DRAFT REPORT

HARRIS GREEN

VICTORIA, BC

PEDESTRIAN WIND STUDY
RWDI # 2001879
May 4, 2020

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Harris Green project in Victoria, BC (Image 1). Based on our wind-tunnel testing for the proposed development (Image 2B), and the local wind records (Image 3), the potential wind comfort and safety conditions are predicted as shown on site plans in Figures 1 through 3, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- Wind conditions on and around the proposed development, including the sidewalks and walkways bounding the site, are generally predicted to be appropriate for the anticipated pedestrian usages throughout the year.
- Wind conditions on most terrace levels are expected to be suitable for the intended use throughout the year. Higher than desired wind speeds for passive use are predicted at select terrace and roof locations.
- Wind speeds at the majority of tested locations are anticipated to comply with the RWDI wind safety criterion. Exceptions include one location at grade level near the northwest corner of the 900 Yates development and four locations on the roofs of the towers.
- Conceptual wind control measures have been presented to help reduce wind speeds in areas of elevated wind activity.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed Harris Green in Victoria, BC. 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 proposed development (site shown in Image 1) is approximately 1.3M sq ft over 1.5 city blocks and includes the 900 block of Yates Street and the east portion of the 1000 block of Yates Street. On the full block site, there are two podiums separated by a large public plaza, with 3 towers in total. On the half block site, there is a podium with two towers above. There will be up to 1500 residential units, 100k sq ft of retail and all podiums have internal courtyards private to the residents.

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 appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including the public plaza, surrounding sidewalks and walkways and all above-grade accessible areas.

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

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

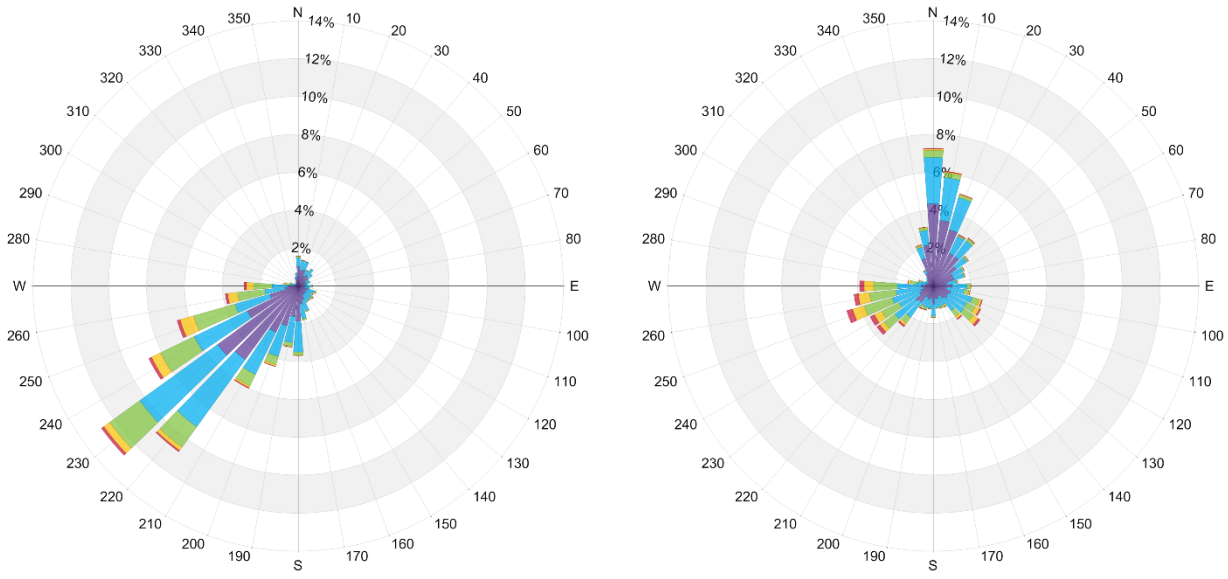
To assess the wind environment around the proposed project, a 1:400 scale model of the proposed project site and existing surroundings was constructed for the wind tunnel test. The wind tunnel model included all relevant existing and approved surrounding buildings and topography within an approximately 480 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 202 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 and reviewed by the design team.

Image 2: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Victoria Harbour Seaplane between 1995 and 2019, inclusive, were analyzed for the Summer (May through October) and Winter (November through April) seasons. Image 3 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. As indicated by the wind roses, winds from the westerly through southwesterly directions are predominant throughout the year with additional northerly and southeasterly winds observed during the winter season. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 30 ft) occur for 4.1% and 6.0% 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.



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

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	15.2	11.4
1-10	37.2	40.6
11-20	31.0	30.8
21-30	12.5	11.2
31-40	3.2	4.1
>40	0.9	1.9

Image 3: Directional Distribution of Winds Approaching Victoria Harbour Seaplane Airport From 1995 to 2019

2.3 RWDI Pedestrian Wind Criteria

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

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

Notes:
(1) GEM speed = max (mean speed, gust speed/1.85);
(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 Victoria, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

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

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

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1 through 3 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.

3.1 Grade Level

With the addition of the proposed Harris Green development, wind conditions at grade level are predicted to be comfortable for sitting or standing throughout the year (Figures 1 and 2). These conditions are considered appropriate for areas intended for passive activities such as the outdoor public plaza space and for sidewalks and walkways where pedestrians will be active and less likely to remain in one area for prolonged periods of time.

Wind speeds at all grade level locations are anticipated to comply with the RWDI wind safety criterion, with the exception of one location near the northwest corner of the 900 Yates development (Location 1 in Figure 3). Elevated wind speeds at this location are predicted primarily due to easterly winds accelerating and downwashing around the proposed building corner. These generalized types of wind flow are commonly observed when winds approach at an oblique angle to a tall façade and are redirected down, creating a localized increase in the wind activity around the exposed building corner at pedestrian level (Image 4).

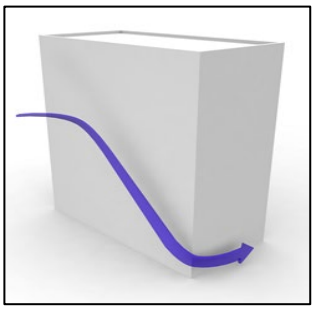


Image 4: Downwashing and Corner Acceleration Wind Flows

To help mitigate wind speeds at this location, RWDI recommends implementing vertical elements such as windscreens and/or dense landscaping placed upwind (i.e. east) of the building corner and undercut. In addition, if feasible, a larger building footprint setback can be considered along the east façade wrapping around the northwest corner to provide greater protection by the building overhang from downwashing wind flows. For vertical wind screen elements being considered, it is recommended that the elements be at least 2 m tall and approximately 80% solid. The porosity could be designed into the screen elements by incorporating a mix of landscaping or greenery into these features or including perforations between glass panels. For landscaping being considered, tree types such as marcescent or evergreen should be considered which are able to retain their foliage all year-round and provide annual protection from winds. These species, particularly evergreens, are also known to have a denser foliage. Examples of these elements are provided in Image 5.

Image 5: Examples of Windscreens (Top) and Dense Landscaping (Bottom)

3.2 Above-Grade Levels

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 (defined as May to October). During the winter, we have assumed that the area would not be used frequently, and therefore increased wind activity would be considered appropriate.

Wind conditions on the majority of the terrace levels are expected to be appropriate for passive pedestrian use during the summer, with conditions comfortable for sitting or standing (Figure 1). However, higher than desired wind speeds, comfortable for strolling or walking, are predicted at select terrace and roof locations. These conditions are primarily a result of exposure of higher elevations to southeasterly winds.

To reduce wind activity on the above-grade levels where desired, RWDI recommends implementing tall guardrails around the perimeter of terraces. For the guardrails to be effective, they should be at least 2m tall. This will provide added protection to the areas directly behind the guardrails, particularly for areas intended for seating. The guardrails may also include a porosity of 20 to 30%, this type of design will help reduce energy from oncoming winds and provide greater downwind protection. In addition to tall perimeter guardrails, dispersed planters and/or porous wind screens of similar heights, may be considered on the terraces to help provide localized areas of protection. Examples of these are shown in Image 6.

Image 6: Examples of Tall Perimeter Guardrails and Planters

4 APPLICABILITY OF RESULTS

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

File Name	File Type	Date Received (dd/mm/yyyy)
20200325_Model.skp	SketchUp	25/03/2020
20200116_Concept.skp	SketchUp	26/03/2020

5 REFERENCES

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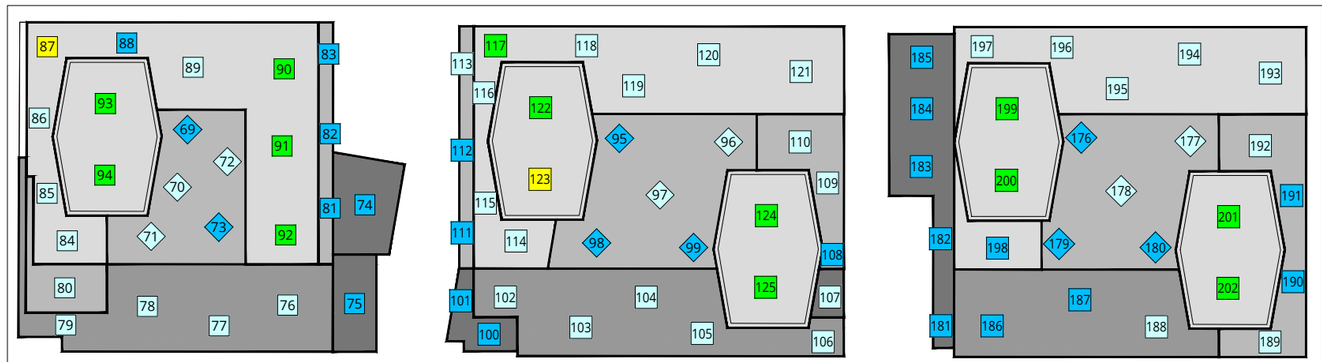
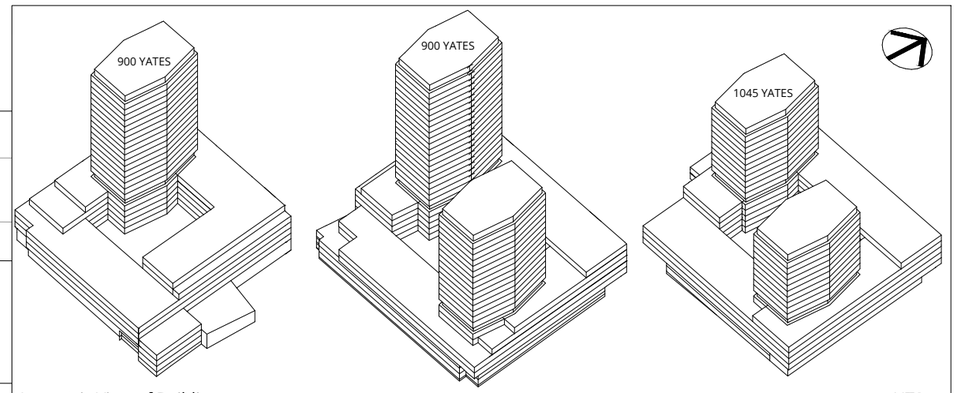
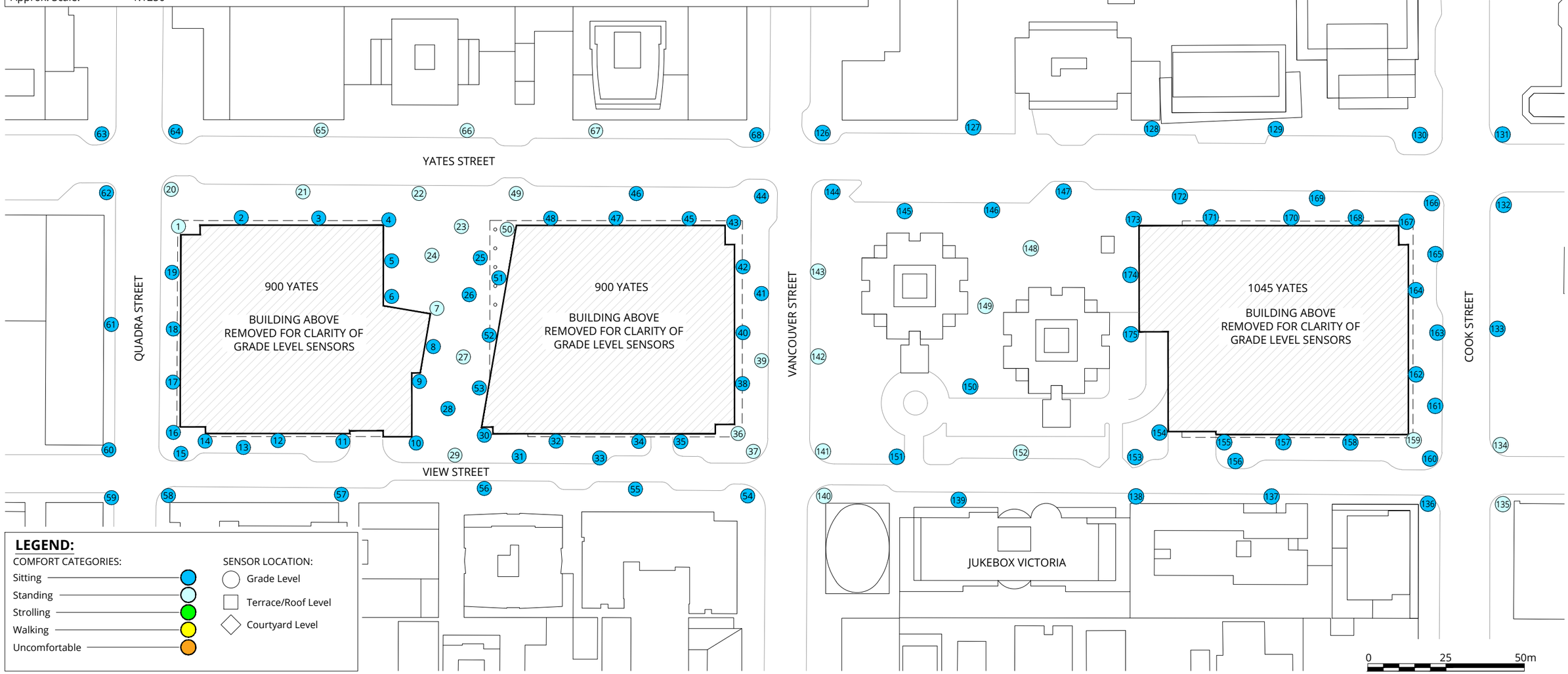
FIGURES



Elevated Level Sensor Locations
Approx. Scale: 1:1250



Isometric View of Building NTS



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Terrace/Roof Level
- Courtyard Level

Pedestrian Wind Comfort Conditions

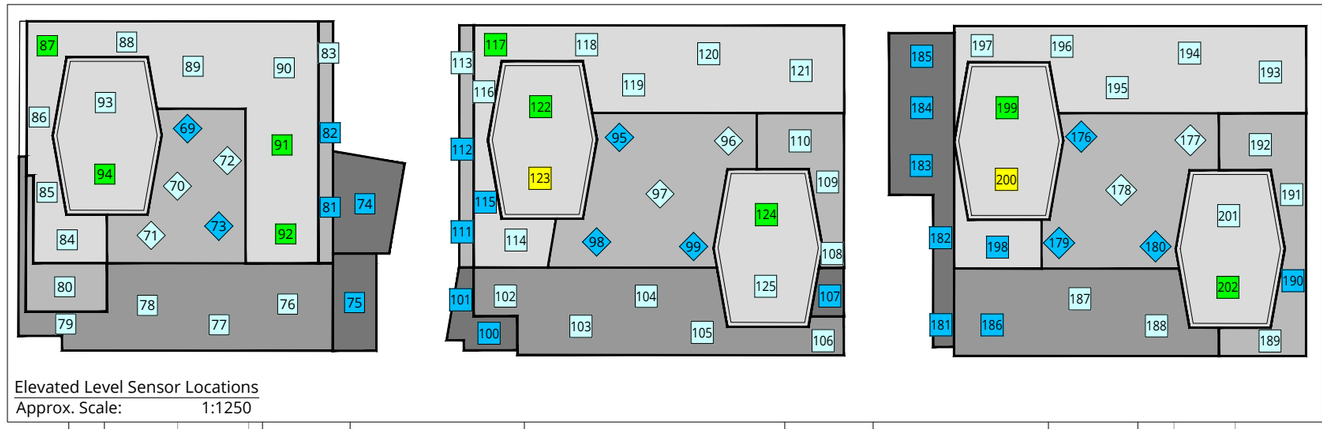
Proposed Configuration
Summer (May to October, 6:00 to 23:00)

Harris Green - Victoria, BC

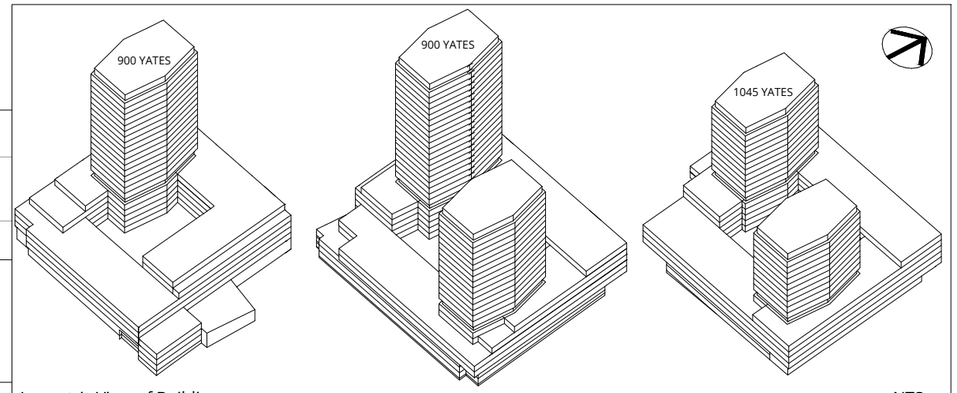
True North

Project #2001879

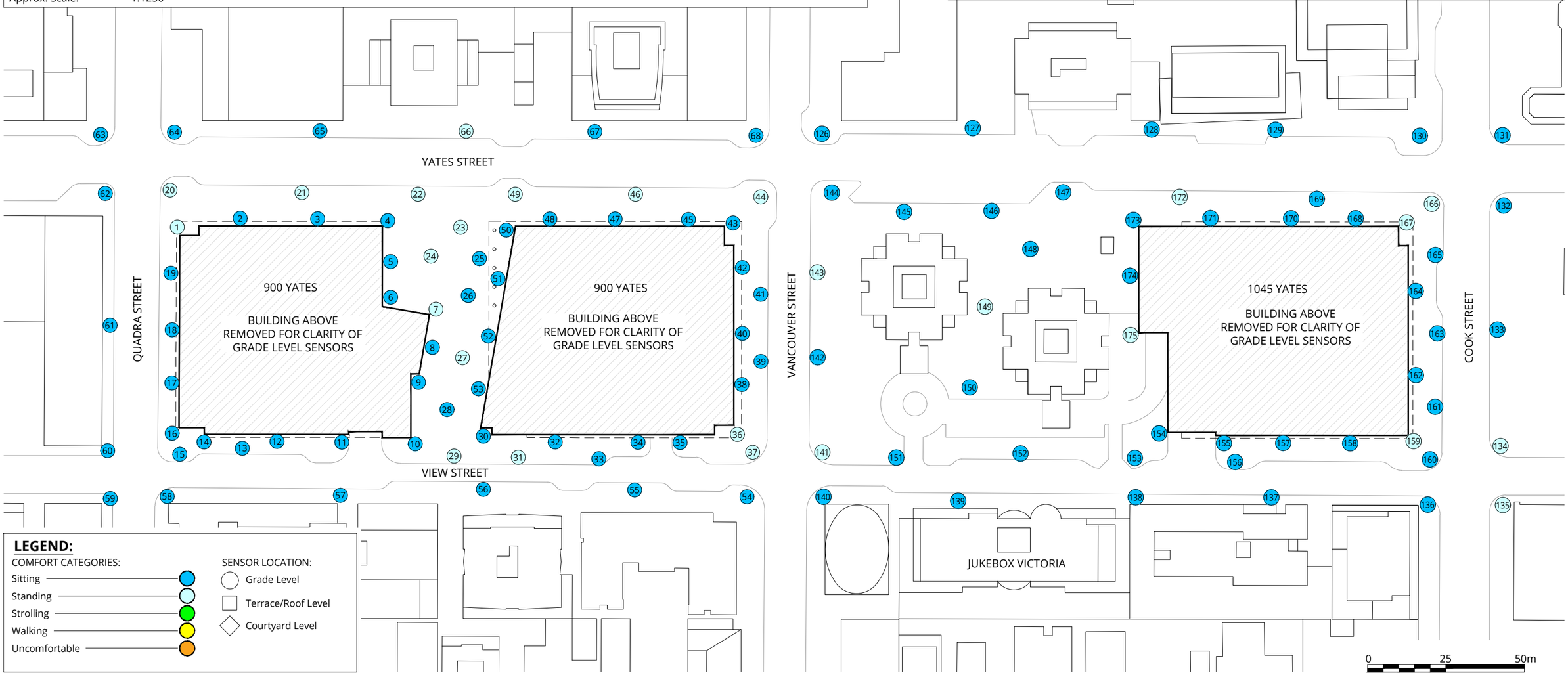
Drawn by: DF	Figure: 1	
Approx. Scale: 1:1250		
Date Revised: Apr. 14, 2020		



Elevated Level Sensor Locations
Approx. Scale: 1:1250



Isometric View of Building NTS



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Terrace/Roof Level
- Courtyard Level

Pedestrian Wind Comfort Conditions

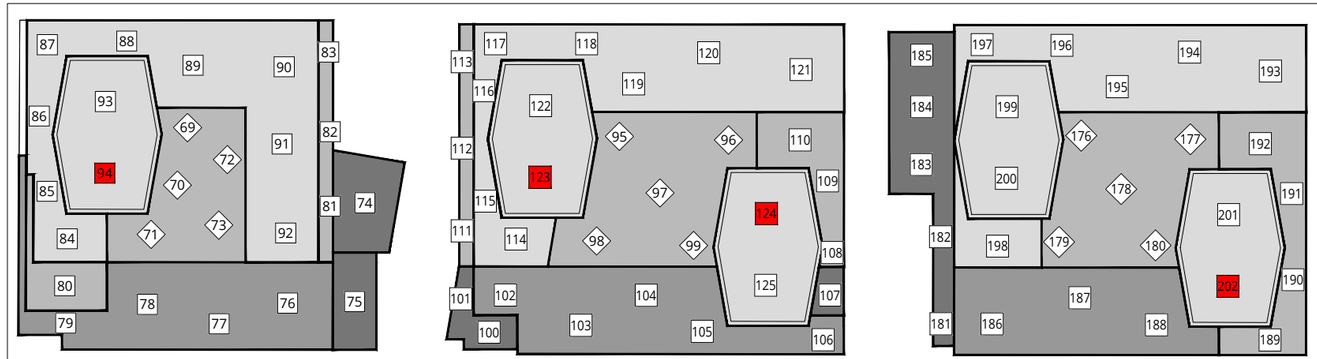
Proposed Configuration
Winter (November to April, 6:00 to 23:00)

Harris Green - Victoria, BC

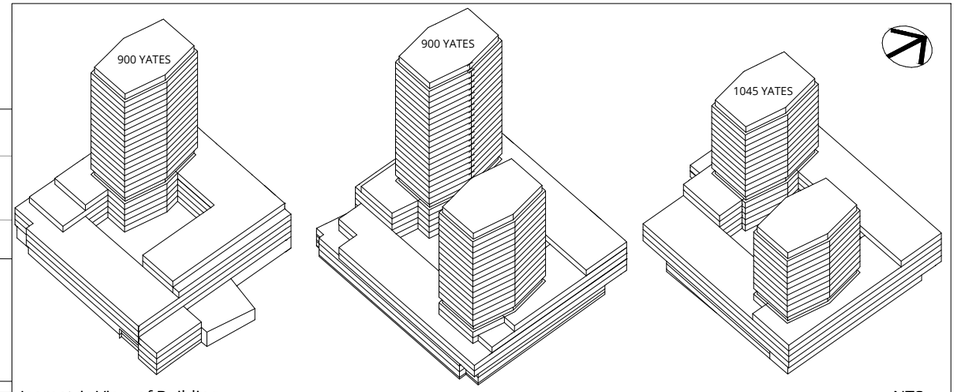
True North

Project #2001879

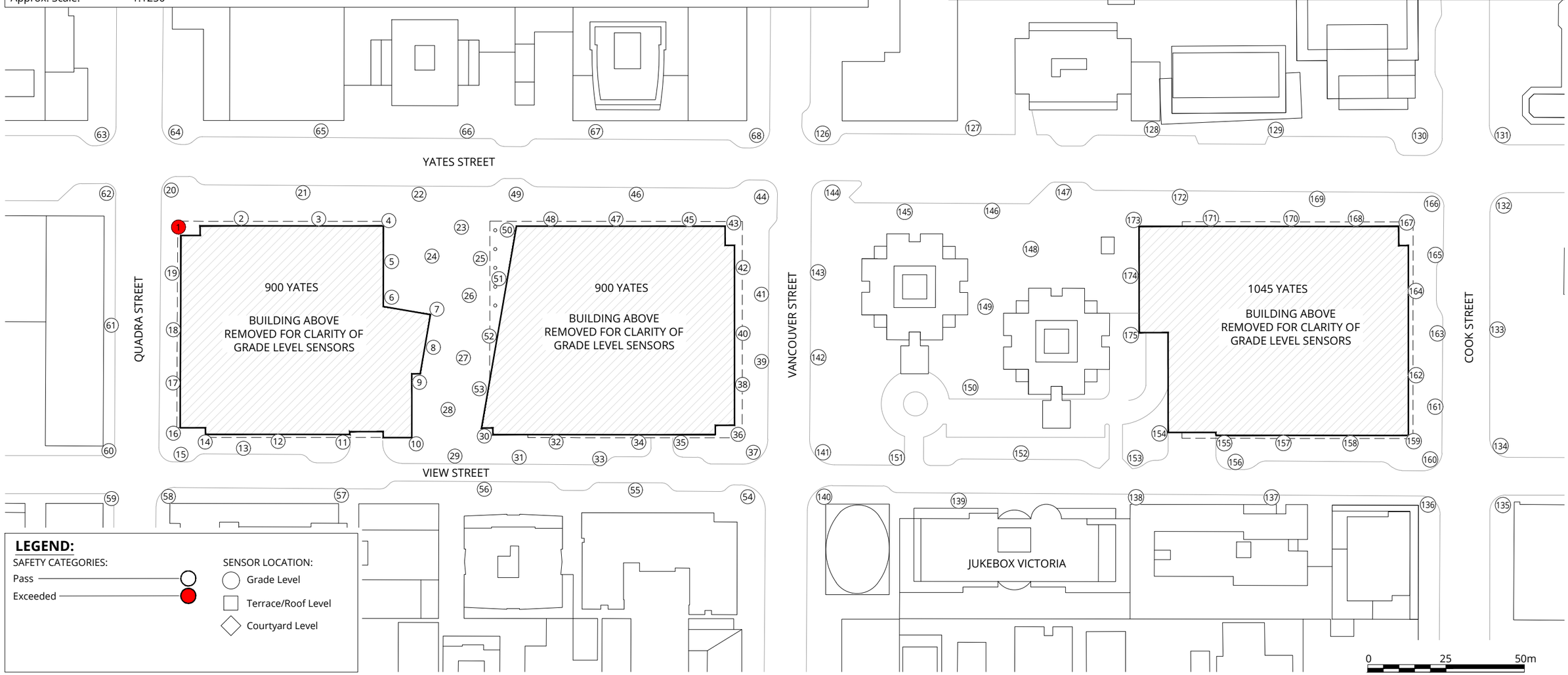
Drawn by: DF	Figure: 2
Approx. Scale:	1:1250
Date Revised:	Apr. 14, 2020



Elevated Level Sensor Locations
Approx. Scale: 1:1250



Isometric View of Building NTS



LEGEND:

SAFETY CATEGORIES:
Pass
Exceeded

SENSOR LOCATION:
Grade Level
Terrace/Roof Level
Courtyard Level

0 25 50m

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

Harris Green - Victoria, BC

True North

Project #2001879

Drawn by: DF	Figure: 3
Approx. Scale: 1:1250	
Date Revised: Apr. 14, 2020	

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
1	Proposed	14	Standing	13	Standing	94	Exceeded
2	Proposed	10	Sitting	10	Sitting	67	Pass
3	Proposed	9	Sitting	9	Sitting	54	Pass
4	Proposed	10	Sitting	10	Sitting	58	Pass
5	Proposed	7	Sitting	8	Sitting	47	Pass
6	Proposed	10	Sitting	9	Sitting	54	Pass
7	Proposed	12	Standing	12	Standing	69	Pass
8	Proposed	8	Sitting	9	Sitting	50	Pass
9	Proposed	7	Sitting	8	Sitting	44	Pass
10	Proposed	9	Sitting	9	Sitting	54	Pass
11	Proposed	10	Sitting	8	Sitting	61	Pass
12	Proposed	9	Sitting	8	Sitting	52	Pass
13	Proposed	9	Sitting	9	Sitting	51	Pass
14	Proposed	8	Sitting	9	Sitting	50	Pass
15	Proposed	10	Sitting	10	Sitting	56	Pass
16	Proposed	10	Sitting	10	Sitting	56	Pass
17	Proposed	8	Sitting	8	Sitting	48	Pass
18	Proposed	8	Sitting	9	Sitting	46	Pass
19	Proposed	10	Sitting	10	Sitting	55	Pass
20	Proposed	13	Standing	12	Standing	69	Pass
21	Proposed	11	Standing	11	Standing	68	Pass
22	Proposed	12	Standing	12	Standing	69	Pass
23	Proposed	11	Standing	11	Standing	66	Pass
24	Proposed	12	Standing	12	Standing	69	Pass
25	Proposed	9	Sitting	10	Sitting	52	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
26	Proposed	9	Sitting	9	Sitting	50	Pass
27	Proposed	11	Standing	11	Standing	59	Pass
28	Proposed	10	Sitting	10	Sitting	56	Pass
29	Proposed	11	Standing	11	Standing	60	Pass
30	Proposed	9	Sitting	10	Sitting	61	Pass
31	Proposed	10	Sitting	11	Standing	63	Pass
32	Proposed	10	Sitting	10	Sitting	52	Pass
33	Proposed	9	Sitting	10	Sitting	51	Pass
34	Proposed	8	Sitting	8	Sitting	44	Pass
35	Proposed	8	Sitting	9	Sitting	46	Pass
36	Proposed	11	Standing	11	Standing	57	Pass
37	Proposed	12	Standing	11	Standing	58	Pass
38	Proposed	9	Sitting	8	Sitting	47	Pass
39	Proposed	11	Standing	10	Sitting	55	Pass
40	Proposed	10	Sitting	9	Sitting	55	Pass
41	Proposed	9	Sitting	9	Sitting	48	Pass
42	Proposed	8	Sitting	9	Sitting	50	Pass
43	Proposed	8	Sitting	10	Sitting	56	Pass
44	Proposed	10	Sitting	11	Standing	58	Pass
45	Proposed	8	Sitting	10	Sitting	55	Pass
46	Proposed	9	Sitting	11	Standing	58	Pass
47	Proposed	8	Sitting	9	Sitting	52	Pass
48	Proposed	9	Sitting	10	Sitting	56	Pass
49	Proposed	13	Standing	12	Standing	79	Pass
50	Proposed	11	Standing	9	Sitting	70	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
51	Proposed	9	Sitting	8	Sitting	54	Pass
52	Proposed	9	Sitting	8	Sitting	49	Pass
53	Proposed	9	Sitting	9	Sitting	50	Pass
54	Proposed	10	Sitting	10	Sitting	55	Pass
55	Proposed	9	Sitting	10	Sitting	51	Pass
56	Proposed	9	Sitting	10	Sitting	59	Pass
57	Proposed	10	Sitting	9	Sitting	55	Pass
58	Proposed	9	Sitting	9	Sitting	56	Pass
59	Proposed	9	Sitting	9	Sitting	49	Pass
60	Proposed	9	Sitting	9	Sitting	50	Pass
61	Proposed	9	Sitting	10	Sitting	63	Pass
62	Proposed	9	Sitting	9	Sitting	49	Pass
63	Proposed	10	Sitting	10	Sitting	61	Pass
64	Proposed	10	Sitting	9	Sitting	53	Pass
65	Proposed	11	Standing	10	Sitting	58	Pass
66	Proposed	12	Standing	11	Standing	65	Pass
67	Proposed	11	Standing	10	Sitting	62	Pass
68	Proposed	10	Sitting	10	Sitting	58	Pass
69	Proposed	9	Sitting	8	Sitting	51	Pass
70	Proposed	14	Standing	11	Standing	75	Pass
71	Proposed	11	Standing	11	Standing	65	Pass
72	Proposed	11	Standing	11	Standing	66	Pass
73	Proposed	10	Sitting	10	Sitting	59	Pass
74	Proposed	7	Sitting	8	Sitting	52	Pass
75	Proposed	8	Sitting	8	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
76	Proposed	13	Standing	12	Standing	72	Pass
77	Proposed	14	Standing	13	Standing	74	Pass
78	Proposed	12	Standing	12	Standing	65	Pass
79	Proposed	11	Standing	11	Standing	61	Pass
80	Proposed	11	Standing	12	Standing	69	Pass
81	Proposed	8	Sitting	9	Sitting	51	Pass
82	Proposed	9	Sitting	10	Sitting	56	Pass
83	Proposed	10	Sitting	11	Standing	69	Pass
84	Proposed	13	Standing	14	Standing	83	Pass
85	Proposed	11	Standing	11	Standing	66	Pass
86	Proposed	12	Standing	11	Standing	69	Pass
87	Proposed	18	Walking	17	Strolling	88	Pass
88	Proposed	9	Sitting	11	Standing	64	Pass
89	Proposed	11	Standing	13	Standing	75	Pass
90	Proposed	15	Strolling	14	Standing	76	Pass
91	Proposed	17	Strolling	15	Strolling	83	Pass
92	Proposed	16	Strolling	15	Strolling	81	Pass
93	Proposed	16	Strolling	14	Standing	80	Pass
94	Proposed	15	Strolling	16	Strolling	92	Exceeded
95	Proposed	9	Sitting	9	Sitting	50	Pass
96	Proposed	12	Standing	12	Standing	73	Pass
97	Proposed	13	Standing	13	Standing	77	Pass
98	Proposed	9	Sitting	9	Sitting	54	Pass
99	Proposed	8	Sitting	8	Sitting	44	Pass
100	Proposed	8	Sitting	8	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
101	Proposed	8	Sitting	8	Sitting	50	Pass
102	Proposed	12	Standing	12	Standing	67	Pass
103	Proposed	11	Standing	12	Standing	66	Pass
104	Proposed	12	Standing	12	Standing	68	Pass
105	Proposed	14	Standing	14	Standing	74	Pass
106	Proposed	13	Standing	11	Standing	71	Pass
107	Proposed	13	Standing	10	Sitting	74	Pass
108	Proposed	10	Sitting	11	Standing	63	Pass
109	Proposed	11	Standing	12	Standing	68	Pass
110	Proposed	13	Standing	13	Standing	71	Pass
111	Proposed	10	Sitting	10	Sitting	58	Pass
112	Proposed	10	Sitting	10	Sitting	62	Pass
113	Proposed	12	Standing	12	Standing	75	Pass
114	Proposed	14	Standing	14	Standing	81	Pass
115	Proposed	11	Standing	10	Sitting	60	Pass
116	Proposed	11	Standing	12	Standing	73	Pass
117	Proposed	15	Strolling	15	Strolling	86	Pass
118	Proposed	11	Standing	13	Standing	69	Pass
119	Proposed	12	Standing	13	Standing	76	Pass
120	Proposed	13	Standing	14	Standing	77	Pass
121	Proposed	14	Standing	14	Standing	80	Pass
122	Proposed	17	Strolling	15	Strolling	89	Pass
123	Proposed	18	Walking	18	Walking	97	Exceeded
124	Proposed	17	Strolling	16	Strolling	94	Exceeded
125	Proposed	16	Strolling	14	Standing	83	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
126	Proposed	9	Sitting	9	Sitting	50	Pass
127	Proposed	8	Sitting	8	Sitting	48	Pass
128	Proposed	9	Sitting	9	Sitting	54	Pass
129	Proposed	10	Sitting	10	Sitting	61	Pass
130	Proposed	9	Sitting	10	Sitting	59	Pass
131	Proposed	9	Sitting	10	Sitting	56	Pass
132	Proposed	9	Sitting	10	Sitting	55	Pass
133	Proposed	10	Sitting	10	Sitting	56	Pass
134	Proposed	12	Standing	11	Standing	63	Pass
135	Proposed	13	Standing	11	Standing	71	Pass
136	Proposed	8	Sitting	9	Sitting	53	Pass
137	Proposed	8	Sitting	9	Sitting	57	Pass
138	Proposed	8	Sitting	9	Sitting	53	Pass
139	Proposed	7	Sitting	7	Sitting	45	Pass
140	Proposed	11	Standing	10	Sitting	61	Pass
141	Proposed	13	Standing	11	Standing	68	Pass
142	Proposed	11	Standing	10	Sitting	56	Pass
143	Proposed	11	Standing	11	Standing	60	Pass
144	Proposed	10	Sitting	10	Sitting	54	Pass
145	Proposed	8	Sitting	8	Sitting	46	Pass
146	Proposed	10	Sitting	10	Sitting	55	Pass
147	Proposed	8	Sitting	9	Sitting	48	Pass
148	Proposed	11	Standing	10	Sitting	60	Pass
149	Proposed	12	Standing	12	Standing	64	Pass
150	Proposed	10	Sitting	10	Sitting	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
151	Proposed	9	Sitting	8	Sitting	51	Pass
152	Proposed	11	Standing	10	Sitting	62	Pass
153	Proposed	10	Sitting	10	Sitting	56	Pass
154	Proposed	10	Sitting	10	Sitting	56	Pass
155	Proposed	9	Sitting	9	Sitting	59	Pass
156	Proposed	9	Sitting	10	Sitting	62	Pass
157	Proposed	7	Sitting	8	Sitting	53	Pass
158	Proposed	9	Sitting	9	Sitting	57	Pass
159	Proposed	12	Standing	11	Standing	68	Pass
160	Proposed	10	Sitting	10	Sitting	58	Pass
161	Proposed	8	Sitting	9	Sitting	50	Pass
162	Proposed	8	Sitting	8	Sitting	46	Pass
163	Proposed	8	Sitting	9	Sitting	50	Pass
164	Proposed	8	Sitting	9	Sitting	54	Pass
165	Proposed	9	Sitting	10	Sitting	59	Pass
166	Proposed	10	Sitting	11	Standing	65	Pass
167	Proposed	10	Sitting	11	Standing	71	Pass
168	Proposed	7	Sitting	9	Sitting	47	Pass
169	Proposed	9	Sitting	10	Sitting	52	Pass
170	Proposed	7	Sitting	8	Sitting	47	Pass
171	Proposed	10	Sitting	10	Sitting	62	Pass
172	Proposed	10	Sitting	11	Standing	64	Pass
173	Proposed	9	Sitting	10	Sitting	53	Pass
174	Proposed	9	Sitting	9	Sitting	53	Pass
175	Proposed	10	Sitting	11	Standing	64	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
176	Proposed	8	Sitting	8	Sitting	47	Pass
177	Proposed	11	Standing	11	Standing	64	Pass
178	Proposed	11	Standing	12	Standing	68	Pass
179	Proposed	9	Sitting	8	Sitting	52	Pass
180	Proposed	10	Sitting	10	Sitting	60	Pass
181	Proposed	8	Sitting	8	Sitting	51	Pass
182	Proposed	8	Sitting	8	Sitting	53	Pass
183	Proposed	10	Sitting	10	Sitting	61	Pass
184	Proposed	10	Sitting	10	Sitting	63	Pass
185	Proposed	10	Sitting	9	Sitting	63	Pass
186	Proposed	9	Sitting	10	Sitting	61	Pass
187	Proposed	10	Sitting	11	Standing	67	Pass
188	Proposed	12	Standing	12	Standing	63	Pass
189	Proposed	14	Standing	14	Standing	77	Pass
190	Proposed	8	Sitting	9	Sitting	56	Pass
191	Proposed	9	Sitting	11	Standing	67	Pass
192	Proposed	13	Standing	14	Standing	78	Pass
193	Proposed	12	Standing	13	Standing	73	Pass
194	Proposed	13	Standing	13	Standing	76	Pass
195	Proposed	13	Standing	12	Standing	71	Pass
196	Proposed	11	Standing	12	Standing	63	Pass
197	Proposed	14	Standing	13	Standing	81	Pass
198	Proposed	10	Sitting	10	Sitting	55	Pass
199	Proposed	17	Strolling	17	Strolling	87	Pass
200	Proposed	17	Strolling	18	Walking	89	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
201	Proposed	16	Strolling	14	Standing	80	Pass
202	Proposed	17	Strolling	16	Strolling	91	Exceeded

Seasons		Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	0:00 - 23:00 for safety

Configurations	
Proposed	Project with existing surroundings

Comfort Speed (km/h) (20% Seasonal Exceedance)	
≤ 10	Sitting
11 - 14	Standing
15 - 17	Strolling
18 - 20	Walking
> 20	Uncomfortable

Safety Speed (km/h) (> 0.1% Annual Exceedance)	
≤ 90	Pass
> 90	Exceeded