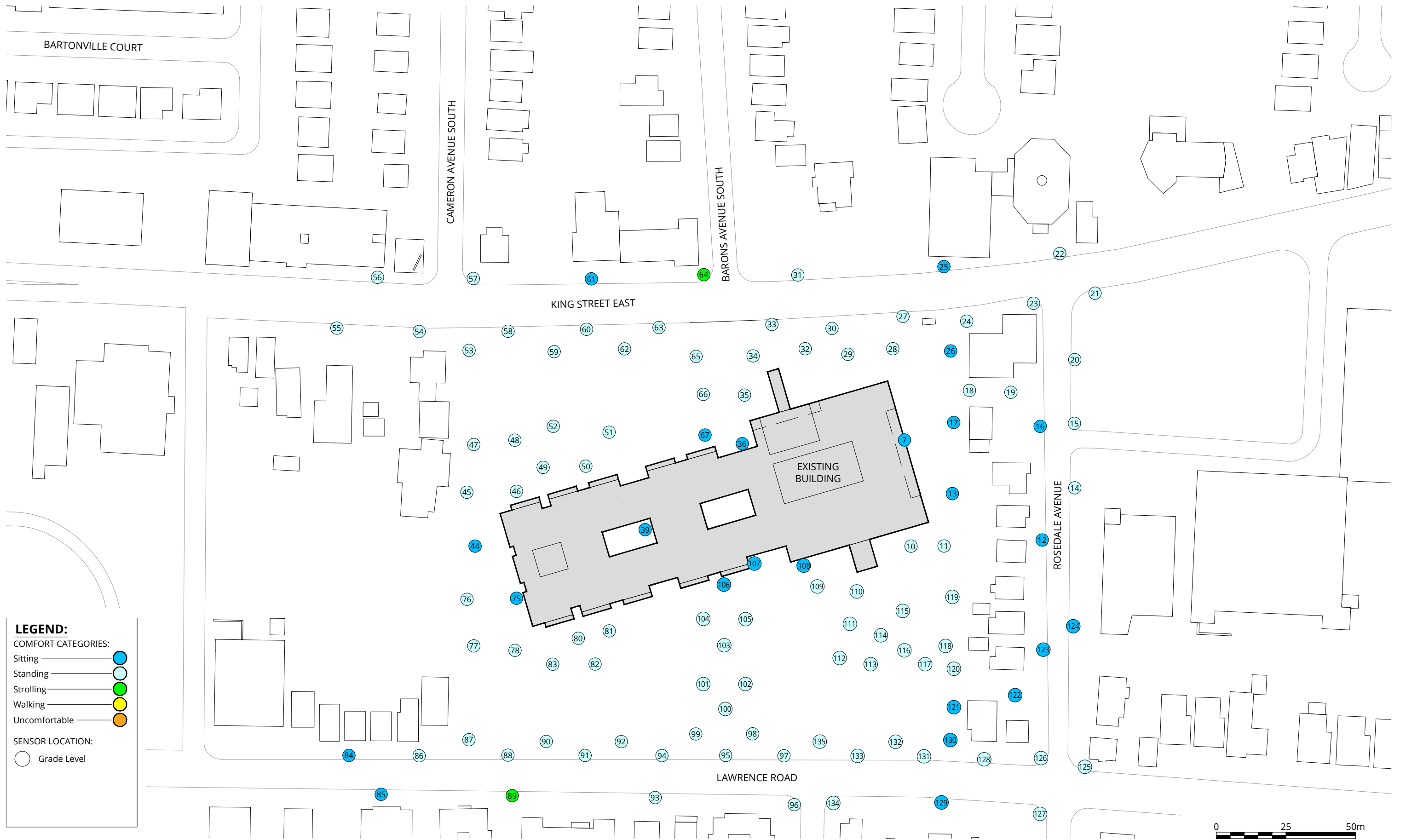
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Date Revised: Feb. 24, 2022

Project #2004825







**Pedestrian Wind Comfort Conditions**

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

1842 King Street East - Hamilton, ON



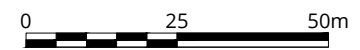
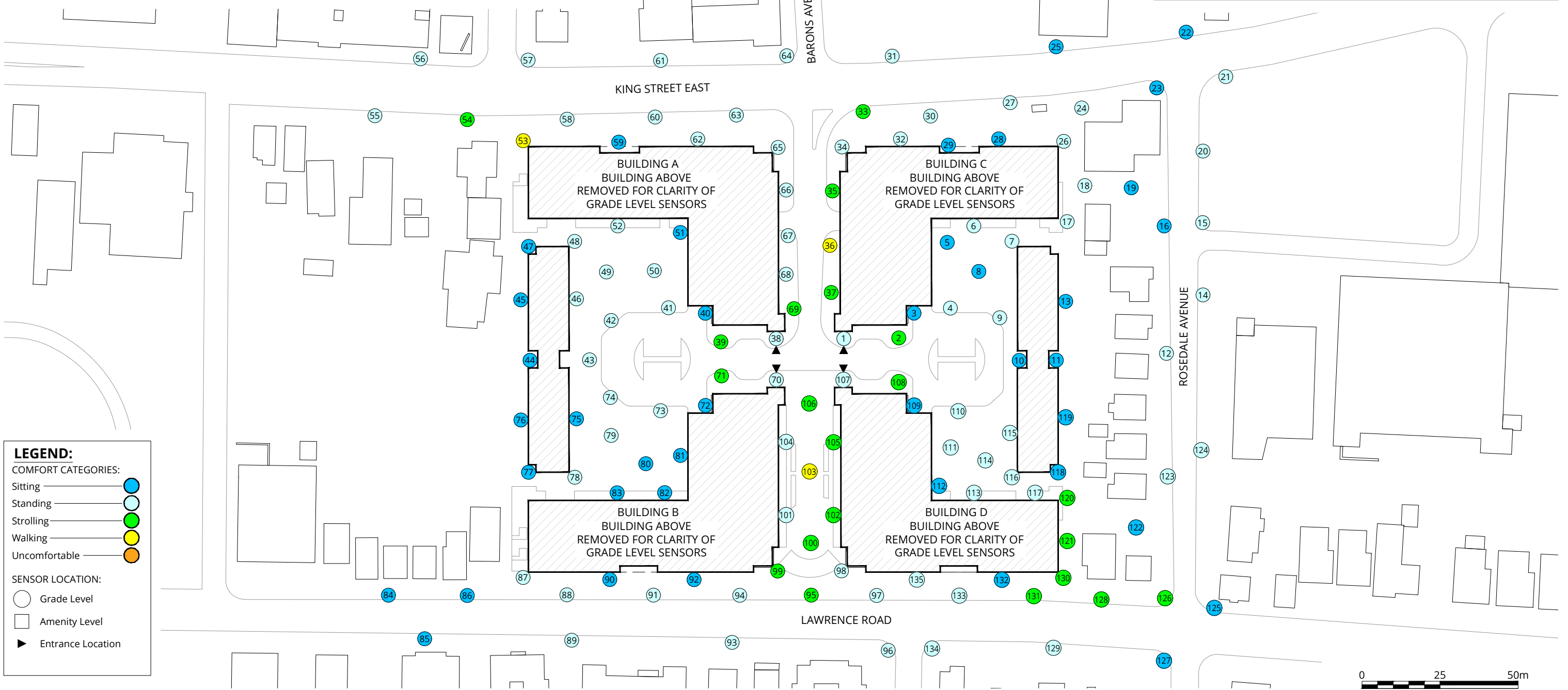
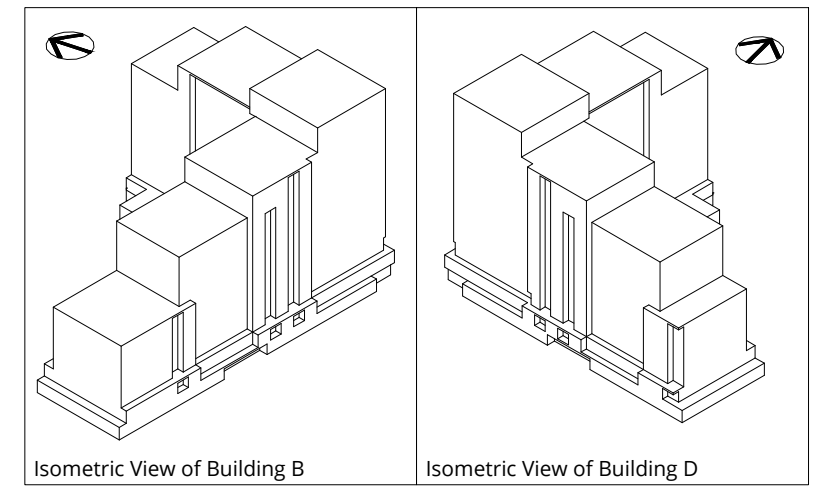
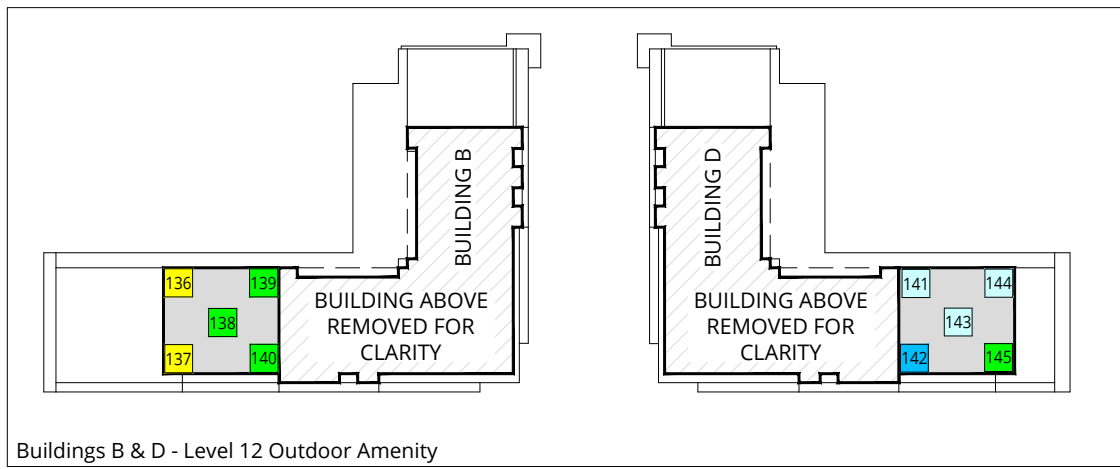
Drawn by: GRE Figure: 2A

Approx. Scale: 1:1250

Date Revised: Feb. 24, 2022

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**Pedestrian Wind Comfort Conditions**  
 Proposed Configuration  
 Winter (November to April, 6:00 to 23:00)  
 1842 King Street East - Hamilton, ON

True North  
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 Date Revised: Feb. 24, 2022



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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	-	-	-	-	-	-
	Proposed	10	Sitting	13	Standing	55	Pass
2	Existing	-	-	-	-	-	-
	Proposed	13	Standing	17	Strolling	65	Pass
3	Existing	-	-	-	-	-	-
	Proposed	5	Sitting	5	Sitting	31	Pass
4	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	54	Pass
5	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	9	Sitting	40	Pass
6	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	11	Standing	52	Pass
7	Existing	5	Sitting	6	Sitting	39	Pass
	Proposed	9	Sitting	12	Standing	58	Pass
8	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	48	Pass
9	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	52	Pass
10	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	6	Sitting	8	Sitting	35	Pass
11	Existing	10	Sitting	13	Standing	57	Pass
	Proposed	5	Sitting	6	Sitting	31	Pass
12	Existing	8	Sitting	10	Sitting	51	Pass
	Proposed	9	Sitting	11	Standing	51	Pass
13	Existing	9	Sitting	10	Sitting	57	Pass
	Proposed	6	Sitting	8	Sitting	48	Pass
14	Existing	10	Sitting	12	Standing	56	Pass
	Proposed	10	Sitting	13	Standing	55	Pass
15	Existing	9	Sitting	11	Standing	51	Pass
	Proposed	9	Sitting	12	Standing	51	Pass
16	Existing	8	Sitting	10	Sitting	49	Pass
	Proposed	8	Sitting	10	Sitting	48	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
17	Existing	8	Sitting	10	Sitting	45	Pass
	Proposed	9	Sitting	12	Standing	55	Pass
18	Existing	10	Sitting	13	Standing	62	Pass
	Proposed	9	Sitting	11	Standing	52	Pass
19	Existing	8	Sitting	11	Standing	45	Pass
	Proposed	7	Sitting	8	Sitting	40	Pass
20	Existing	9	Sitting	11	Standing	51	Pass
	Proposed	9	Sitting	11	Standing	47	Pass
21	Existing	9	Sitting	11	Standing	51	Pass
	Proposed	8	Sitting	11	Standing	48	Pass
22	Existing	8	Sitting	11	Standing	51	Pass
	Proposed	8	Sitting	10	Sitting	47	Pass
23	Existing	8	Sitting	11	Standing	45	Pass
	Proposed	8	Sitting	10	Sitting	44	Pass
24	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	8	Sitting	11	Standing	48	Pass
25	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	8	Sitting	10	Sitting	42	Pass
26	Existing	7	Sitting	9	Sitting	37	Pass
	Proposed	10	Sitting	12	Standing	52	Pass
27	Existing	9	Sitting	12	Standing	46	Pass
	Proposed	10	Sitting	12	Standing	54	Pass
28	Existing	9	Sitting	11	Standing	43	Pass
	Proposed	8	Sitting	10	Sitting	49	Pass
29	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	5	Sitting	7	Sitting	43	Pass
30	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	11	Standing	13	Standing	61	Pass
31	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	9	Sitting	11	Standing	53	Pass
32	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	9	Sitting	11	Standing	56	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
33	Existing	10	Sitting	13	Standing	50	Pass
	Proposed	11	Standing	15	Strolling	70	Pass
34	Existing	10	Sitting	13	Standing	50	Pass
	Proposed	12	Standing	14	Standing	81	Pass
35	Existing	10	Sitting	12	Standing	49	Pass
	Proposed	12	Standing	16	Strolling	67	Pass
36	Existing	5	Sitting	7	Sitting	34	Pass
	Proposed	13	Standing	18	Walking	73	Pass
37	Existing	-	-	-	-	-	-
	Proposed	12	Standing	16	Strolling	58	Pass
38	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	14	Standing	61	Pass
39	Existing	5	Sitting	7	Sitting	30	Pass
	Proposed	12	Standing	15	Strolling	65	Pass
40	Existing	-	-	-	-	-	-
	Proposed	5	Sitting	7	Sitting	31	Pass
41	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	48	Pass
42	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	13	Standing	59	Pass
43	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	47	Pass
44	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	5	Sitting	7	Sitting	31	Pass
45	Existing	11	Standing	14	Standing	56	Pass
	Proposed	8	Sitting	10	Sitting	45	Pass
46	Existing	9	Sitting	11	Standing	50	Pass
	Proposed	10	Sitting	13	Standing	57	Pass
47	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	6	Sitting	8	Sitting	33	Pass
48	Existing	10	Sitting	13	Standing	55	Pass
	Proposed	10	Sitting	13	Standing	53	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
49	Existing	9	Sitting	11	Standing	50	Pass
	Proposed	10	Sitting	13	Standing	55	Pass
50	Existing	8	Sitting	11	Standing	45	Pass
	Proposed	8	Sitting	11	Standing	48	Pass
51	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	6	Sitting	9	Sitting	41	Pass
52	Existing	10	Sitting	12	Standing	54	Pass
	Proposed	10	Sitting	13	Standing	60	Pass
53	Existing	10	Sitting	12	Standing	50	Pass
	Proposed	15	Strolling	19	Walking	75	Pass
54	Existing	10	Sitting	14	Standing	55	Pass
	Proposed	13	Standing	16	Strolling	79	Pass
55	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	9	Sitting	12	Standing	49	Pass
56	Existing	10	Sitting	13	Standing	57	Pass
	Proposed	10	Sitting	14	Standing	54	Pass
57	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	10	Sitting	13	Standing	51	Pass
58	Existing	10	Sitting	12	Standing	57	Pass
	Proposed	11	Standing	14	Standing	71	Pass
59	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	8	Sitting	10	Sitting	60	Pass
60	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	11	Standing	14	Standing	63	Pass
61	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	10	Sitting	13	Standing	54	Pass
62	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	9	Sitting	11	Standing	57	Pass
63	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	11	Standing	14	Standing	61	Pass
64	Existing	12	Standing	16	Strolling	67	Pass
	Proposed	10	Sitting	13	Standing	62	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
65	Existing	10	Sitting	13	Standing	57	Pass
	Proposed	10	Sitting	12	Standing	62	Pass
66	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	10	Sitting	11	Standing	62	Pass
67	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	11	Standing	13	Standing	73	Pass
68	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	12	Standing	64	Pass
69	Existing	-	-	-	-	-	-
	Proposed	12	Standing	16	Strolling	67	Pass
70	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	12	Standing	51	Pass
71	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Strolling	73	Pass
72	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	8	Sitting	33	Pass
73	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	48	Pass
74	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	51	Pass
75	Existing	7	Sitting	9	Sitting	36	Pass
	Proposed	8	Sitting	10	Sitting	50	Pass
76	Existing	9	Sitting	11	Standing	43	Pass
	Proposed	6	Sitting	8	Sitting	36	Pass
77	Existing	8	Sitting	11	Standing	42	Pass
	Proposed	6	Sitting	8	Sitting	32	Pass
78	Existing	9	Sitting	11	Standing	43	Pass
	Proposed	10	Sitting	13	Standing	58	Pass
79	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	51	Pass
80	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	8	Sitting	10	Sitting	44	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
81	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	7	Sitting	10	Sitting	41	Pass
82	Existing	9	Sitting	12	Standing	51	Pass
	Proposed	6	Sitting	8	Sitting	33	Pass
83	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	8	Sitting	10	Sitting	43	Pass
84	Existing	8	Sitting	10	Sitting	41	Pass
	Proposed	7	Sitting	9	Sitting	37	Pass
85	Existing	8	Sitting	10	Sitting	64	Pass
	Proposed	7	Sitting	8	Sitting	41	Pass
86	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	7	Sitting	9	Sitting	49	Pass
87	Existing	9	Sitting	12	Standing	51	Pass
	Proposed	11	Standing	13	Standing	53	Pass
88	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	11	Standing	14	Standing	55	Pass
89	Existing	13	Standing	16	Strolling	66	Pass
	Proposed	11	Standing	14	Standing	55	Pass
90	Existing	10	Sitting	13	Standing	56	Pass
	Proposed	8	Sitting	10	Sitting	45	Pass
91	Existing	8	Sitting	11	Standing	47	Pass
	Proposed	10	Sitting	13	Standing	52	Pass
92	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	8	Sitting	10	Sitting	48	Pass
93	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	11	Standing	14	Standing	62	Pass
94	Existing	9	Sitting	12	Standing	50	Pass
	Proposed	11	Standing	14	Standing	58	Pass
95	Existing	9	Sitting	12	Standing	52	Pass
	Proposed	12	Standing	15	Strolling	66	Pass
96	Existing	10	Sitting	12	Standing	47	Pass
	Proposed	11	Standing	13	Standing	53	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
97	Existing	10	Sitting	12	Standing	51	Pass
	Proposed	11	Standing	14	Standing	61	Pass
98	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	11	Standing	13	Standing	59	Pass
99	Existing	9	Sitting	12	Standing	52	Pass
	Proposed	12	Standing	16	Strolling	73	Pass
100	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	13	Standing	17	Strolling	68	Pass
101	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	11	Standing	14	Standing	58	Pass
102	Existing	10	Sitting	13	Standing	55	Pass
	Proposed	12	Standing	15	Strolling	65	Pass
103	Existing	10	Sitting	12	Standing	53	Pass
	Proposed	14	Standing	18	Walking	70	Pass
104	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	11	Standing	13	Standing	60	Pass
105	Existing	9	Sitting	12	Standing	50	Pass
	Proposed	12	Standing	17	Strolling	70	Pass
106	Existing	7	Sitting	10	Sitting	40	Pass
	Proposed	13	Standing	16	Strolling	65	Pass
107	Existing	7	Sitting	9	Sitting	42	Pass
	Proposed	11	Standing	14	Standing	64	Pass
108	Existing	7	Sitting	9	Sitting	41	Pass
	Proposed	12	Standing	15	Strolling	65	Pass
109	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	5	Sitting	6	Sitting	37	Pass
110	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	9	Sitting	12	Standing	63	Pass
111	Existing	10	Sitting	14	Standing	55	Pass
	Proposed	8	Sitting	11	Standing	56	Pass
112	Existing	11	Standing	14	Standing	55	Pass
	Proposed	7	Sitting	9	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
113	Existing	10	Sitting	13	Standing	50	Pass
	Proposed	9	Sitting	11	Standing	52	Pass
114	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	9	Sitting	12	Standing	60	Pass
115	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	11	Standing	14	Standing	58	Pass
116	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	10	Sitting	12	Standing	52	Pass
117	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	10	Sitting	13	Standing	65	Pass
118	Existing	9	Sitting	11	Standing	45	Pass
	Proposed	6	Sitting	7	Sitting	32	Pass
119	Existing	9	Sitting	12	Standing	45	Pass
	Proposed	7	Sitting	8	Sitting	44	Pass
120	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	13	Standing	16	Strolling	74	Pass
121	Existing	8	Sitting	10	Sitting	50	Pass
	Proposed	13	Standing	17	Strolling	72	Pass
122	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	8	Sitting	10	Sitting	44	Pass
123	Existing	8	Sitting	10	Sitting	47	Pass
	Proposed	10	Sitting	12	Standing	55	Pass
124	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	10	Sitting	13	Standing	56	Pass
125	Existing	8	Sitting	11	Standing	42	Pass
	Proposed	8	Sitting	10	Sitting	45	Pass
126	Existing	9	Sitting	11	Standing	52	Pass
	Proposed	12	Standing	15	Strolling	61	Pass
127	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	8	Sitting	9	Sitting	45	Pass
128	Existing	8	Sitting	11	Standing	47	Pass
	Proposed	12	Standing	16	Strolling	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
129	Existing	8	Sitting	10	Sitting	44	Pass
	Proposed	10	Sitting	13	Standing	58	Pass
130	Existing	9	Sitting	10	Sitting	42	Pass
	Proposed	12	Standing	16	Strolling	62	Pass
131	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	13	Standing	17	Strolling	66	Pass
132	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	7	Sitting	10	Sitting	49	Pass
133	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	10	Sitting	14	Standing	62	Pass
134	Existing	10	Sitting	13	Standing	55	Pass
	Proposed	10	Sitting	13	Standing	60	Pass
135	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	8	Sitting	11	Standing	52	Pass
136	Existing	-	-	-	-	-	-
	Proposed	15	Strolling	18	Walking	76	Pass
137	Existing	-	-	-	-	-	-
	Proposed	14	Standing	18	Walking	79	Pass
138	Existing	-	-	-	-	-	-
	Proposed	12	Standing	16	Strolling	67	Pass
139	Existing	-	-	-	-	-	-
	Proposed	12	Standing	15	Strolling	68	Pass
140	Existing	-	-	-	-	-	-
	Proposed	12	Standing	15	Strolling	60	Pass
141	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	11	Standing	68	Pass
142	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	10	Sitting	64	Pass
143	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	12	Standing	65	Pass
144	Existing	-	-	-	-	-	-
	Proposed	12	Standing	14	Standing	85	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
145	Existing Proposed	- 12	- Standing	- 15	- Strolling	- 74	- 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
Configurations				
<b>Existing</b>	Existing site and surroundings		15 - 17 Strolling	
<b>Proposed</b>	Project with existing surroundings		18 - 20 Walking	
			> 20 Uncomfortable	