



# NOVA CENTRE



Attachment D

# PEDESTRIAN WIND STUDY



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**Nova Centre**  
Halifax, Nova Scotia

# Final Report

## Pedestrian Wind Study Wind Tunnel Tests

RWDI # 1301472  
May 6, 2014

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## 1. INTRODUCTION

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Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Argyle Developments to consult on the pedestrian wind conditions for the proposed Nova Centre in Halifax. The purpose of the study was to assess the wind environment around the development in terms of pedestrian wind comfort and safety. This objective was achieved through wind tunnel testing of a 1:300 scale model of the proposed development for the following configurations:

- Configuration A: Existing (pre-demolition) - Summer:** Includes the existing buildings, vegetation around the intersection of Argyle and Prince and existing sidewalk features and landscaping on the east side of Argyle Street.
- Configuration B: Existing (pre-demolition) - Winter:** Includes the existing buildings and existing sidewalk features on the east side of Argyle Street.
- Configuration C: Proposed - Summer:** Includes the proposed building with canopies above the entrances to the proposed building along Argyle Street, vegetation around the intersection of Argyle and Prince and existing sidewalk features and landscaping on the east side of Argyle Street.
- Configuration D: Proposed - Winter:** Includes the proposed building with canopies above the entrances to the proposed building along Argyle Street and existing features on the east side of Argyle Street.

The photographs in Figures 1a and 1d show the test model in RWDI's boundary-layer wind tunnel. The proposed building is 180 ft high, consisting of a 5-storey podium and two office and hotel towers. The test model was constructed using the design information and drawings listed in Appendix A. This report summarizes the methodology of wind tunnel studies for pedestrian wind conditions, describes the RWDI pedestrian wind criteria, presents the local wind conditions and their effects on pedestrians and provides conceptual wind control measures, where necessary.

## 2. SUMMARY OF WIND CONDITIONS

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The wind conditions around the proposed Nova Centre are discussed in detail in Section 5 of this report and may be summarized as follows:

- All locations passed the wind criterion used to assess pedestrian wind safety.
- The proposed development provided suitable summer and winter wind comfort conditions.
- There are no recommendations for wind control mitigation as the proposed development did not adversely alter the exiting wind conditions, nor did it create any significant adverse wind activity.



### 3. METHODOLOGY

As shown in Figures 1a and 1d, the wind tunnel model included the proposed development and all relevant surrounding buildings and topography within a 350 m radius of the study site. The boundary-layer wind conditions beyond the modelled area were also simulated in RWDI's wind tunnel. The model was instrumented with 80 wind speed sensors to measure mean and gust wind speeds at a full-scale height of approximately 1.5 m. These measurements were recorded for 36 equally incremented wind directions.

Wind statistics recorded at the Shearwater Airport between 1971 and 2009 were analysed for the Summer (May through October) and Winter (November through April) seasons. Figure 2 graphically depicts the directional distributions of wind frequencies and speeds for the two seasons. Winds are frequent from the south through west southwest, northwest and east directions in the summer. During the winter, the prevailing winds are from the northwest quadrant, in addition to winds from the east, 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 10m) occur more often in the winter (11.2%) than in the summer (2.7%).

Wind statistics from the Shearwater Airport were combined with the wind tunnel data in order to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the RWDI criteria for pedestrian comfort and safety.

### 4. EXPLANATION OF CRITERIA

The RWDI pedestrian wind criteria are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 (References 1 through 6). They have also been widely accepted by municipal authorities as well as by the building design and city planning community.

#### RWDI Pedestrian Wind Criteria

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 and bus stops
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 most activities, and wind mitigation is typically recommended
<b>Notes:</b> (1) Gust Equivalent Mean (GEM) speed = $\max(\text{mean speed, gust speed}/1.85)$ ; and (2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.		



Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.
<b>Note:</b> Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day.		

A few additional comments are provided below to further explain the wind criteria and their applications.

- Both mean and gust speeds can affect pedestrian's comfort and their combined effect is typically quantified by a Gust Equivalent Mean (GEM) speed, with a gust factor of 1.85 (References 1, 5, 7 and 8).
- 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 moderate or cold climate such as that found in Halifax, there are distinct differences in pedestrian outdoor behaviours between these two time periods.
- Nightly hours between the midnight and 5 o'clock in the morning are excluded from the wind analysis for wind comfort since limited usage of outdoor spaces is anticipated.
- A 20% exceedance is used in these criteria to determine the comfort category, which suggests that wind speeds would be comfortable for the corresponding activity at least 80% of the time or four out of five days.
- Only gust winds 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.
- These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate. Comparisons of wind speeds for different building configurations are the most objective way in assessing local pedestrian wind conditions.

## 5. PREDICTED WIND CONDITIONS

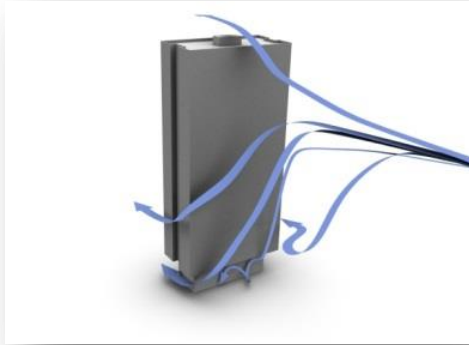
Table 1, located in the Tables section of this report, presents the wind comfort and safety conditions for the four test configurations. These conditions are graphically depicted on a site plan in Figures 3a through 4d.

In our discussion of anticipated wind conditions, reference may be made to the following generalized wind flows. Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level (see Image 1). Such a *Downwashing Flow* is often the main cause for wind accelerations

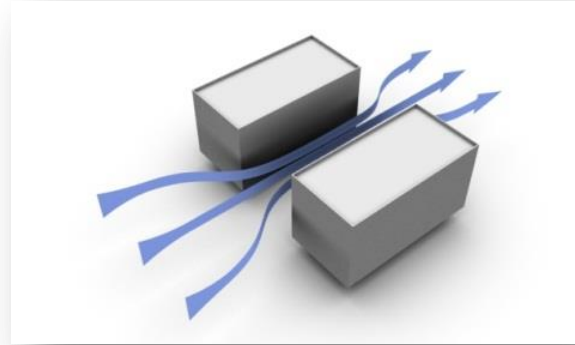


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around large buildings at the pedestrian level. Also, when two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to the *Channelling Effect* (see Image 2). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.



**Image 1 – Downwashing Flow**



**Image 2 – Channelling Effect**

Winds at all of the measurement locations passed the safety criterion for the four test configurations. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area.

## **5.1 Grade Level – On-Site (Locations 1 through 24)**

Wind conditions suitable for walking or strolling are appropriate for sidewalks. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. It is our understanding that primary building entrances around the proposed building are located on the east side of the building along Argyle Street, and are located close to Locations 1 through 7 in Figures 3b and 4b.

### **5.1.1 Existing (Pre-Demolition)**

In the summer, the comfort conditions on the existing site are expected to be comfortable for sitting and standing, as shown in Figure 3a.

In the winter, the comfort conditions on the existing site are expected to be comfortable for strolling or better, as shown in Figure 4a.

### **5.1.2 Proposed**

In the summer, the comfort conditions on-site around the proposed development are expected to be comfortable for standing and sitting, as shown in Figure 3b. Based on the comfort conditions of Locations 1 through 7 in Figure 3b, the main entrances along Argyle Street are expected to be comfortable for sitting, thus meeting the suggested comfort criteria for these areas.



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In the winter, the strong and more frequent prevailing winter winds are expected to result in conditions that are comfortable for strolling and standing. Additionally, one area is expected to be comfortable for walking (Locations 8), as show in Figure 4b. These conditions are considered comfortable for sidewalks.

Four of the seven Locations along Argyle Street are expected to be comfortable for strolling in the winter (Locations 1, 2, 6 and 7). It is expected that the existing canopies above the main entrances along the proposed development will help minimize the effects of downwashing winds, while the landscaping will help shelter the entrances from the channeled winds along Argyle Street. These combined benefits are expected to result in conditions that are comfortable for standing or better.

## **5.2 Grade Level – Off-Site (Locations 25 through 80)**

Wind conditions suitable for walking or strolling are appropriate for sidewalks. Lower wind speeds conducive to sitting are preferred at designated outdoor patio areas where people may be dining.

### **5.2.1 Existing (Pre- Demolition)**

In the summer, wind conditions are expected to be comfortable for sitting and standing off-site, with the exception of Location 64 that is expected to be comfortable for strolling (see Figure 3a).

Special consideration was given to the sidewalk on the east side of Argyle Street, as it is populated with outdoor dining areas that would require sitting conditions throughout the summer. It is expected that in the existing configuration the summer comfort conditions on this sidewalk are comfortable for sitting (see Figure 3a).

In the winter, the stronger and more frequent prevailing winds result in conditions off-site to be comfortable for walking or better (see Figure 4a). These conditions are considered appropriate for sidewalks. Because outdoor dining is not expected in the winter season, the standing conditions along Argyle Street are not a concern.

### **5.2.2 Proposed**

In the summer, the wind conditions around the proposed site are expected to be comfortable for standing and sitting, as shown by Figure 3b. The east side of Argyle Street is expected to be comfortable for sitting, which is considered ideal for outdoor patios during the summer.

In the winter, the wind conditions around the proposed site are expected to be comfortable for strolling or better, with the exception of Location 60 that is expected to be comfortable for walking in the winter (see Figure 4b). These conditions are considered comfortable for sidewalks.

The sidewalk on the east side of Argyle is expected to be comfortable for sitting and standing in the winter. The standing conditions in this area are not considered to be problematic because outdoor dining is not expected in during the winter.





## 6. APPLICABILITY

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The wind conditions presented in this report pertain to the model of the proposed Nova Centre development constructed using the architectural design drawings listed in Appendix A. Should there be any design changes that deviate from this list of drawings, the wind conditions 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.

## 7. REFERENCES

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- 1) ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.
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# TABLES



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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
1	Existing - Summer	11	Standing	73	Pass
	Existing - Winter	16	Strolling	73	Pass
	Proposed - Summer	11	Standing	62	Pass
	Proposed - Winter	15	Strolling	68	Pass
2	Existing - Summer	9	Sitting	64	Pass
	Existing - Winter	11	Standing	67	Pass
	Proposed - Summer	10	Sitting	58	Pass
	Proposed - Winter	15	Strolling	70	Pass
3	Existing - Summer	7	Sitting	48	Pass
	Existing - Winter	11	Standing	59	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	14	Standing	61	Pass
4	Existing - Summer	8	Sitting	48	Pass
	Existing - Winter	12	Standing	56	Pass
	Proposed - Summer	10	Sitting	58	Pass
	Proposed - Winter	14	Standing	60	Pass
5	Existing - Summer	8	Sitting	48	Pass
	Existing - Winter	12	Standing	56	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	14	Standing	60	Pass
6	Existing - Summer	7	Sitting	41	Pass
	Existing - Winter	11	Standing	50	Pass
	Proposed - Summer	10	Sitting	60	Pass
	Proposed - Winter	15	Strolling	65	Pass
7	Existing - Summer	7	Sitting	45	Pass
	Existing - Winter	11	Standing	50	Pass
	Proposed - Summer	10	Sitting	66	Pass
	Proposed - Winter	17	Strolling	75	Pass
8	Existing - Summer	9	Sitting	54	Pass
	Existing - Winter	12	Standing	56	Pass
	Proposed - Summer	12	Standing	67	Pass
	Proposed - Winter	18	Walking	71	Pass
9	Existing - Summer	10	Sitting	57	Pass
	Existing - Winter	13	Standing	59	Pass
	Proposed - Summer	11	Standing	63	Pass
	Proposed - Winter	14	Standing	61	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14        Standing  
 15 to 17        Strolling  
 18 to 20        Walking  
 > 20 km/h      Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table



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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
10	Existing - Summer	10	Sitting	53	Pass
	Existing - Winter	13	Standing	55	Pass
	Proposed - Summer	11	Standing	59	Pass
	Proposed - Winter	14	Standing	59	Pass
11	Existing - Summer	10	Sitting	55	Pass
	Existing - Winter	12	Standing	55	Pass
	Proposed - Summer	12	Standing	61	Pass
	Proposed - Winter	15	Strolling	61	Pass
12	Existing - Summer	11	Standing	60	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	11	Standing	58	Pass
	Proposed - Winter	14	Standing	58	Pass
13	Existing - Summer	12	Standing	65	Pass
	Existing - Winter	15	Strolling	65	Pass
	Proposed - Summer	11	Standing	59	Pass
	Proposed - Winter	14	Standing	59	Pass
14	Existing - Summer	11	Standing	61	Pass
	Existing - Winter	15	Strolling	60	Pass
	Proposed - Summer	13	Standing	74	Pass
	Proposed - Winter	17	Strolling	76	Pass
15	Existing - Summer	10	Sitting	58	Pass
	Existing - Winter	15	Strolling	58	Pass
	Proposed - Summer	10	Sitting	66	Pass
	Proposed - Winter	14	Standing	66	Pass
16	Existing - Summer	10	Sitting	61	Pass
	Existing - Winter	15	Strolling	61	Pass
	Proposed - Summer	11	Standing	61	Pass
	Proposed - Winter	14	Standing	62	Pass
17	Existing - Summer	11	Standing	57	Pass
	Existing - Winter	14	Standing	58	Pass
	Proposed - Summer	11	Standing	64	Pass
	Proposed - Winter	16	Strolling	64	Pass
18	Existing - Summer	10	Sitting	56	Pass
	Existing - Winter	14	Standing	56	Pass
	Proposed - Summer	11	Standing	65	Pass
	Proposed - Winter	16	Strolling	67	Pass

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 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14        Standing  
 15 to 17        Strolling  
 18 to 20        Walking  
 > 20 km/h      Uncomfortable

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 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
19	Existing - Summer	11	Standing	57	Pass
	Existing - Winter	14	Standing	58	Pass
	Proposed - Summer	11	Standing	62	Pass
	Proposed - Winter	15	Strolling	62	Pass
20	Existing - Summer	11	Standing	58	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	11	Standing	61	Pass
	Proposed - Winter	15	Strolling	62	Pass
21	Existing - Summer	9	Sitting	50	Pass
	Existing - Winter	12	Standing	51	Pass
	Proposed - Summer	8	Sitting	52	Pass
	Proposed - Winter	11	Standing	52	Pass
22	Existing - Summer	10	Sitting	56	Pass
	Existing - Winter	13	Standing	57	Pass
	Proposed - Summer	9	Sitting	54	Pass
	Proposed - Winter	11	Standing	53	Pass
23	Existing - Summer	10	Sitting	72	Pass
	Existing - Winter	13	Standing	71	Pass
	Proposed - Summer	9	Sitting	56	Pass
	Proposed - Winter	12	Standing	55	Pass
24	Existing - Summer	11	Standing	74	Pass
	Existing - Winter	14	Standing	73	Pass
	Proposed - Summer	10	Sitting	69	Pass
	Proposed - Winter	13	Standing	69	Pass
25	Existing - Summer	9	Sitting	56	Pass
	Existing - Winter	13	Standing	56	Pass
	Proposed - Summer	8	Sitting	59	Pass
	Proposed - Winter	12	Standing	60	Pass
26	Existing - Summer	11	Standing	67	Pass
	Existing - Winter	16	Strolling	69	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	13	Standing	58	Pass
27	Existing - Summer	8	Sitting	49	Pass
	Existing - Winter	12	Standing	49	Pass
	Proposed - Summer	10	Sitting	52	Pass
	Proposed - Winter	12	Standing	52	Pass

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≤ 90 km/h      Pass  
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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
28	Existing - Summer	10	Sitting	54	Pass
	Existing - Winter	13	Standing	54	Pass
	Proposed - Summer	12	Standing	60	Pass
	Proposed - Winter	14	Standing	59	Pass
29	Existing - Summer	8	Sitting	51	Pass
	Existing - Winter	11	Standing	50	Pass
	Proposed - Summer	10	Sitting	53	Pass
	Proposed - Winter	11	Standing	52	Pass
30	Existing - Summer	10	Sitting	58	Pass
	Existing - Winter	14	Standing	59	Pass
	Proposed - Summer	10	Sitting	56	Pass
	Proposed - Winter	13	Standing	57	Pass
31	Existing - Summer	6	Sitting	34	Pass
	Existing - Winter	8	Sitting	36	Pass
	Proposed - Summer	8	Sitting	47	Pass
	Proposed - Winter	9	Sitting	47	Pass
32	Existing - Summer	5	Sitting	30	Pass
	Existing - Winter	8	Sitting	31	Pass
	Proposed - Summer	6	Sitting	37	Pass
	Proposed - Winter	7	Sitting	33	Pass
33	Existing - Summer	5	Sitting	29	Pass
	Existing - Winter	8	Sitting	32	Pass
	Proposed - Summer	6	Sitting	35	Pass
	Proposed - Winter	9	Sitting	38	Pass
34	Existing - Summer	8	Sitting	47	Pass
	Existing - Winter	12	Standing	51	Pass
	Proposed - Summer	8	Sitting	53	Pass
	Proposed - Winter	13	Standing	53	Pass
35	Existing - Summer	9	Sitting	50	Pass
	Existing - Winter	12	Standing	52	Pass
	Proposed - Summer	9	Sitting	56	Pass
	Proposed - Winter	13	Standing	57	Pass
36	Existing - Summer	9	Sitting	52	Pass
	Existing - Winter	13	Standing	55	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	14	Standing	60	Pass

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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
37	Existing - Summer	8	Sitting	51	Pass
	Existing - Winter	12	Standing	51	Pass
	Proposed - Summer	8	Sitting	49	Pass
	Proposed - Winter	12	Standing	51	Pass
38	Existing - Summer	9	Sitting	50	Pass
	Existing - Winter	13	Standing	51	Pass
	Proposed - Summer	11	Standing	54	Pass
	Proposed - Winter	15	Strolling	57	Pass
39	Existing - Summer	8	Sitting	54	Pass
	Existing - Winter	12	Standing	55	Pass
	Proposed - Summer	10	Sitting	56	Pass
	Proposed - Winter	14	Standing	58	Pass
40	Existing - Summer	11	Standing	65	Pass
	Existing - Winter	15	Strolling	65	Pass
	Proposed - Summer	9	Sitting	58	Pass
	Proposed - Winter	14	Standing	60	Pass
41	Existing - Summer	11	Standing	73	Pass
	Existing - Winter	16	Strolling	71	Pass
	Proposed - Summer	10	Sitting	64	Pass
	Proposed - Winter	16	Strolling	73	Pass
42	Existing - Summer	10	Sitting	59	Pass
	Existing - Winter	13	Standing	60	Pass
	Proposed - Summer	9	Sitting	59	Pass
	Proposed - Winter	11	Standing	60	Pass
43	Existing - Summer	9	Sitting	60	Pass
	Existing - Winter	13	Standing	63	Pass
	Proposed - Summer	10	Sitting	65	Pass
	Proposed - Winter	15	Strolling	65	Pass
44	Existing - Summer	9	Sitting	49	Pass
	Existing - Winter	12	Standing	50	Pass
	Proposed - Summer	11	Standing	64	Pass
	Proposed - Winter	15	Strolling	66	Pass
45	Existing - Summer	10	Sitting	59	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	11	Standing	61	Pass
	Proposed - Winter	14	Standing	60	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14      Standing  
 15 to 17      Strolling  
 18 to 20      Walking  
 > 20 km/h    Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table



CONSULTING ENGINEERS  
 & SCIENTISTS

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
46	Existing - Summer	10	Sitting	57	Pass
	Existing - Winter	13	Standing	57	Pass
	Proposed - Summer	10	Sitting	58	Pass
	Proposed - Winter	13	Standing	59	Pass
47	Existing - Summer	10	Sitting	63	Pass
	Existing - Winter	13	Standing	64	Pass
	Proposed - Summer	9	Sitting	66	Pass
	Proposed - Winter	12	Standing	67	Pass
48	Existing - Summer	11	Standing	63	Pass
	Existing - Winter	14	Standing	63	Pass
	Proposed - Summer	12	Standing	66	Pass
	Proposed - Winter	15	Strolling	66	Pass
49	Existing - Summer	9	Sitting	56	Pass
	Existing - Winter	11	Standing	57	Pass
	Proposed - Summer	12	Standing	63	Pass
	Proposed - Winter	15	Strolling	62	Pass
50	Existing - Summer	11	Standing	60	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	10	Sitting	59	Pass
	Proposed - Winter	14	Standing	58	Pass
51	Existing - Summer	9	Sitting	51	Pass
	Existing - Winter	13	Standing	52	Pass
	Proposed - Summer	9	Sitting	50	Pass
	Proposed - Winter	13	Standing	51	Pass
52	Existing - Summer	12	Standing	67	Pass
	Existing - Winter	15	Strolling	67	Pass
	Proposed - Summer	10	Sitting	55	Pass
	Proposed - Winter	13	Standing	55	Pass
53	Existing - Summer	11	Standing	58	Pass
	Existing - Winter	14	Standing	57	Pass
	Proposed - Summer	10	Sitting	56	Pass
	Proposed - Winter	14	Standing	56	Pass
54	Existing - Summer	11	Standing	57	Pass
	Existing - Winter	14	Standing	57	Pass
	Proposed - Summer	10	Sitting	51	Pass
	Proposed - Winter	12	Standing	52	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14      Standing  
 15 to 17      Strolling  
 18 to 20      Walking  
 > 20 km/h    Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table





CONSULTING ENGINEERS  
 & SCIENTISTS

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
55	Existing - Summer	12	Standing	64	Pass
	Existing - Winter	16	Strolling	65	Pass
	Proposed - Summer	10	Sitting	56	Pass
	Proposed - Winter	14	Standing	56	Pass
56	Existing - Summer	11	Standing	61	Pass
	Existing - Winter	15	Strolling	61	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	14	Standing	58	Pass
57	Existing - Summer	13	Standing	66	Pass
	Existing - Winter	16	Strolling	67	Pass
	Proposed - Summer	12	Standing	62	Pass
	Proposed - Winter	15	Strolling	62	Pass
58	Existing - Summer	11	Standing	63	Pass
	Existing - Winter	15	Strolling	64	Pass
	Proposed - Summer	10	Sitting	54	Pass
	Proposed - Winter	13	Standing	54	Pass
59	Existing - Summer	11	Standing	59	Pass
	Existing - Winter	15	Strolling	58	Pass
	Proposed - Summer	12	Standing	69	Pass
	Proposed - Winter	16	Strolling	69	Pass
60	Existing - Summer	12	Standing	68	Pass
	Existing - Winter	16	Strolling	67	Pass
	Proposed - Summer	13	Standing	73	Pass
	Proposed - Winter	18	Walking	74	Pass
61	Existing - Summer	10	Sitting	59	Pass
	Existing - Winter	14	Standing	61	Pass
	Proposed - Summer	11	Standing	70	Pass
	Proposed - Winter	16	Strolling	71	Pass
62	Existing - Summer	10	Sitting	58	Pass
	Existing - Winter	14	Standing	61	Pass
	Proposed - Summer	12	Standing	64	Pass
	Proposed - Winter	16	Strolling	65	Pass
63	Existing - Summer	13	Standing	68	Pass
	Existing - Winter	16	Strolling	69	Pass
	Proposed - Summer	12	Standing	66	Pass
	Proposed - Winter	16	Strolling	67	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14      Standing  
 15 to 17      Strolling  
 18 to 20      Walking  
 > 20 km/h    Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table



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**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
64	Existing - Summer	15	Strolling	74	Pass
	Existing - Winter	19	Walking	75	Pass
	Proposed - Summer	13	Standing	68	Pass
	Proposed - Winter	17	Strolling	69	Pass
65	Existing - Summer	12	Standing	67	Pass
	Existing - Winter	16	Strolling	67	Pass
	Proposed - Summer	12	Standing	65	Pass
	Proposed - Winter	15	Strolling	65	Pass
66	Existing - Summer	10	Sitting	58	Pass
	Existing - Winter	14	Standing	58	Pass
	Proposed - Summer	10	Sitting	56	Pass
	Proposed - Winter	13	Standing	55	Pass
67	Existing - Summer	11	Standing	59	Pass
	Existing - Winter	14	Standing	57	Pass
	Proposed - Summer	11	Standing	61	Pass
	Proposed - Winter	14	Standing	60	Pass
68	Existing - Summer	13	Standing	79	Pass
	Existing - Winter	18	Walking	82	Pass
	Proposed - Summer	11	Standing	65	Pass
	Proposed - Winter	15	Strolling	65	Pass
69	Existing - Summer	11	Standing	66	Pass
	Existing - Winter	16	Strolling	68	Pass
	Proposed - Summer	12	Standing	70	Pass
	Proposed - Winter	17	Strolling	71	Pass
70	Existing - Summer	10	Sitting	60	Pass
	Existing - Winter	14	Standing	63	Pass
	Proposed - Summer	9	Sitting	58	Pass
	Proposed - Winter	13	Standing	58	Pass
71	Existing - Summer	9	Sitting	61	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	9	Sitting	59	Pass
	Proposed - Winter	14	Standing	60	Pass
72	Existing - Summer	11	Standing	66	Pass
	Existing - Winter	16	Strolling	70	Pass
	Proposed - Summer	10	Sitting	57	Pass
	Proposed - Winter	14	Standing	58	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14      Standing  
 15 to 17      Strolling  
 18 to 20      Walking  
 > 20 km/h    Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table



CONSULTING ENGINEERS  
& SCIENTISTS

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
73	Existing - Summer	8	Sitting	51	Pass
	Existing - Winter	12	Standing	53	Pass
	Proposed - Summer	10	Sitting	63	Pass
	Proposed - Winter	14	Standing	63	Pass
74	Existing - Summer	11	Standing	63	Pass
	Existing - Winter	15	Strolling	65	Pass
	Proposed - Summer	10	Sitting	63	Pass
	Proposed - Winter	15	Strolling	64	Pass
75	Existing - Summer	10	Sitting	59	Pass
	Existing - Winter	14	Standing	60	Pass
	Proposed - Summer	9	Sitting	59	Pass
	Proposed - Winter	12	Standing	59	Pass
76	Existing - Summer	10	Sitting	57	Pass
	Existing - Winter	14	Standing	59	Pass
	Proposed - Summer	9	Sitting	50	Pass
	Proposed - Winter	11	Standing	49	Pass
77	Existing - Summer	11	Standing	57	Pass
	Existing - Winter	14	Standing	58	Pass
	Proposed - Summer	10	Sitting	67	Pass
	Proposed - Winter	14	Standing	71	Pass
78	Existing - Summer	8	Sitting	50	Pass
	Existing - Winter	12	Standing	50	Pass
	Proposed - Summer	10	Sitting	66	Pass
	Proposed - Winter	14	Standing	73	Pass
79	Existing - Summer	12	Standing	72	Pass
	Existing - Winter	18	Walking	72	Pass
	Proposed - Summer	11	Standing	66	Pass
	Proposed - Winter	15	Strolling	68	Pass
80	Existing - Summer	9	Sitting	57	Pass
	Existing - Winter	13	Standing	57	Pass
	Proposed - Summer	8	Sitting	61	Pass
	Proposed - Winter	11	Standing	62	Pass

**Seasons**  
 Summer = May to October  
 Winter = November to April

**Hours**  
 6:00 to 23:00 for Comfort  
 0:00 to 23:00 for Safety

**Wind Comfort Category**  
 (20% Seasonal Exceedance)

≤ 10 km/h      Sitting  
 11 to 14      Standing  
 15 to 17      Strolling  
 18 to 20      Walking  
 > 20 km/h    Uncomfortable

**Wind Safety Category**  
 (0.1% Annual Exceedance)

≤ 90 km/h      Pass  
 > 90 km/h      Exceeded

**Configurations**  
 See page 10 of this Table

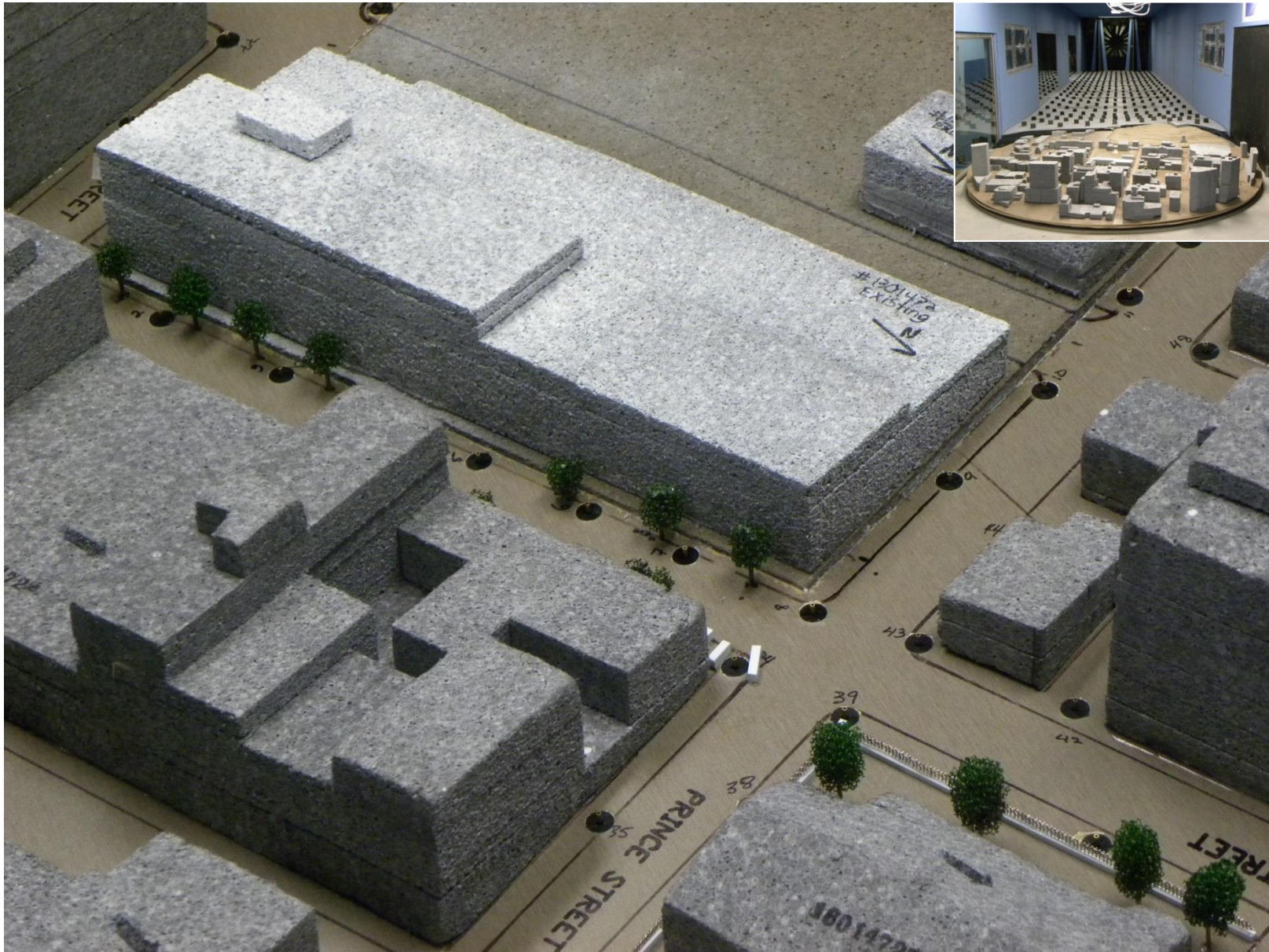


CONSULTING ENGINEERS  
 & SCIENTISTS

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort (20% Exceedance)		Wind Safety (0.1% Exceedance)	
		Speed (km/h)	Rating	Speed (km/h)	Rating
<p><b>Configurations</b></p> <p><u>Existing – Summer:</u> Includes the existing (pre –demolition) buildings, vegetation around the intersection of Argyle and Prince and existing features on the east side of Argyle Street.</p> <p><u>Existing – Winter:</u> Includes the existing (pre-demolition) buildings and existing features on the east side of Argyle Street.</p> <p><u>Proposed – Summer:</u> Includes the proposed building with canopies above the entrances to the proposed building along Argyle Street, vegetation around the intersection of Argyle and Prince and existing features on the east side of Argyle Street.</p> <p><u>Proposed – Winter:</u> Includes the proposed building with canopies above the entrances to the proposed building along Argyle Street and existing features on the east side of Argyle Street.</p>					
<b>Seasons</b>	<b>Hours</b>	<b>Wind Comfort Category</b> (20% Seasonal Exceedance)		<b>Wind Safety Category</b> (0.1% Annual Exceedance)	
Summer = May to October Winter = November to April	6:00 to 23:00 for Comfort 0:00 to 23:00 for Safety	≤ 10 km/h	Sitting	≤ 90 km/h	Pass
		11 to 14	Standing	> 90 km/h	Exceeded
		15 to 17	Strolling		
		18 to 20	Walking		
		> 20 km/h	Uncomfortable		
<b>Configurations</b>	See page 10 of this Table				

# FIGURES



**Wind Tunnel Study Model**  
**Existing Configuration – Summer**

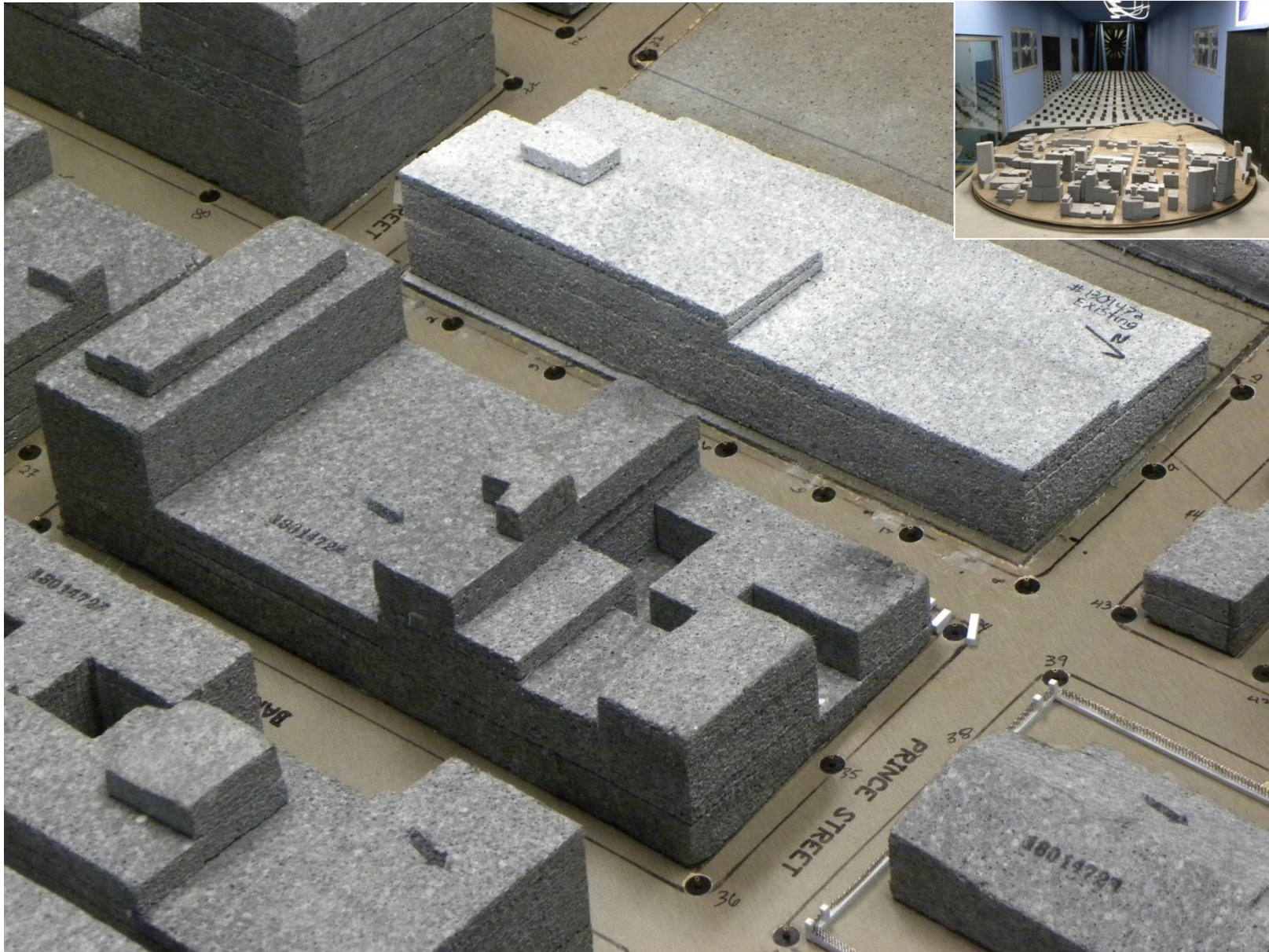
Nova Centre – Halifax, Nova Scotia

Figure No. 1a

Project #1301472

Date: April 25, 2014





**Wind Tunnel Study Model  
Existing Configuration – Winter**

Nova Centre – Halifax, Nova Scotia

Figure No. 1b

Date: April 25, 2014



Project #1301472



**Wind Tunnel Study Model  
Proposed Configuration – Summer**

Nova Centre – Halifax, Nova Scotia

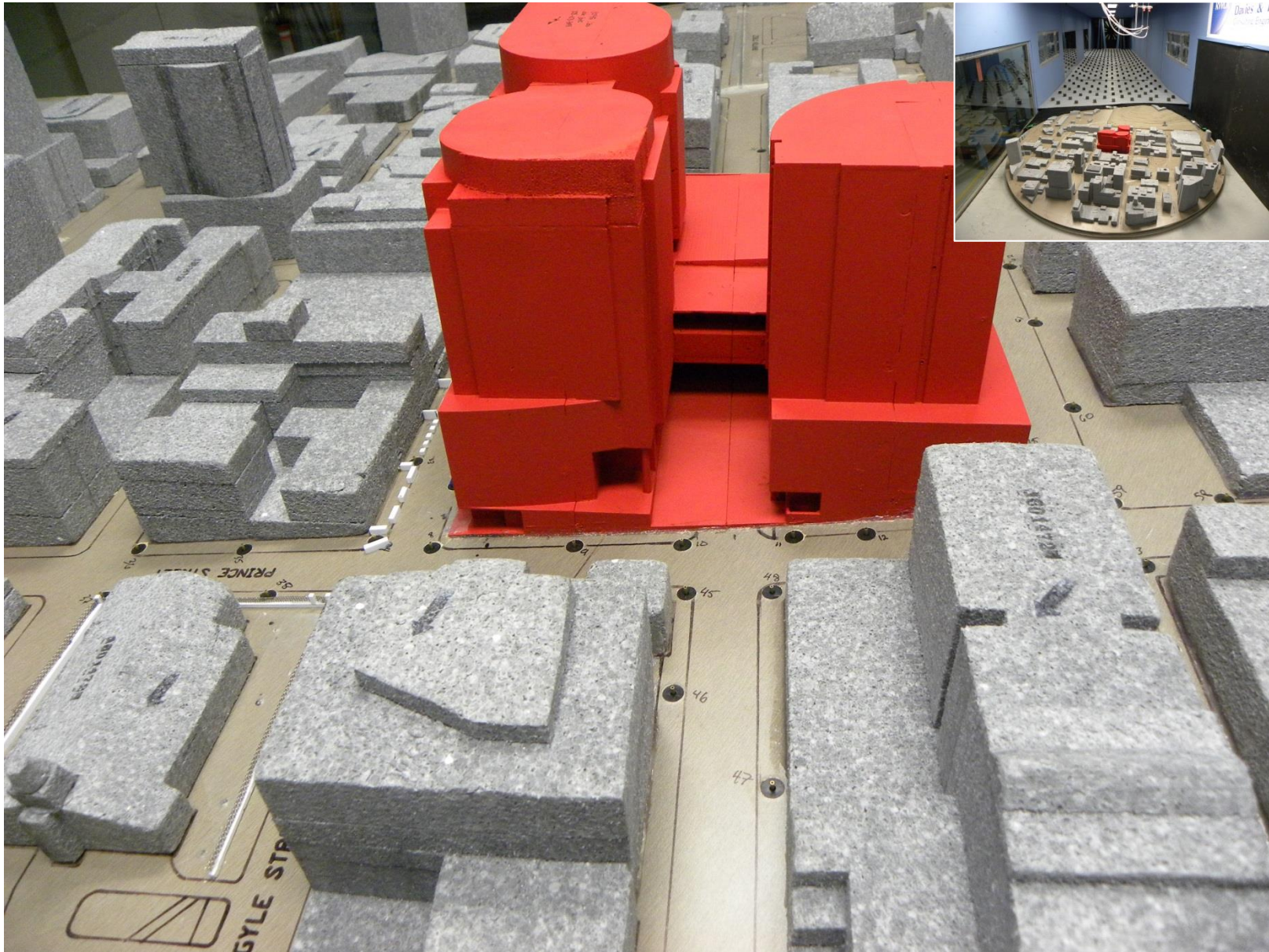
Figure No. 1c

Date: April 25, 2014



Project #1301472





**Wind Tunnel Study Model  
Proposed Configuration – Winter**

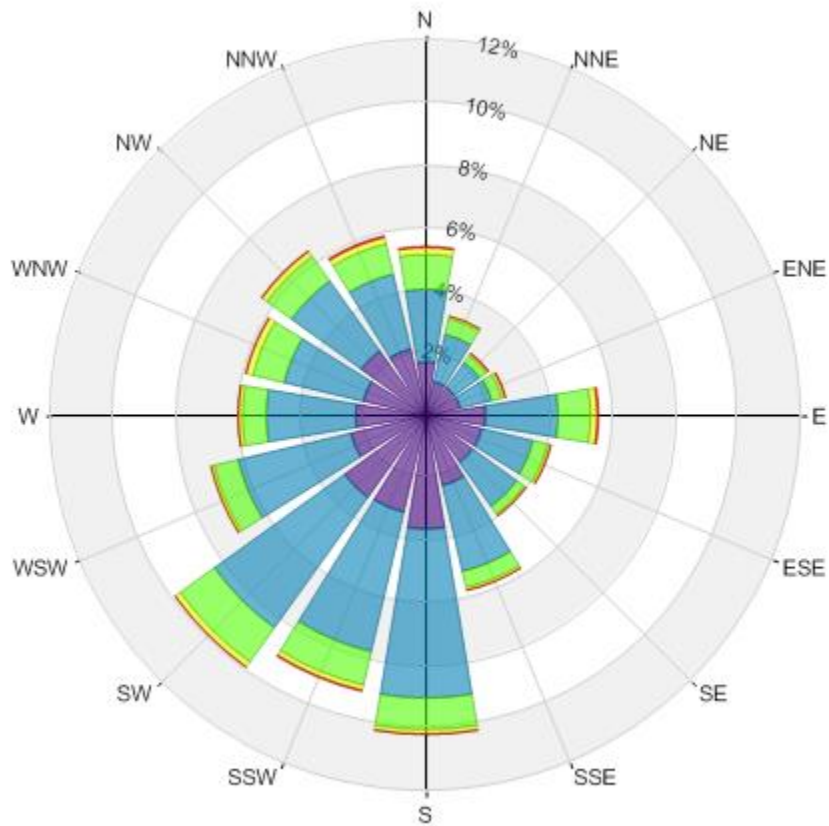
Nova Centre – Halifax, Nova Scotia

Figure No. 1d

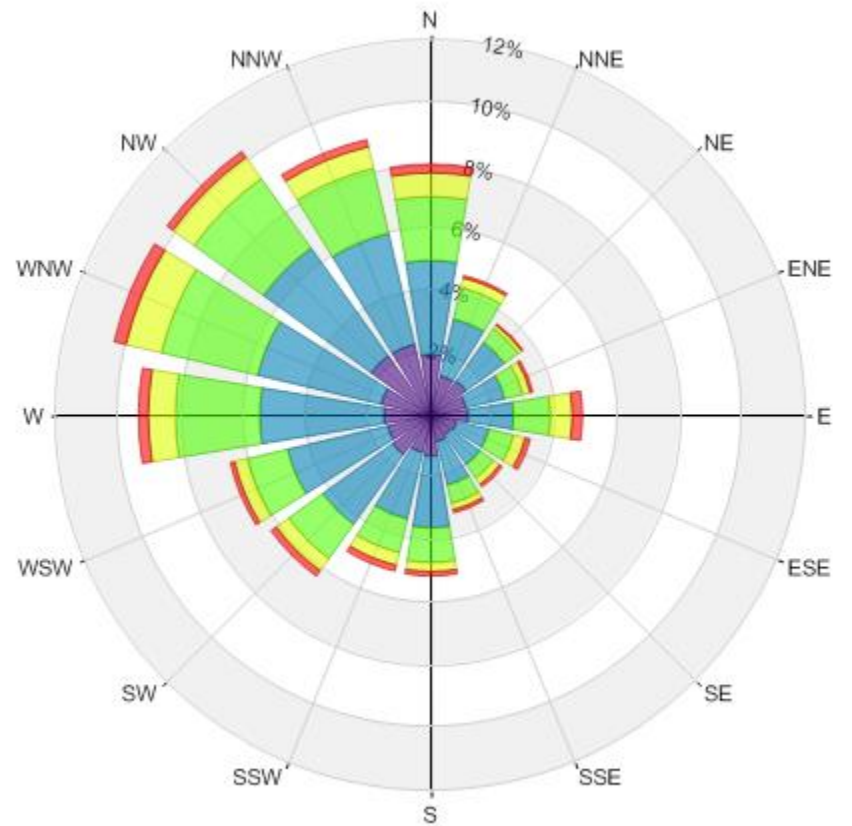
Project #1301472

Date: April 25, 2014





Summer  
(May - October)



Winter  
(November - April)

Wind Speed (km/h)	Probability (%)	
	Summer	Winter
Calm	6.4	4.0
1-10	34.5	22.7
11-20	43.9	39.2
21-30	12.6	23.0
31-40	2.3	8.2
>40	0.4	3.0

**Directional Distribution (%) of Winds (Blowing From)  
Shearwater Airport (1971 - 2009)**

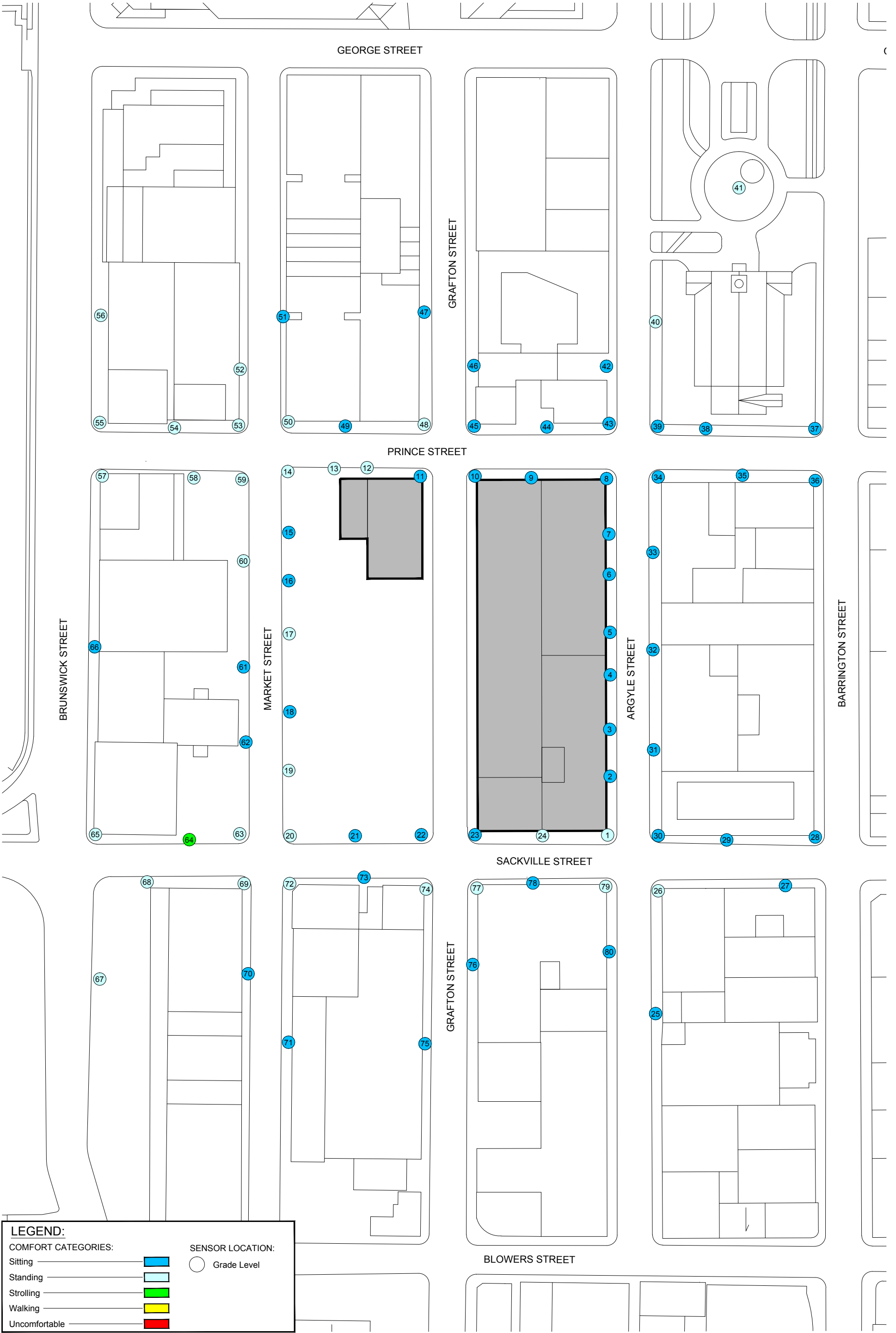
Nova Centre – Halifax, Nova Scotia

Figure No. 2

Project #1301472

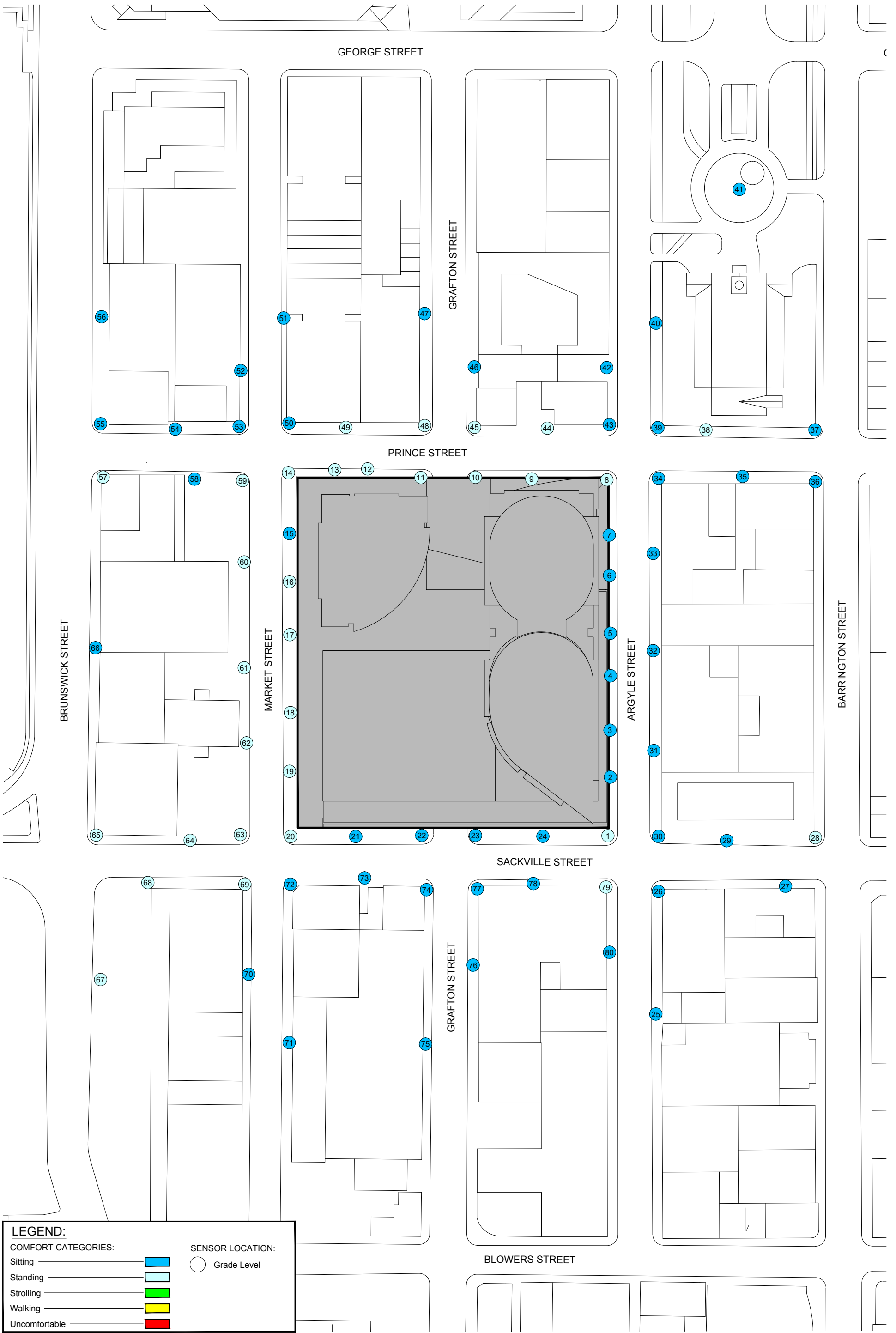
Date: April 25, 2014





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





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



Drawn by: SMR | Figure: 3b  
 Approx. Scale: 1:1000  
 Date Revised: April 14, 2014





**LEGEND:**

**COMFORT CATEGORIES:**

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

**SENSOR LOCATION:**

- Grade Level

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

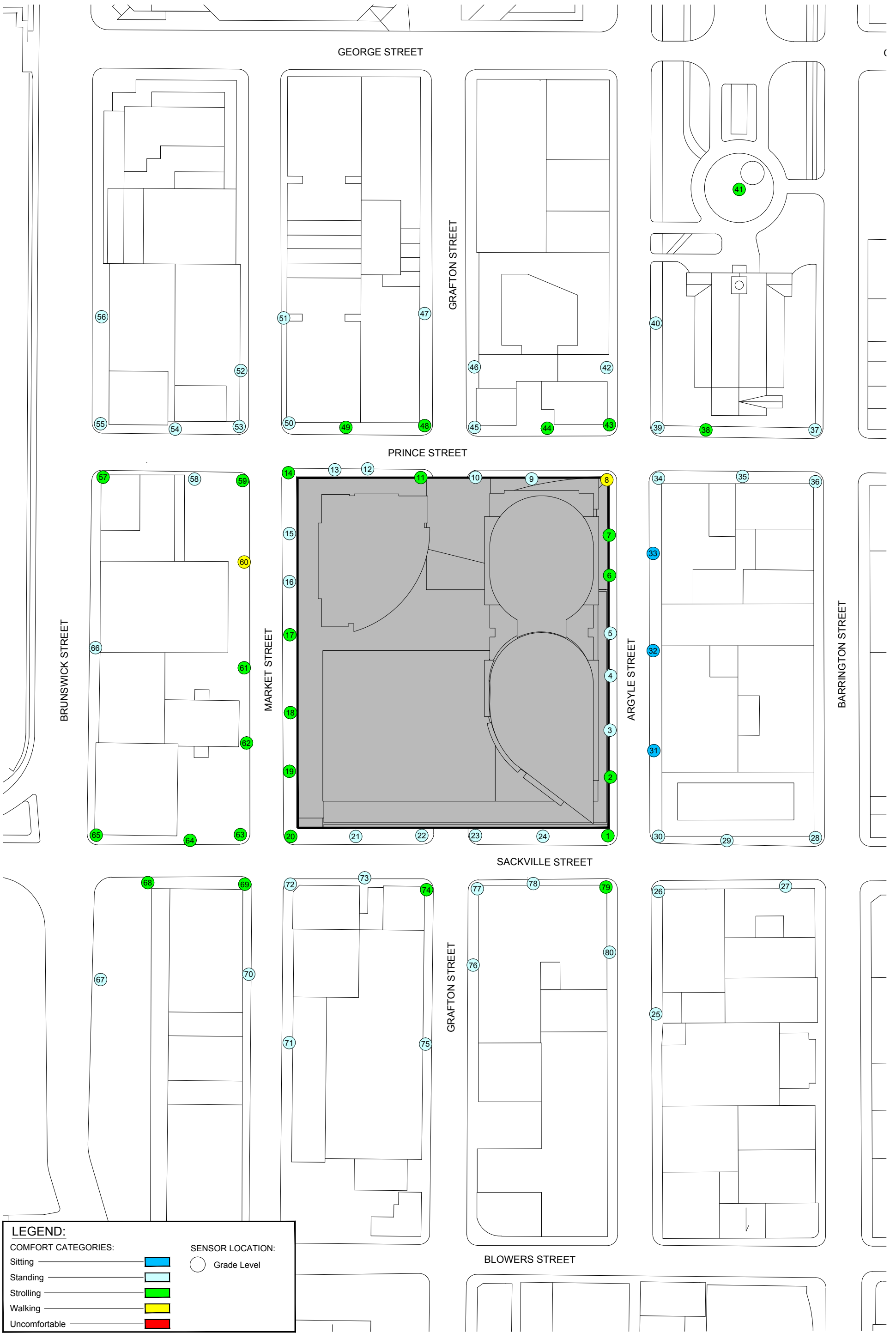
Nova Centre - Halifax, Nova Scotia



Drawn by: SMR | Figure: 4a  
 Approx. Scale: 1:1000  
 Date Revised: April 14, 2014



Project #1301472



**LEGEND:**

**COMFORT CATEGORIES:**

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

**SENSOR LOCATION:**

- Grade Level

**Pedestrian Wind Safety Conditions - High Canopy**  
 Winter (November to April, 6:00 to 23:00)



Drawn by: SMR | Figure: **4b**  
 Approx. Scale: 1:1000  
 Date Revised: April 14, 2014



# APPENDIX A



CONSULTING ENGINEERS  
& SCIENTISTS

Nova Centre – Halifax, Nova Scotia  
Pedestrian Wind Consultation  
RWDI #1301472  
April 25, 2014

Page B1 of 1

## **APPENDIX A: DRAWING LIST FOR MODEL CONSTRUCTION**

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The drawings and information listed below were received from IBI Group Architects and were used to construct the scale model of the proposed Nova Centre. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design area made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

<b>File Name</b>	<b>File Type</b>	<b>Date Received (dd/mm/yyyy)</b>
A-Nova Centre-Central-33143-13-06-25	.rvt	26/06/2013
A-Nova Centre-Central-EXTERIOR-2014-04-04	.rvt	4/8/2014