

1809-1843 RYMAL ROAD

HAMILTON, ONTARIO

PEDESTRIAN WIND STUDY

RWDI # 2306875

November 24, 2023

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed development at 1809 - 1843 Rymal Road in Hamilton, Ontario (Image 1). The assessment was based on the wind tunnel testing conducted for the proposed development site under the Existing and Proposed configurations (Image 2). The results were analysed using the regional wind climate records (Image 3) 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 criteria description is appended to this report to assist with the interpretation of the results. The predicted wind conditions are presented in Figures 1A through 2B and Table 1 and are summarized as follows:

- Wind comfort conditions across the existing site are appropriate for general pedestrian usage throughout the year.
- With the proposed development in place, wind conditions on and around the site are expected to be suitable for the intended usage at all locations in the summer and most locations in the winter. Uncomfortable wind conditions are predicted to be experienced occasionally in the winter, mainly in the passages between different building massing and around a few building corners.
- Wind speeds on the rooftop terraces are predicted to be comfortable for general passive usage in the summer. Higher wind speeds are anticipated in the winter, which may be acceptable since the outdoor amenity areas would be occupied less frequently during the colder months.
- Positively, the pedestrian wind safety criterion is met at all locations assessed in both the existing and proposed configurations.



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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed development at 1809 – 1843 Rymal Road in Hamilton, Ontario. This report presents the project objectives, approach and the main results from RWDI's assessment and provides conceptual wind control measures, where necessary. Our Statement of Limitations as it pertains to this study can be found in Section 4 of this report.

1.1 Project Description

The proposed development site is located on the north side of Rymal Road East between Columbus Gate and Upper Red Hill Road Valley Parkway (Image 1). The development will consist of four mixed-use residential buildings that are 12-storey tall and two townhouse blocks.

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. 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 building entrances, public sidewalks, and outdoor amenity areas.

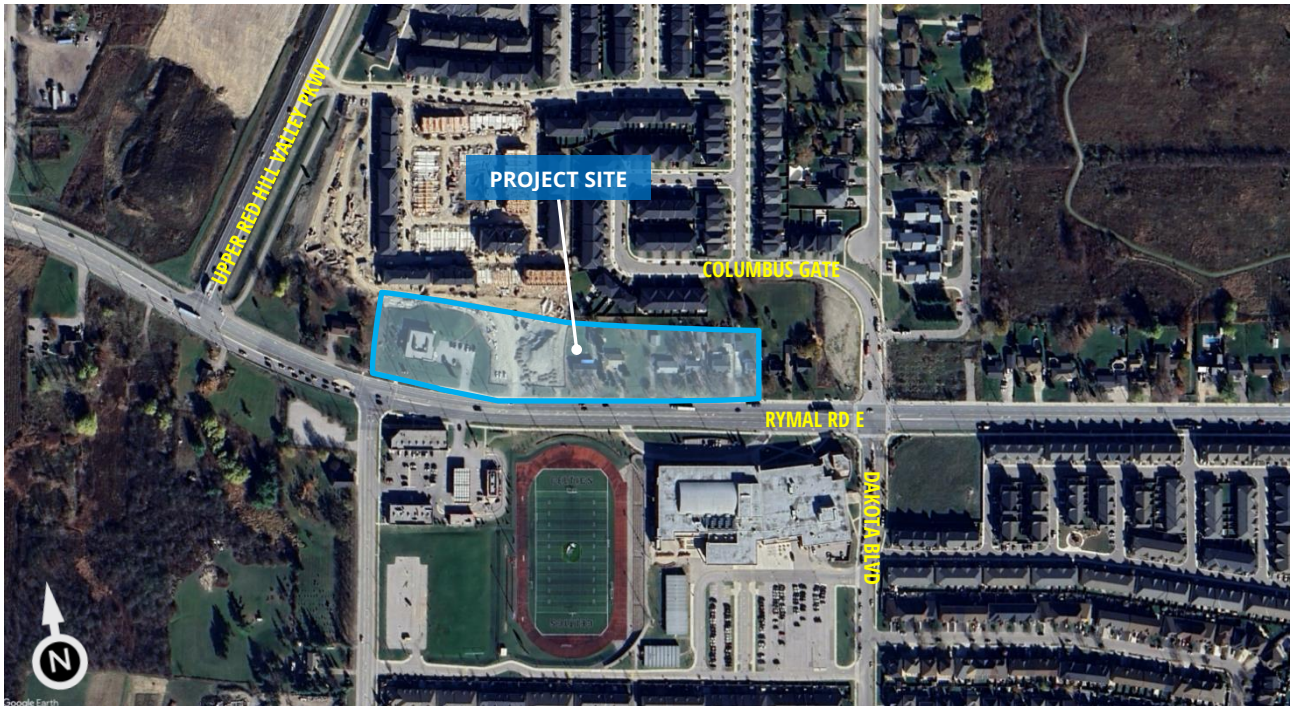


Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)



2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:400 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), and,

The wind tunnel model included all relevant surrounding buildings and topography within an approximate 480m 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 158 Irwin 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 and was reviewed by the City of Hamilton. Wind speeds were measured for 36 directions in 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model.

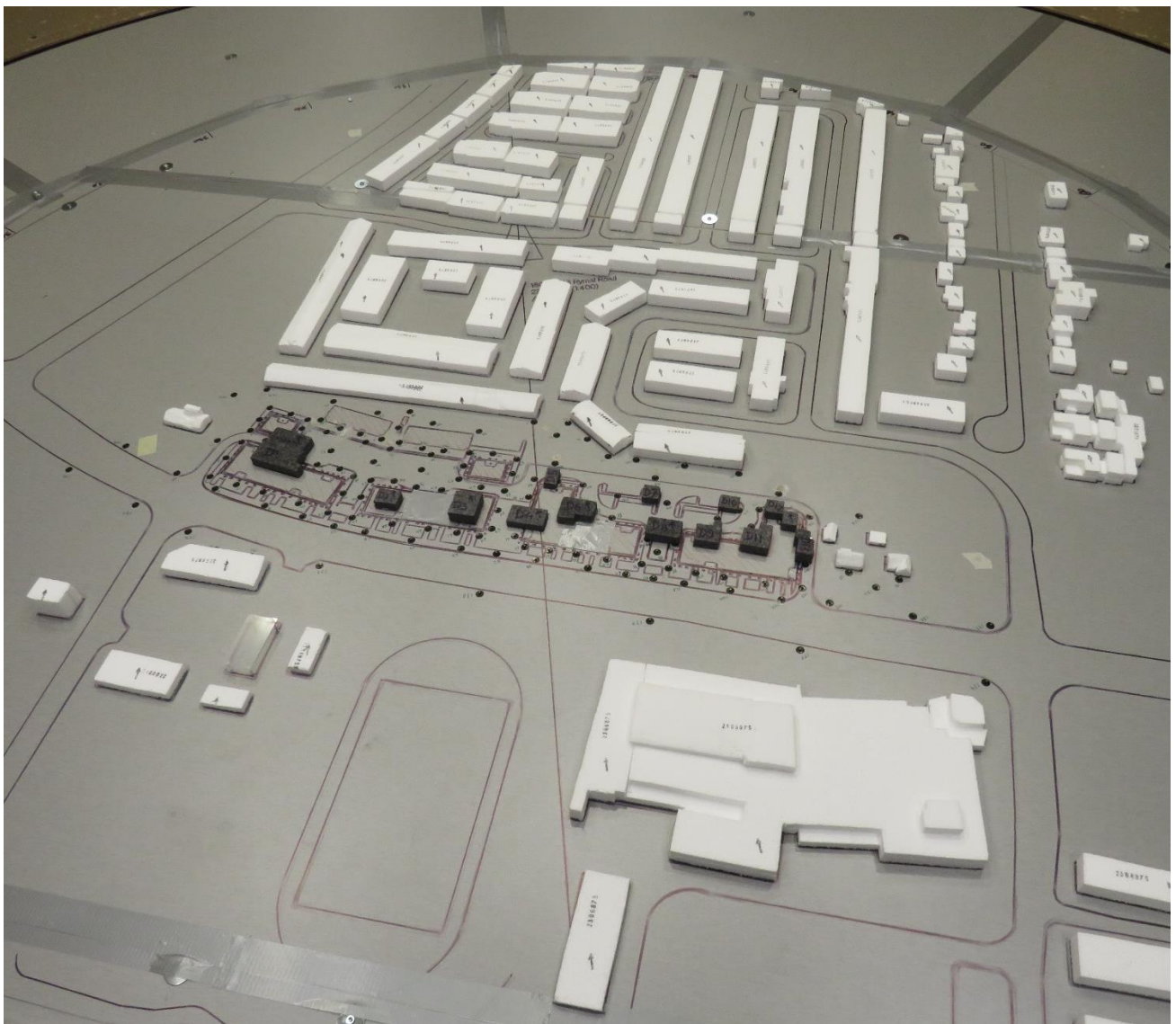


Image 2A: Wind Tunnel Study Model – Existing Configuration

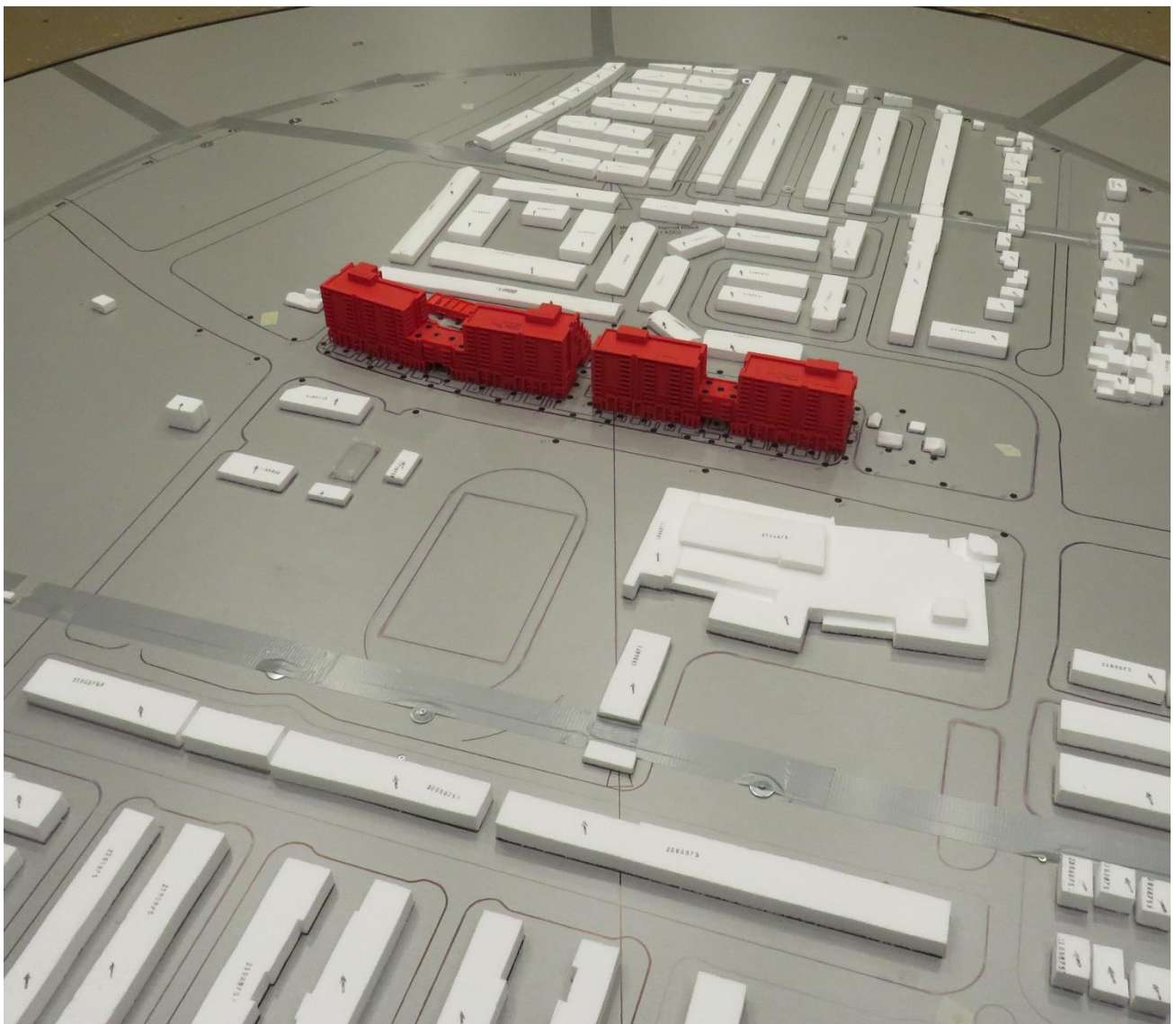
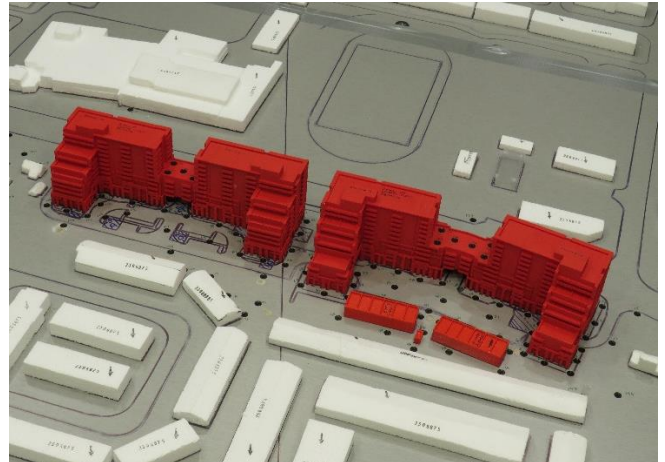
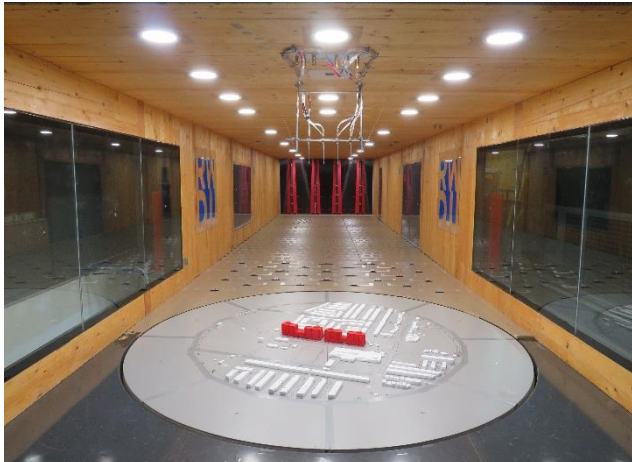


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Wind Climate Data

Wind statistics recorded at Hamilton International Airport between 1991 and 2021, 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 3.6% and 12.4% 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.

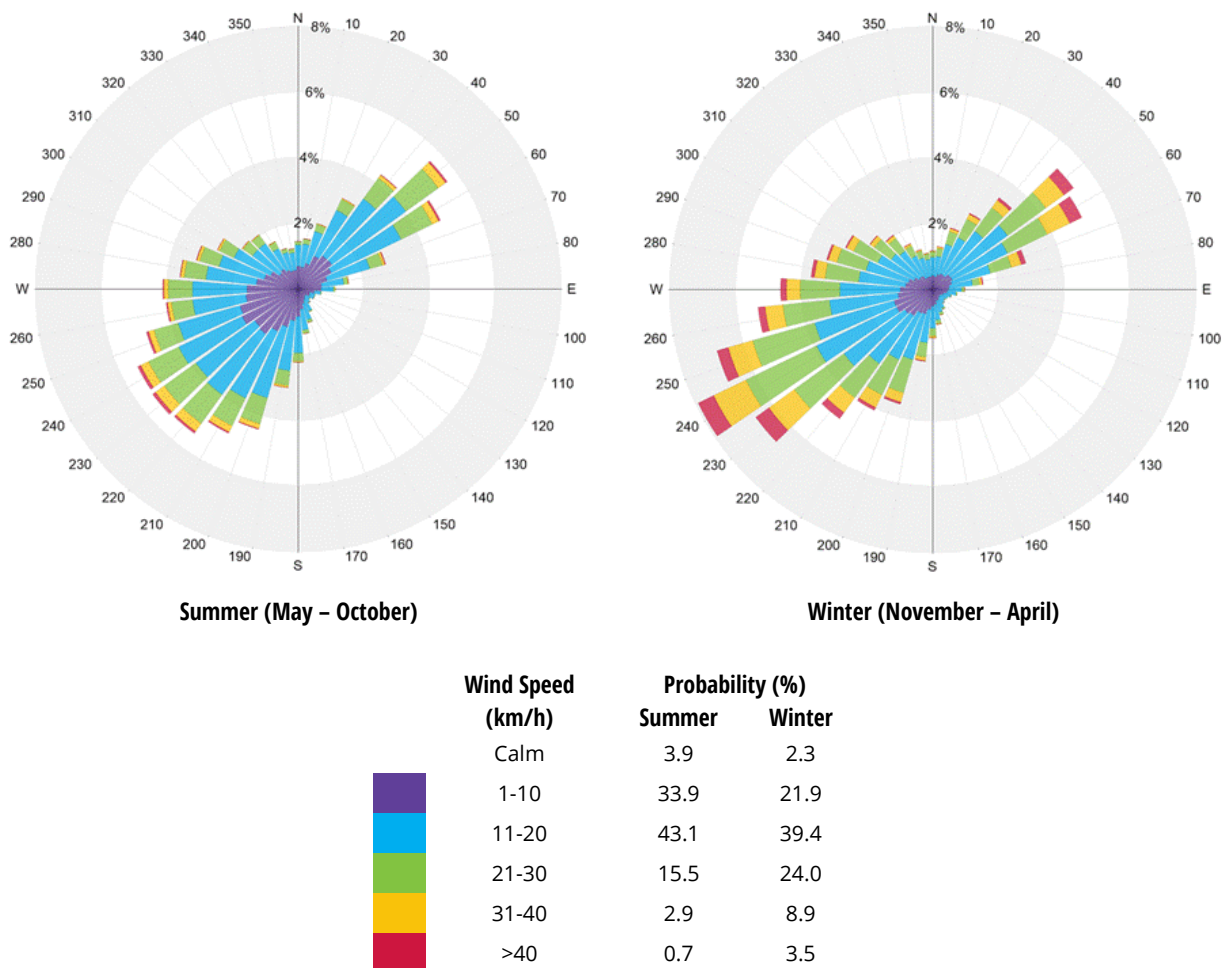


Image 3: Directional Distribution of Winds Approaching Hamilton International Airport between 1991 and 2021



2.3 RWDI Pedestrian Wind Criteria

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

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 17	Moderate winds that are appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds of this magnitude are considered a nuisance for all pedestrian activities, and wind mitigation is typically recommended

Notes:

- (1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and Gust Speed = Mean Speed + 3*RMS Speed;
- (2) Wind conditions are considered to be comfortable if the predicted GEM speeds are within the respective thresholds for at least 80% of the time between 6:00 and 23:00. Nightly hours between 0:00 and 5:00 are excluded from the wind analysis for comfort since limited usage of outdoor spaces is anticipated; and,
- (3) Instead of standard four seasons, two periods of summer (May to October) and winter (November to April) are adopted in the wind analysis, because in a cold climate such as that found in Hamilton, ON, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

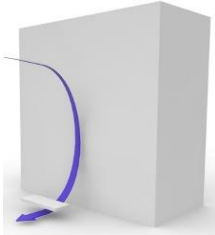
Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:

- (1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day; and,
- (2) Only gust speeds need to be considered in the wind safety criterion. These are usually rare events, but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

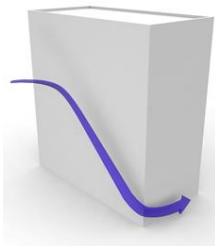
2.4 General Wind Flow Mechanisms

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



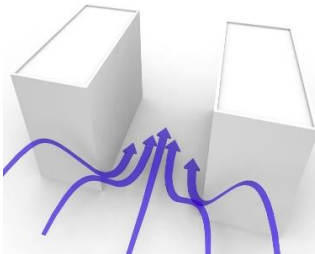
DOWNWASHING

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



CORNER ACCELERATION

When wind moves around the buildings, a localized increase in wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level. The effect is intensified when the wind approaches at an oblique angle to a tall façade and are deflected down and around the exposed corners.



CHANNELLING EFFECT

Wind flow tends to accelerate through the space between buildings, under bridges or in passages through buildings due to channelling effect caused by the narrow gap. The effect is intensified if the channel is aligned with the predominant wind direction.

Image 4: General Wind Flow Mechanisms

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as 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)

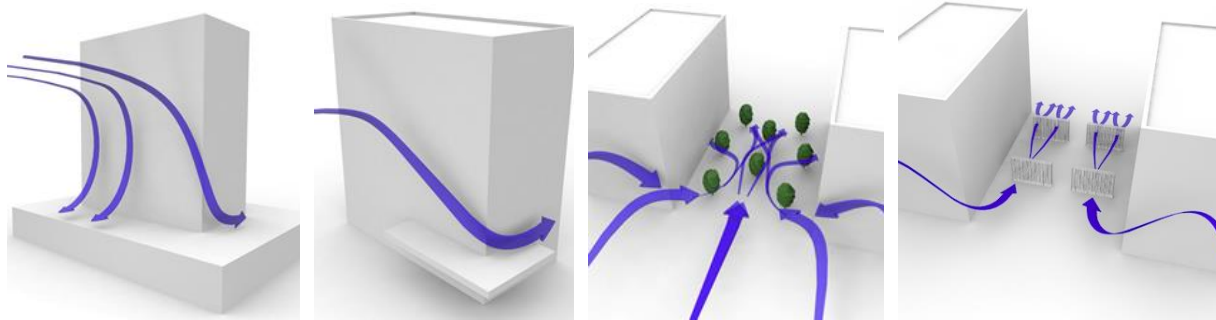


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown in Figures 1A through 2B, located in the Figures section of this report. These conditions and the associated wind speeds are also presented in Table 1, located in the Tables section of this report. In general, wind conditions comfortable for walking or strolling are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. Wind speeds comfortable for sitting are preferred for areas intended for passive activities, such as the grade-level seating areas and rooftop terraces.

Positively, wind speeds that meet the safety criterion are predicted at all locations for all configurations assessed. 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

Low wind speeds are expected around the existing site in the summer, with conditions comfortable for sitting or standing at all locations (see Figure 1A). During the winter, although higher wind speeds are experienced around the site, wind speeds at all locations are suitable for strolling or lower (Figure 2A), and are considered appropriate for the intended pedestrian usage.

3.2 Proposed Configuration

With the proposed development in place, wind speeds are expected to increase compared to the existing configuration, which is typical with the addition of a taller structure to existing low-rise or open surroundings. These localized increases in wind speeds are results of the interaction between wind flows and the proposed buildings, causing downwashing and corner acceleration around the buildings, as well as channeling effects through building passages (Figure 4). Following is a detailed breakdown of the predicted wind conditions on and around the proposed development.

3.2.1 Grade Level (Locations 1 through 147)

Main entrances of the proposed buildings are situated near Locations marked by arrows in Figures 1B and 2B, and they are positively located away from the windy areas. As a result, wind conditions at all entrances are expected to be satisfactory year-round.

During the summer, wind conditions around the site are generally expected to be comfortable for sitting or standing, with conditions suitable for strolling at several building corners (Figure 1B), and would be conducive to the intended pedestrian use. Higher wind speeds comfortable for walking are predicted in the building passages (Locations 10, 26, and 93 in Figure 1B), which are still considered appropriate for walkway uses. Positively, the grade-level seating areas shown in the latest landscaping plan (Image 6) are located along the south façades of Buildings A to D, away from the windy building corners and passages. As a result, low wind speeds that are suitable for sitting are predicted at these seating areas during the summer season, which is considered appropriate (see dark blue categorization along the south façades in Figure 1B).

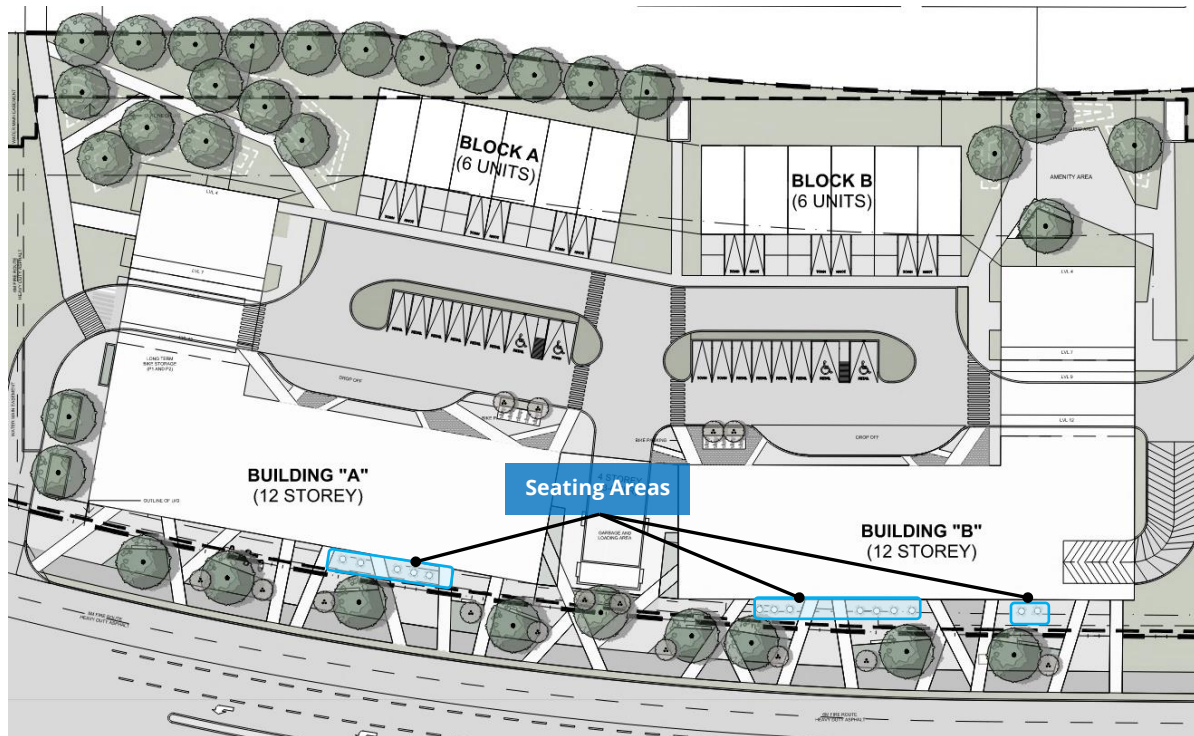


Image 6: Proposed Landscaping and Seating Areas near Buildings A and B

In the winter months, wind conditions comfortable for walking or strolling are expected at most locations along the sidewalks on Rymal Road East, and lower wind speeds that are suitable for sitting or standing are anticipated in the sheltered areas along the south facades and on the north side of Buildings A to D (see Figure 2B). Uncomfortable conditions are anticipated in localized areas at the northwest corner of Building A, the southeast corner of Building B, and locations within the passages between the buildings (Figure 2B). The wind speeds at most of these locations would be marginally uncomfortable (1 to 3 km/h over the threshold for the 'walking' criteria, see Table 1); localized wind control features can be considered by the design team to achieve satisfactory wind conditions. These features might include soft and/or hard landscaping features that are at least 2m tall. The current landscape plan for the proposed development (Image 6) indicates the addition of street trees around the proposed buildings and a large group of trees around the northwest of the site. While these trees would reduce wind speeds in the summer, it is necessary for trees to be coniferous to offer adequate wind sheltering during the winter season. Examples of recommended wind mitigation features are presented in Image 7. RWDI can guide the design team on the placement and selection of wind control features.



Image 7: Design Strategies for Wind Control at Grade Level

3.2.2 Rooftop Terraces (Locations 148 through 158)

During the summer, wind conditions at the rooftop amenity areas are predicted to be comfortable for standing between Buildings A and B and comfortable for sitting or standing between Buildings C and D (Figure 1B). These conditions are considered acceptable for general passive patron uses; however, speeds comfortable for sitting are ideal for prolonged periods of relaxed use and seating. Wind speeds could be further improved with the addition of the landscaping elements shown in the current landscape plan (Image 8). We recommend shrubs or screens that are at least 2m tall to be placed to the north and south of seating areas to create low-wind zones for patrons.

During the winter, due to seasonally stronger winds, wind speeds comfortable for strolling are mostly expected on these terraces (Figure 2). These elevated wind speeds may not be of significant concern due to the reduced occupancy of outdoor amenities in the cold winter months.



Image 8: Proposed Landscaping on the Rooftop Amenity Areas



4 STATEMENT OF LIMITATIONS

Limitations

This report (dated November 24, 2023) was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for Losani Homes ("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 Losani Homes and used to construct the scale model of the proposed development ("**Project Data**")

File Name	File Type	Date Received (dd/mm/yyyy)
3DView-MASSING-WINDSTUDY	dwg	02/10/2023
121002 - Rymal Rd - 3D - 2023.10.12	dwg	13/10/2023
14196BU_Preliminary Landscape Plan_Oct 13 2023_LR	PDF	15/10/2023



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.

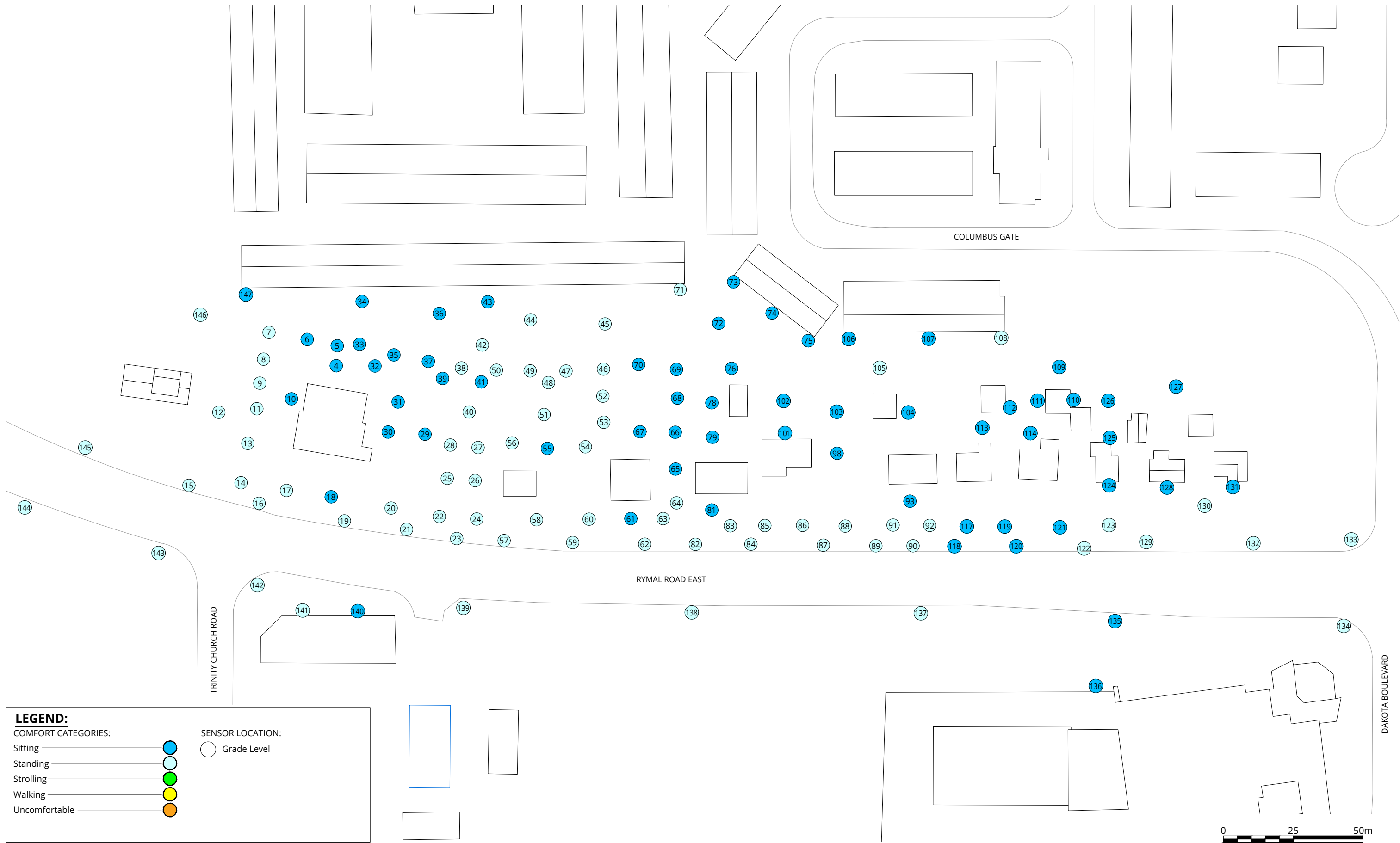


5 REFERENCES

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FIGURES



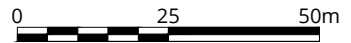
LEGEND:

COMFORT CATEGORIES:

- Sitting ———— ● (Blue)
- Standing ———— ● (Light Blue)
- Strolling ———— ● (Green)
- Walking ———— ● (Yellow)
- Uncomfortable ———— ● (Orange)

SENSOR LOCATION:

- (White) Grade Level



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

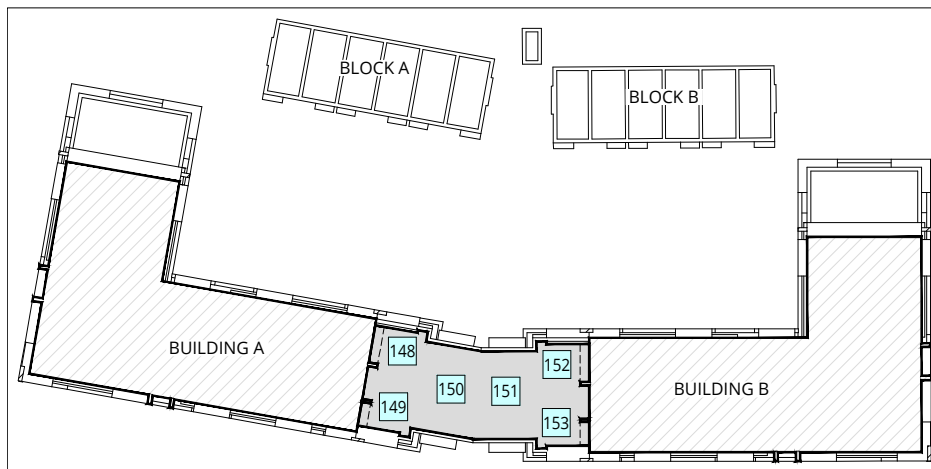
1809-1843 Rymal Road - Hamilton, ON



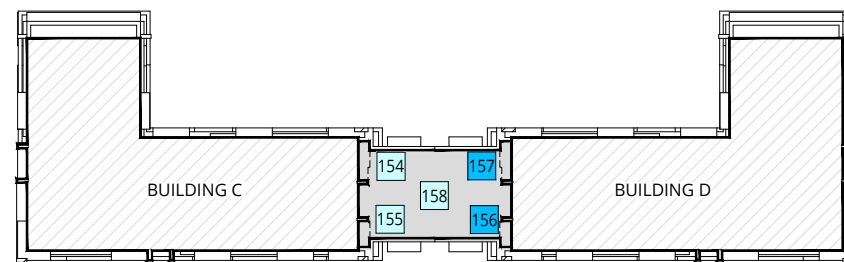
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 Date Revised: Nov. 7, 2023



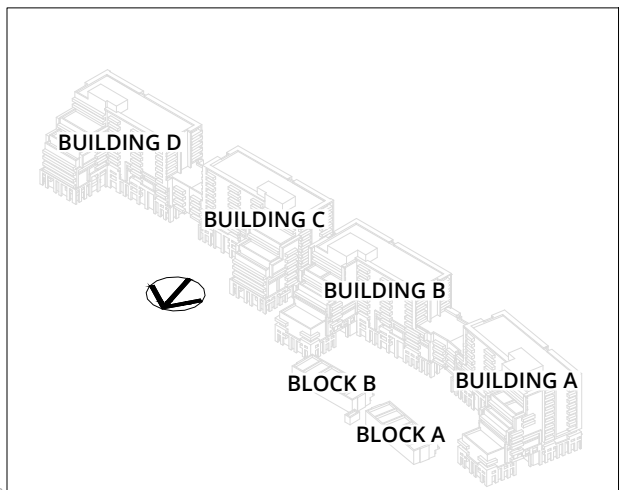
Project #2306875



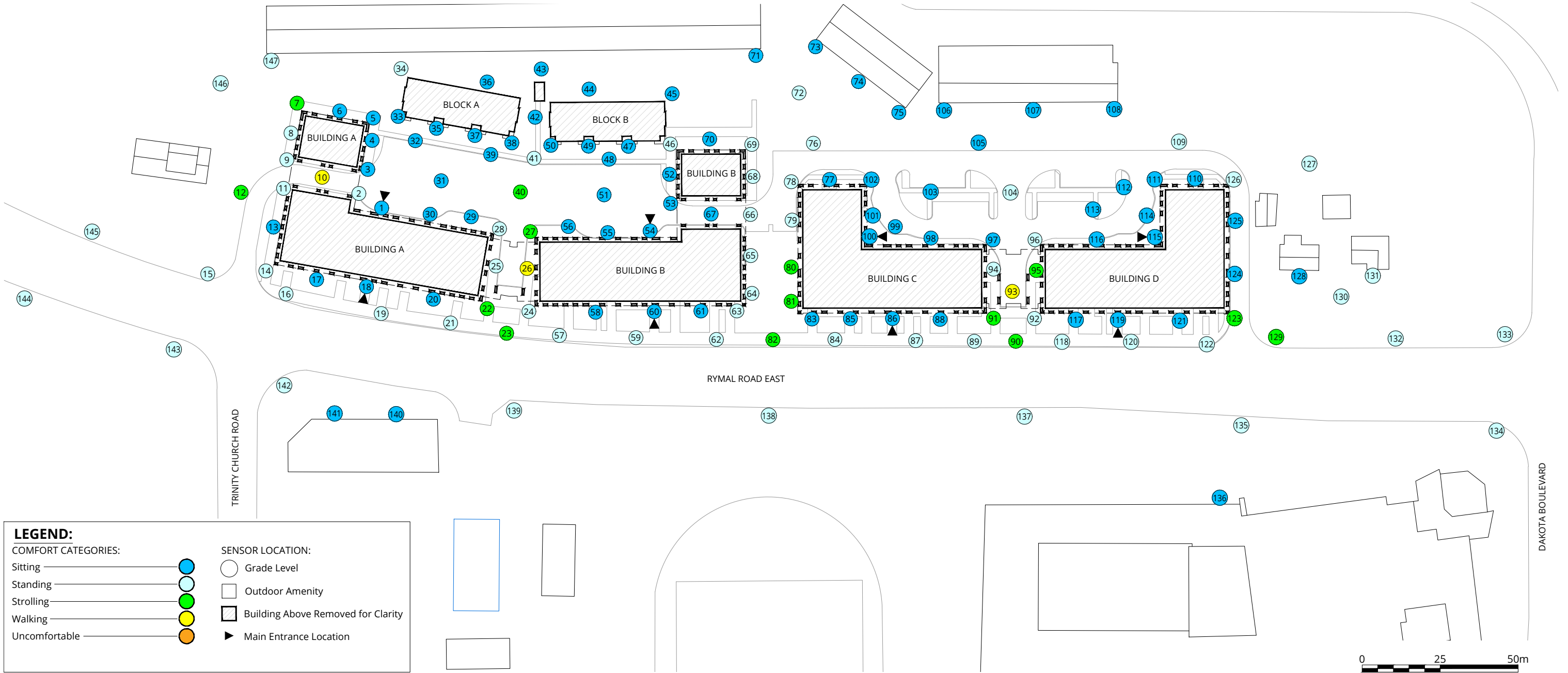
Level 7 Outdoor Amenity



COLUMBUS GATE



Isometric View of Buildings



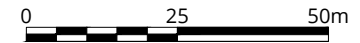
LEGEND:

COMFORT CATEGORIES:

- Sitting — (Light Blue Circle)
- Standing — (Light Green Circle)
- Strolling — (Green Circle)
- Walking — (Yellow Circle)
- Uncomfortable — (Orange Circle)

SENSOR LOCATION:

- Grade Level
- Outdoor Amenity
- ▨ Building Above Removed for Clarity
- ▶ Main Entrance Location



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

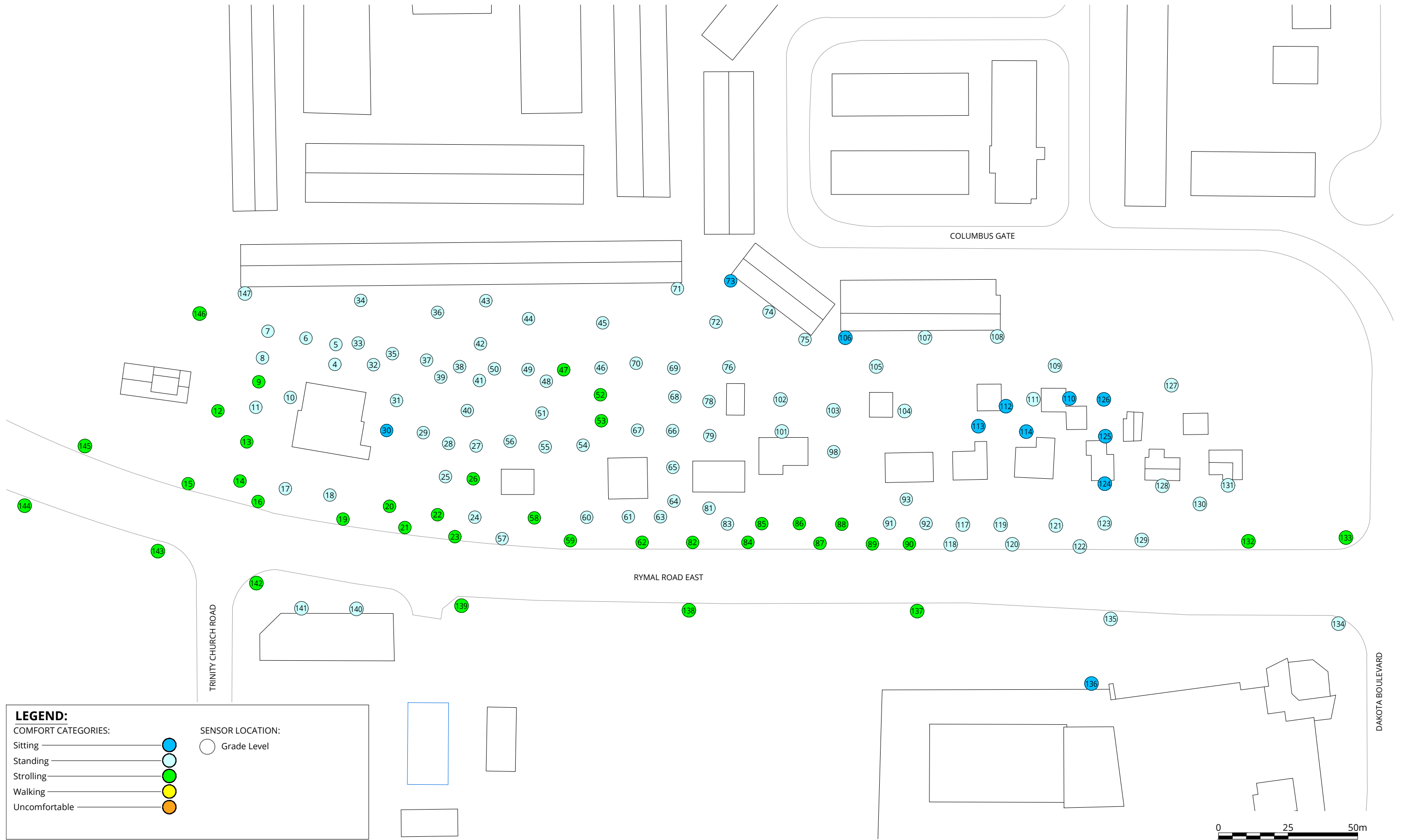
1809-1843 Rymal Road - Hamilton, ON



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Date Revised: Nov. 7, 2023



Project #2306875



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

1809-1843 Rymal Road - Hamilton, ON



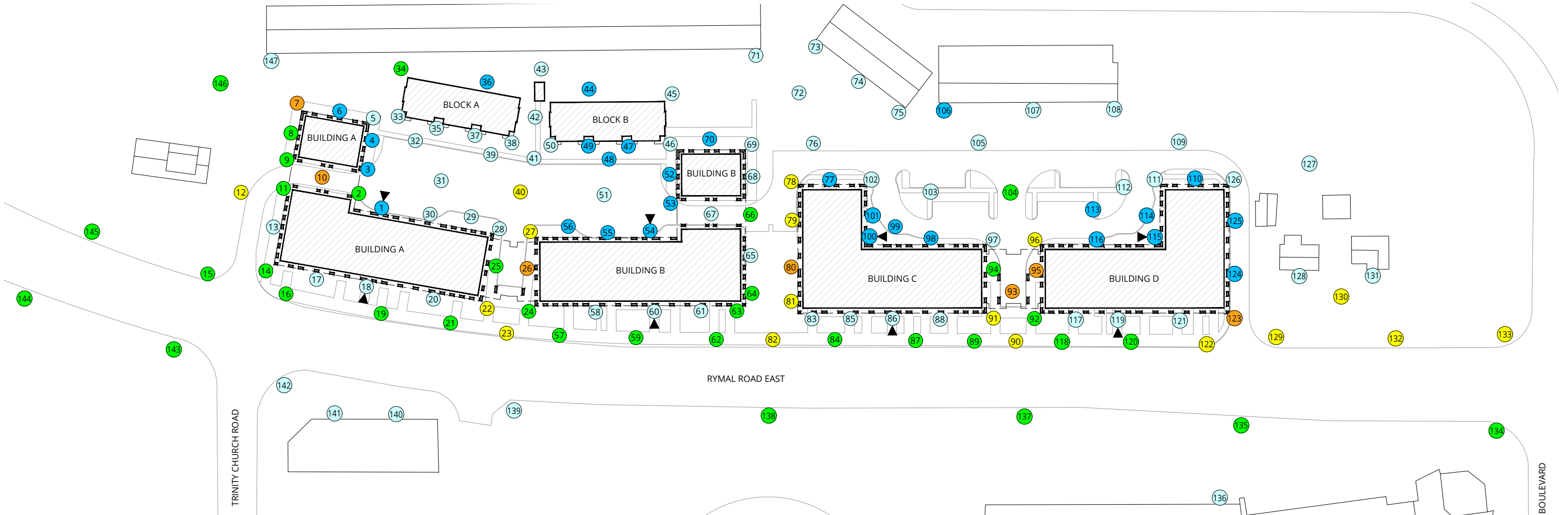
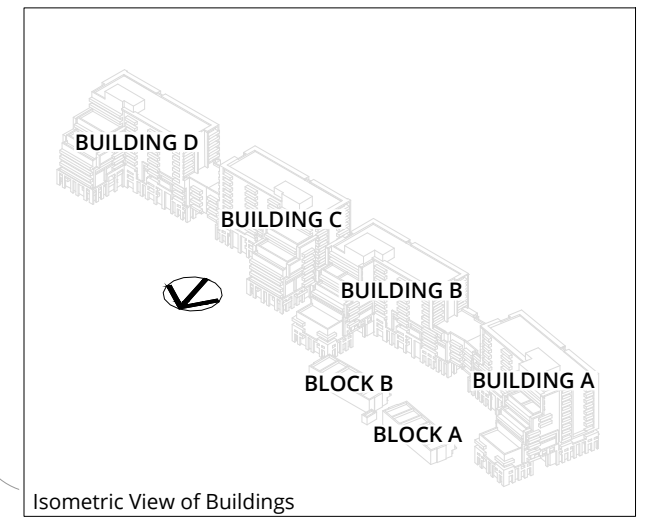
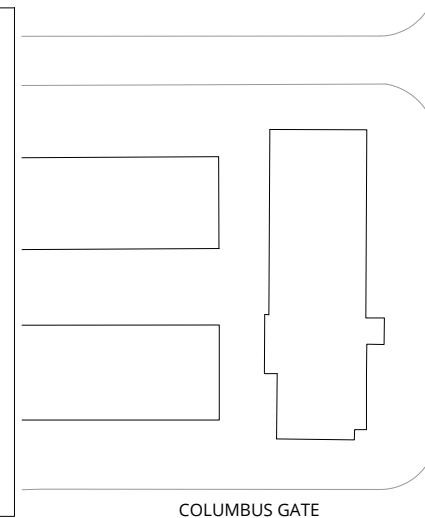
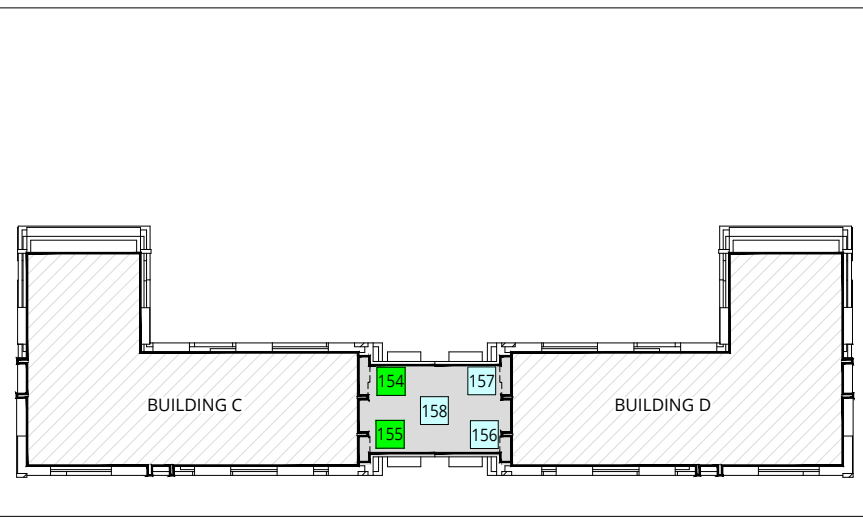
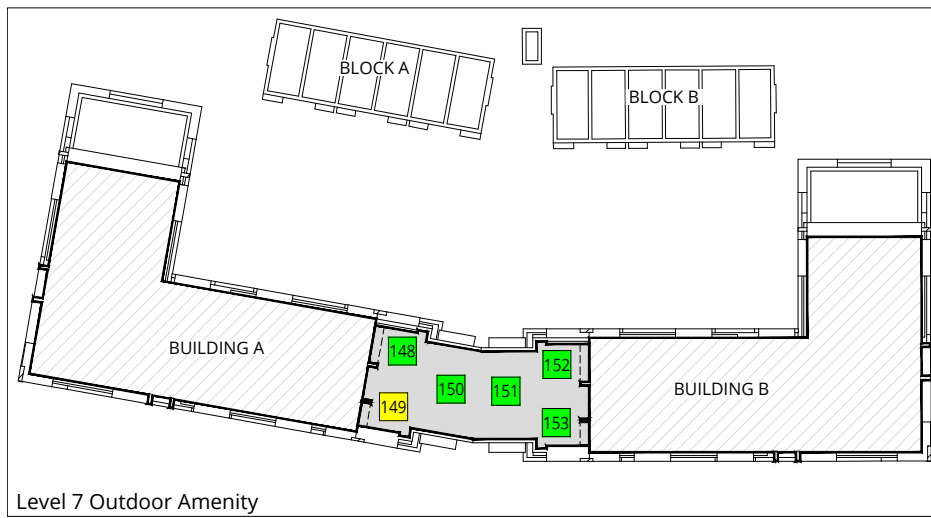
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Date Revised: Nov. 7, 2023

Project #2306875





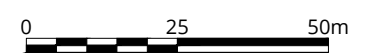
LEGEND:

COMFORT CATEGORIES:

- Sitting — (Blue circle)
- Standing — (Light Blue circle)
- Strolling — (Green circle)
- Walking — (Yellow circle)
- Uncomfortable — (Orange circle)

SENSOR LOCATION:

- Grade Level
- Outdoor Amenity
- ▨ Building Above Removed for Clarity
- ▶ Main Entrance Location



Pedestrian Wind Comfort Conditions
 Proposed Configuration
 Winter (November to April, 6:00 to 23:00)
 1809-1843 Rymal Road - Hamilton, ON

True North

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Approx. Scale: 1:1250

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

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