APPENDIX H
Pedestrian Wind Safety Study

FINAL REPORT

PEDESTRIAN WIND SAFETY STUDY
THE NEW DOMINO
BROOKLYN, NEW YORK

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1. EXECUTIVE SUMMARY

Issue: The objective of this assessment was to evaluate the anticipated pedestrian wind conditions, specifically wind safety, on and around the proposed New Domino development.

Approach: A quantitative study of the pedestrian wind conditions was conducted by RWDI through testing a scale model of the proposed building massing with landscaping in a boundary-layer wind tunnel. The wind tunnel test data were combined with the regional wind climate to predict wind conditions around the site relative to the pedestrian wind safety criterion.

Existing Configuration: All locations met the wind safety criterion in the summer. The existing buildings on the New Domino site are exposed to strong prevailing winds approaching from northwesterly sectors, resulting in the wind safety criterion being exceeded during the winter at the project site at four locations on the westerly extension of South 3rd St. between Kent Avenue and the East River. During the winter, the wind safety criterion was exceeded off site at the northeast corner of the South 2nd St. and Kent Avenue intersection.

Full-Build with Landscaping Configuration: All locations met the wind safety criterion in the summer. In the winter, the wind safety criterion was exceeded at: one location at the eastern limit of Grand Ferry Park; one location along the walkway between Site A and Site B; one location on the north side of the Refinery; and, one location on the west side of Site C. Additional discussion of these areas is provided in Section 5 of this report. The New Domino development design with landscaping minimizes the number of locations exceeding the wind safety criteria. Overall, the wind safety conditions are comparable to, and within the range of similar developments along the west side of Manhattan due to the same exposure to the prevailing northwest winds, with one area exceeding the norm.

Mitigation: Mitigation strategies were developed over the course of conducting several sets of investigative wind tunnel tests. Various combinations of landscaping, wind screens, and trellises were assessed as part of an iterative process with the design team. Of the options tested, the landscaping design (dated November 10, 2009) tested and presented in this report proved the most effective in reducing and minimizing the number of areas where the wind safety criterion was exceeded.

A revised landscaping plan (dated November 30, 2009) was issued to RWDI on December 16, 2009. As indicated in Section 5, the updated landscaping plan is not materially different from the plan as tested and the results reported here are applicable to the latest landscaping plan.

2. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Herrick, Feinstein LLP to conduct a Pedestrian Wind Safety Study for The New Domino development in Brooklyn, New York. The purpose of the study was to assess the wind environment around the development in terms of pedestrian safety. This objective was achieved through wind tunnel testing of a 1:400 scale model of the proposed development for the following two building configurations:

A - Existing: existing on-site buildings with existing surrounding; and,

B - Full-Build with Landscaping: proposed New Domino development and landscaping with existing surroundings.

The photographs in Figures 1a and 1b show the test model in RWDI's boundary-layer wind tunnel. 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 wind safety criterion associated with wind force used in the current study, and presents the test results and conceptual wind control measures, where suggested.

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.

3. SITE INFORMATION

The proposed development is bordered by S 5th Street and Grand Street to the south and north, respectively, and by Kent Avenue to the east, and is located along the east shore of the East River. The proposed development consists of multiple mid and high-rise buildings as illustrated in Figures 3a through 4b. The surroundings further to the east are generally low-rise, with mid- to high-rise towers across the river.

4. APPROACH

4.1 METHODOLOGY

As shown in Figures 1a and 1b, the wind tunnel model included the proposed development and all relevant surrounding buildings and topography within a 1600 ft radius of the study site. The mean speed profile and turbulence of the natural wind approaching the modelled area were also simulated in RWDI's boundary-layer wind tunnel. The model was instrumented with 136 wind speed sensors to measure mean and gust wind speeds at a full-scale height of approximately 5 ft. These measurements were recorded for 36 equally incremented wind directions.

4.2 METEOROLOGICAL DATA

Three long-term sources of hourly wind data for the New York City area were obtained from the National Weather Service for analysis and consideration in this assessment. These sites include wind recording stations at the John F. Kennedy, Newark and LaGuardia International Airports between 1948 and 2005. The position of the study site relative to these three airports is shown in Figure 2a. Newark Airport is located approximately 11 miles to the west-southwest of the New Domino site, La Guardia Airport is approximately 7 miles to the northeast and JFK Airport is approximately 11 miles to the southeast. Wind roses for strong winds (exceeding 20 mph at the airport anemometer) that occur on an annual basis for each of the three airports are shown individually and as a combined average in Figure 2b. Strong winds are emphasized in view of this assessment's focus on pedestrian wind safety, and it is the stronger wind speeds that have the greatest potential to cause the wind safety criterion to be exceeded at grade-level.

The bottom left wind rose (Newark) indicates that strong winds from all directions occur for 7.6% of the time annually. Wind from the northwest occurs nearly 2% of the time at Newark Airport. The northwest winds also occur most frequently at La Guardia (top right wind rose) and JFK (top left wind rose). The purpose of these wind roses is to illustrate the "regional" trend in the wind directions associated most often with strong wind speeds. Overall, the topography in the overall region is not significant enough to influence the general wind patterns or trends and local speed up effects would typically be limited to areas where the terrain rises quickly above the height of the river. The overall trend of strong winds in this region is that they originate from the west through northwest. La Guardia data indicates increased occurrence of northeast and south winds while JFK data exhibits a stronger focus on wind from the south. Considering the distance and varied make-up of building heights and terrain that lie between the study site and these historical wind data sites, no single airport was considered to provide wind conditions (i.e.,

speed, direction and exposure) that would be representative of the study site. Similar to techniques commonly used in wind tunnel studies to determine wind loads for buildings in Manhattan, the wind records from the three airport weather stations were combined to provide a composite set of wind data for this region.

The composite wind data were further analysed for the "summer" (May through October) and "winter" (November through April) seasons. Figure 2c graphically depicts the distribution of wind frequency and directionality for these two "six month" seasons, which are aligned with the pedestrian wind criteria used for two decades by RWDI. The upper-left wind rose identifies the summer wind data when considering all wind speeds. Overall, winds from the south and southwest prevail in the summer season. The lower-left wind rose shows the winter data, indicating the predominant winds from the northwest through west directions during this season. These wind roses reflect the prevailing winds, i.e., those which people experience the majority of the time throughout the year.

Figure 2c also depicts the directionality of strong winds using the composite data set. Strong winds occur for 5.3% and 15.2% of the time during the summer and winter seasons, respectively. In this region, strong winds from the northwest and south directions occur often during the summer, while northwest, west-northwest and west directions are more evident during the winter. Considering that strong winds occur approximately three times more frequently during the winter (i.e., 15.2% vs. 5.3%) emphasis in this assessment was placed on winds blowing from the northwest quadrant, followed by southerly (summertime) winds. The wind approaching the west sides of Manhattan and Brooklyn, from across the Hudson River and across wider portions of the East River, respectively, will generally be similar, resulting in comparable wind conditions along the length of the shore due to exposure to these winds.

4.3 CHARACTERIZATION OF PREDICTED WIND CONDITIONS

Based on our past experience in wind tunnel testing, as well as our knowledge of building and wind flow interactions, the wind conditions predicted for The New Domino were characterized, or compared to, what could be expected at similar locations in Manhattan. To assist in identifying locations with wind conditions that may be comparable, aerial imagery was reviewed to determine locations that exhibit similar characteristics to the study area such as wind exposure, building massing/form and also the general surroundings.

4.4 EXPLANATION OF RWDI WIND SAFETY CRITERION

The RWDI wind criterion in this study deals specifically with pedestrian safety as it relates to the force of the wind. Gust speeds over a short period are critical in some circumstances, particularly where winds are very strong and pedestrians' footing and balance are involved (References 1, 5, 7 and 8 in Section 7). The criterion considers a healthy adult walking on a dry, level surface with good traction.

Gust speeds in excess of 55 mph can adversely affect a pedestrian's balance and footing. If winds of this magnitude occur more than two times per season, the safety criterion has been exceeded. On an annual basis, the safety criterion should not be exceeded more than three times per year. Wind control measures are typically required for locations that exceed the safety criterion.

5. TEST RESULTS

Table 1, located in the Tables section of this report, presents the safety results for the summer and winter seasons, for the configurations tested. The results at each wind measurement location are graphically depicted on a site plan in Figures 3a through 4b.

Large buildings tend to intercept the stronger winds at higher elevations and redirect them to ground level. Such a *Downwashing Flow* (shown in Image 1) is the main cause for wind acceleration at the pedestrian level. Wind acceleration typically occurs at the corners of tall buildings where the downwashed wind passes around the edges of the building. When two buildings are situated side by side, wind tends to accelerate through the gap between the buildings due to a *Channelling Effect* (Image 2). If these building/wind combinations occur for prevailing winds, and especially for strong winds, there is an increased potential for the accelerated winds to create wind safety issues for pedestrians.

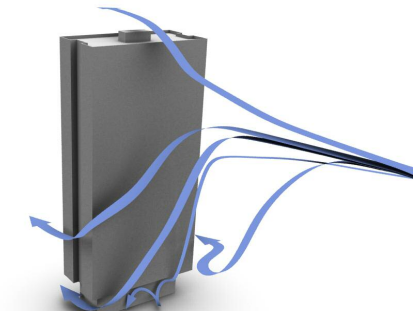


Image 1 – *Downwashing Flow*

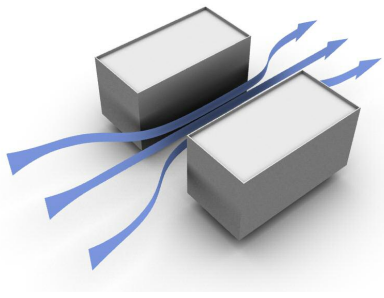


Image 2 – *Channeling Flow*

5.1 PREDICTED WIND SAFETY CONDITIONS - EXISTING CONFIGURATION

The existing Refinery complex is a wide, mid-rise building with low building sections on the west side. The other two buildings on the site are low-rise, with the building to the south of the existing Refinery building having one small tower.

There were no exceedances of the wind safety criterion during the summer. While the site is exposed to the prevailing westerly and northwesterly winds, the existing buildings do not significantly influence the wind patterns on the site. Exceptions include areas to the south and north of the existing Domino Refinery building where prevailing winter winds were intercepted by the west facade and directed downward. The wind accelerated around the southwest building corner resulting in the wind safety criterion not being met in the corridor south of the Refinery during the winter (Locations 64, 65, 75 and 76 on Figure 4a). The wind safety criterion was also exceeded at the northeast corner of Kent Avenue and S 2nd Street, as the prevailing winds accelerated between the existing buildings at the intersection of Kent Ave. and S 2nd St. (Location 49). The predicted wind conditions in this area would be typical of sites in Manhattan, particularly along the west edge of the city.

5.2 PREDICTED WIND SAFETY CONDITIONS - FULL-BUILD WITH LANDSCAPING

The proposed development is comprised of four new towers along the waterfront (Sites A, B, C and D) and a mid-rise tower east of Kent Avenue, between S 3rd Street and S 4th Street (Site E). An addition is also planned for the Refinery Building (increased height and one-storey element on the west facade). The towers on Sites A, B, C and D and the increased height of the Domino Refinery intercepted wind at higher levels. This upper level wind was re-directed towards grade and was accelerated in several areas on and around the site.

The wind safety criterion was not exceeded during the summer (Figure 3b).

Overall, during the winter, wind control features incorporated in the design provided satisfactory wind safety conditions at the pedestrian level, with a few exceptions. These design features included coniferous and marcescent landscaping (illustrated in Figures 3b and 4b). The modelled landscaping represented trees with a height of 20 – 25 feet for both species. The modelled foliage of coniferous trees extended to the ground. Where the marcesant tree species (i.e., deciduous trees that retain their leaves in the winter) were located along sidewalks and pedestrian routes, their lower branch structure was not present in order to allow for pedestrian passage underneath. In all other areas, either the lower branch structure was retained, or the trees

were under-planted with shrubs to provide for a continuous vertical wind screen effect. In modeling the landscaping proposed for the site, the modeled trees represent a number of years of growth after planting, thus it is not implied that the trees be planted at the tested height of 20 – 25 feet. It must also be understood that the wind conditions predicted in this study would not be achieved until the trees approach the modeled height and the project is fully constructed, which may not be for a number of years.

Regarding building height reductions as a means to mitigate wind conditions, based on our engineering judgement and previous wind tunnel tests on similar developments, it is our opinion that it would require significant building height reductions across the site, on the order of 50%, to appreciably change the expected conditions. Hence, building height reductions were not considered a practical mitigation concept.

The following discussion will focus on wind safety during the winter, as the wind safety criterion was met at all locations on and around the site during the summer (Figure 3b). The test locations on the east side of Kent Avenue are considered within the discussion of the adjacent development site (i.e., Sites A, B, C, D and Refinery).

5.2.1 Site A and Grand Ferry Park (Locations 1 through 29)

The proposed Site A building is comprised of a large podium with a high-rise tower on the northwest corner. The west facade intercepted the prevailing northwesterly and westerly winds and directed them toward grade where they accelerated around the building corners, towards Grand Ferry Park and down S 1st Street.

Although the recently planted trees in Grand Ferry Park were included in the model for the Full Build with Landscaping Configuration (illustrated on Figures 3b and 4b), increased wind activity occurred within the park. In the winter, the wind safety criterion was not met near the east boundary along River Street (Location 7). Given the nature of the wind flows, additional trees (coniferous or under-planted marcesant trees) planted within the south-central area of the park would improve the wind conditions. We anticipate that the wind conditions predicted in this study would be similar to areas such as Riverbank State Park, the sports field located beyond the west end of West Houston Street, and perhaps the water's edge of the promenade facing Liberty Island in Robert F. Wagner Jr. Park.

5.2.2 Site B (Locations 30 through 49)

The Site B building is comprised of a high-rise and a mid-rise tower on top of a podium. The combination of coniferous and marcescent landscaping in the design effectively disrupted the prevalent winds, resulting in the safety criterion being met throughout the year with one exception. This occurred in the walkway between Site A and Site B (Location 34) where the wind safety criterion was exceeded during the winter.

5.2.3 Refinery (Locations 50 through 73)

The existing low-rise sections on the west side of the Refinery were removed and replaced with a one-story addition, and a three-story addition was built atop the tower.

During the summer, all locations met the wind safety criterion. All but one location (52) met the wind safety criterion in the winter. At this location, 14 exceedances of the safety criterion were predicted, where 2 per season are permitted. These conditions are higher than average in most areas of Manhattan and in our opinion would be comparable to wind conditions along the west side of Manhattan, for example, in the general vicinity of the World Financial Center along the exposed east shore of the Hudson River.

5.2.4 Site C (Locations 74 through 86)

The Site C building is comprised of a high-rise tower located on the northwest corner of a low-rise podium.

The proposed coniferous and marcescent landscaping design resulted in the wind safety criterion being met in all areas around Site C with the exception of one area west of the tower in the winter (Location 79).

The revised landscaping plan (dated November 30, 2009) indicates that the large coniferous trees to the west of Site C have been replaced with marcescent and/or small coniferous trees. In addition, some small deciduous trees have been replaced with small coniferous trees in the vicinity of Location 79. In our professional opinion, these changes will not have a significant effect on the wind tunnel results in this area.

5.2.5 Site E (Locations 87 through 116)

Site E is sheltered from the prevailing winds by the Refinery as well as the Site C and Site D buildings. As a result, all locations around Site E passed the wind safety criterion throughout the year. These wind conditions are comparable to what can be expected in more wind sheltered regions of Manhattan.

5.2.6 Site D (Locations 117 through 136)

The Site D building footprint is stepped along the southwest corner resulting in a "triangular" footprint, with a high-rise tower on the northwest corner.

The coniferous and marcescent landscaping tested resulted in the wind safety criterion being met throughout the year.

The revised landscaping plan is slightly different from that tested in areas to the west and south of Site D. In general, the coverage of trees in the revised landscaping plan is lighter than the landscape design tested. Specifically, the large coniferous trees west and southwest of Site D have been replaced with marcescent trees and/or smaller coniferous trees, and the English Oak Fastigiate trees to the south of Site D have been replaced with smaller trees of the same species. In our professional opinion, these changes will not have a significant effect on the wind tunnel results in this area as the trees mature.

6. APPLICABILITY OF RESULTS

The results presented in this report pertain to the model of the proposed New Domino development constructed using the architectural design drawings listed in Appendix A and landscaping elements (trees, trellis/canopies, wind screens, etc.) shown in the Figures 4a and 4b. During the future schematic design process, changes to the built form or landscaping may occur in consideration of, for example, views, accessibility, circulation, marketability, etc. Should there be design changes that deviate from this information and list of drawings, other than the ones described in this report, the results 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

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.

2) Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

3) Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4) Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5) Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

6) Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

7) Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

8) Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp. 215-226.

TABLES

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	Exceeded
1	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
2	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
3	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	1	No
4	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	1	No
5	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
6	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
7	A	Summer	0	No
		Winter	0	No
	B	Summer	1	No
		Winter	6	Yes
8	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
9	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
10	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
11	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
12	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	2	No
13	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	2	No
14	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
15	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
16	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
17	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	2	No
18	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
19	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
20	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
21	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
22	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
23	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
24	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
25	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
26	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
27	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
28	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
29	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
30	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
31	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
32	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
33	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	1	No
34	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	2	No
		Winter	8	Yes
35	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	1	No
36	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
37	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	1	No
38	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
39	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
40	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
41	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	2	No
42	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	2	No
43	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	2	No
44	A	Summer	0	No
		Winter	2	No
	B	Summer	0	No
		Winter	2	No
45	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
46	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
47	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
48	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
49	A	Summer	0	No
		Winter	3	Yes
	B	Summer	0	No
		Winter	0	No
50	A	Summer	0	No
		Winter	2	No
	B	Summer	0	No
		Winter	1	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
51	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
52	A	Summer	0	No
		Winter	0	No
	B	Summer	2	No
		Winter	14	Yes
53	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	1	No
54	A	Summer	0	No
		Winter	2	No
	B	Summer	0	No
		Winter	1	No
55	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
56	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
57	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
58	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
59	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	1	No
60	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
61	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
62	A	Summer	0	No
		Winter	1	No
	B	Summer	0	No
		Winter	0	No
63	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
64	A	Summer	0	No
		Winter	3	Yes
	B	Summer	0	No
		Winter	0	No
65	A	Summer	1	No
		Winter	5	Yes
	B	Summer	0	No
		Winter	1	No
66	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
67	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
68	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
69	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
70	A	Summer	0	No
		Winter	2	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
71	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
72	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
73	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
74	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
75	A	Summer	0	No
		Winter	3	Yes
	B	Summer	0	No
		Winter	2	No
76	A	Summer	0	No
		Winter	4	Yes
	B	Summer	0	No
		Winter	0	No
77	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	2	No
78	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
79	A	Summer	0	No
		Winter	0	No
	B	Summer	1	No
		Winter	4	Yes
80	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
81	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
82	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	2	No
83	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	1	No
84	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
85	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
86	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
87	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
88	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
89	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
90	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season
greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
91	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
92	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
93	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
94	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
95	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
96	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
97	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
98	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
99	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
100	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No

Values are for the number of wind events per season
greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
101	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
102	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
103	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
104	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
105	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
106	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
107	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
108	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
109	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
110	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
111	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
112	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
113	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
114	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
115	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
116	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
117	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	2	No
118	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	1	No
119	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
120	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

Loc.	Config.	Season	SAFETY CATEGORY Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
121	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
122	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
123	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
124	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
125	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
126	A	Summer	DATA NOT AVAILABLE	
		Winter	DATA NOT AVAILABLE	
	B	Summer	0	No
		Winter	0	No
127	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
128	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
129	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	2	No
130	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

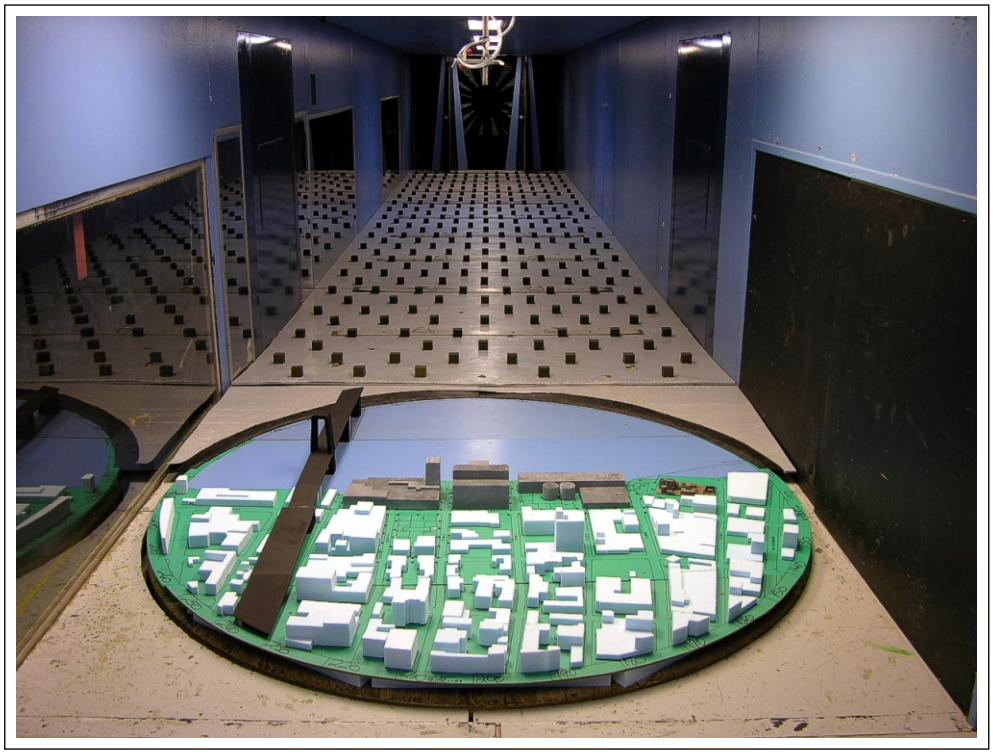
Table 1: Pedestrian Wind Safety Categories - Multiple Seasons

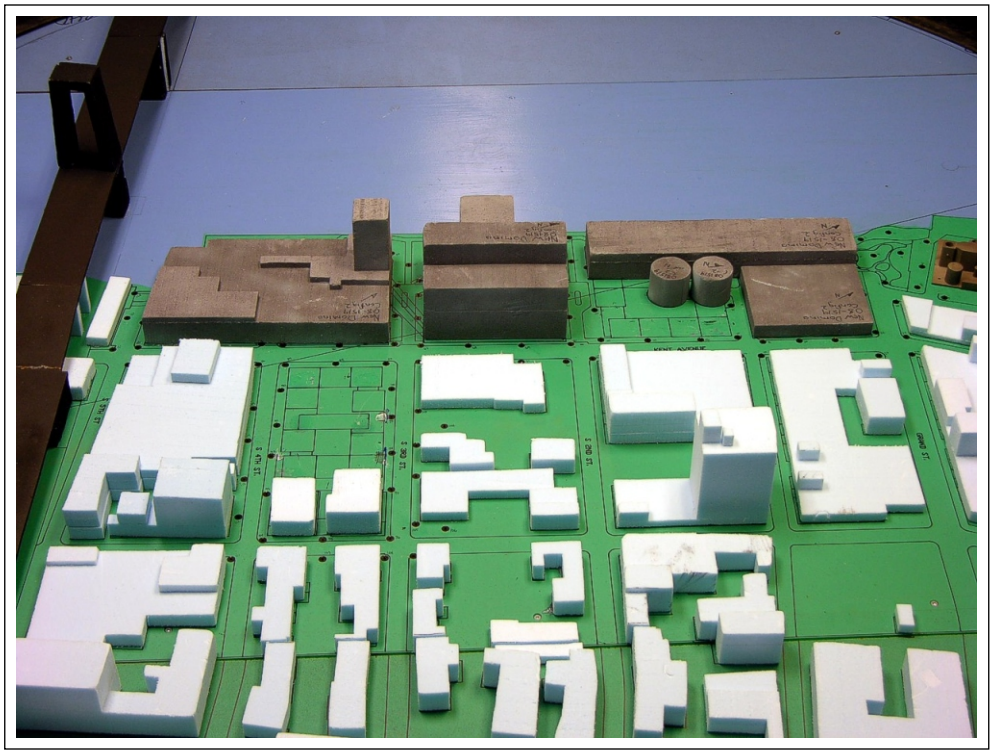
Loc.	Config.	Season	**SAFETY CATEGORY** Gust Speed ≥55 (mph) > 2 Events Seasonally Events	EXCEEDED
131	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
132	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
133	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No
134	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	2	No
135	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	1	No
136	A	Summer	0	No
		Winter	0	No
	B	Summer	0	No
		Winter	0	No

Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph

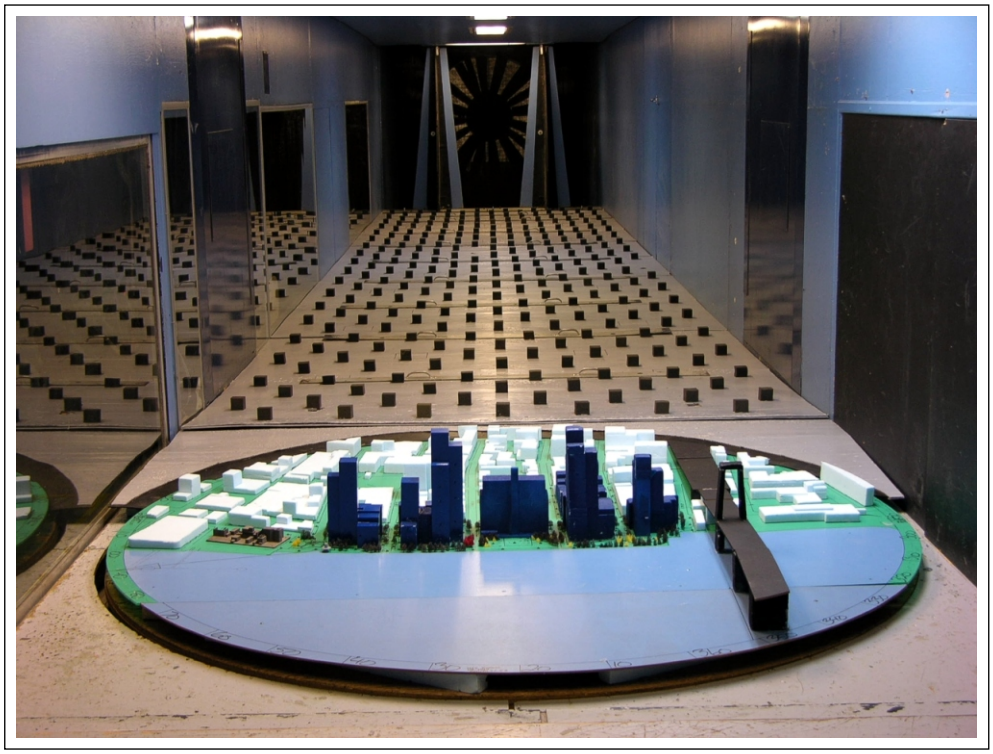
Summer: May - October Winter: November - April	Configuration A - Existing Configuration B - Full Build with Landscaping

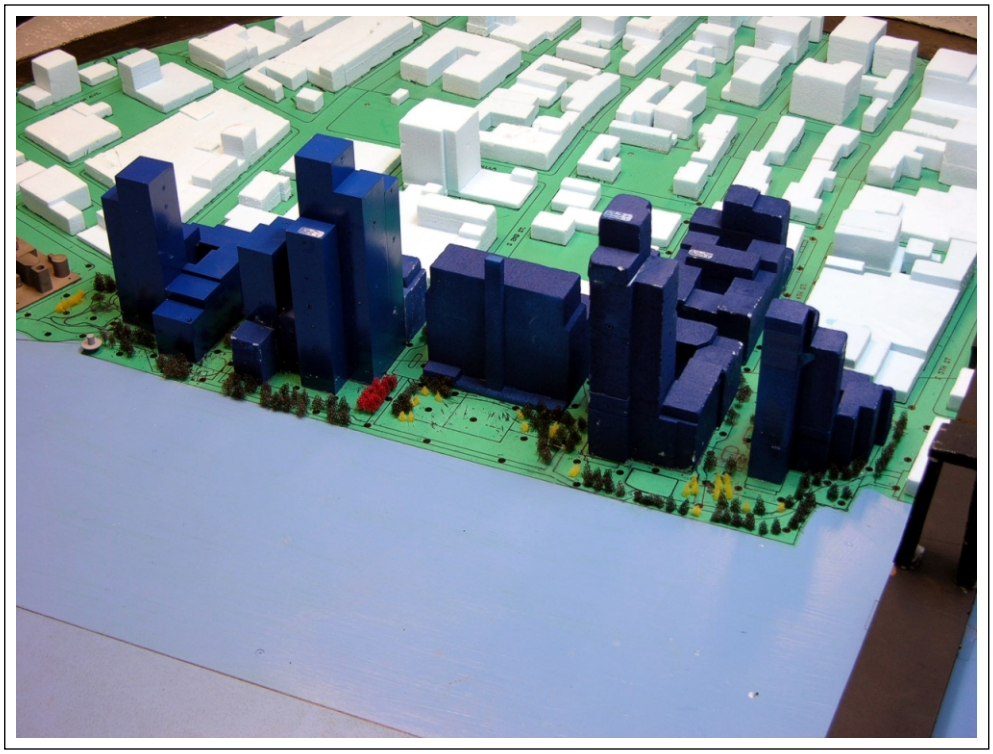
FIGURES





Wind Tunnel Study Model **Configuration A** The New Domino - Brooklyn, New York Project #08-1519	Figure: 1a Date: January 13, 2010	RWDI





Wind Tunnel Study Model **Configuration B** The New Domino - Brooklyn, New York Project #08-1519	Figure: 1b Date: January 13, 2010	RWDI

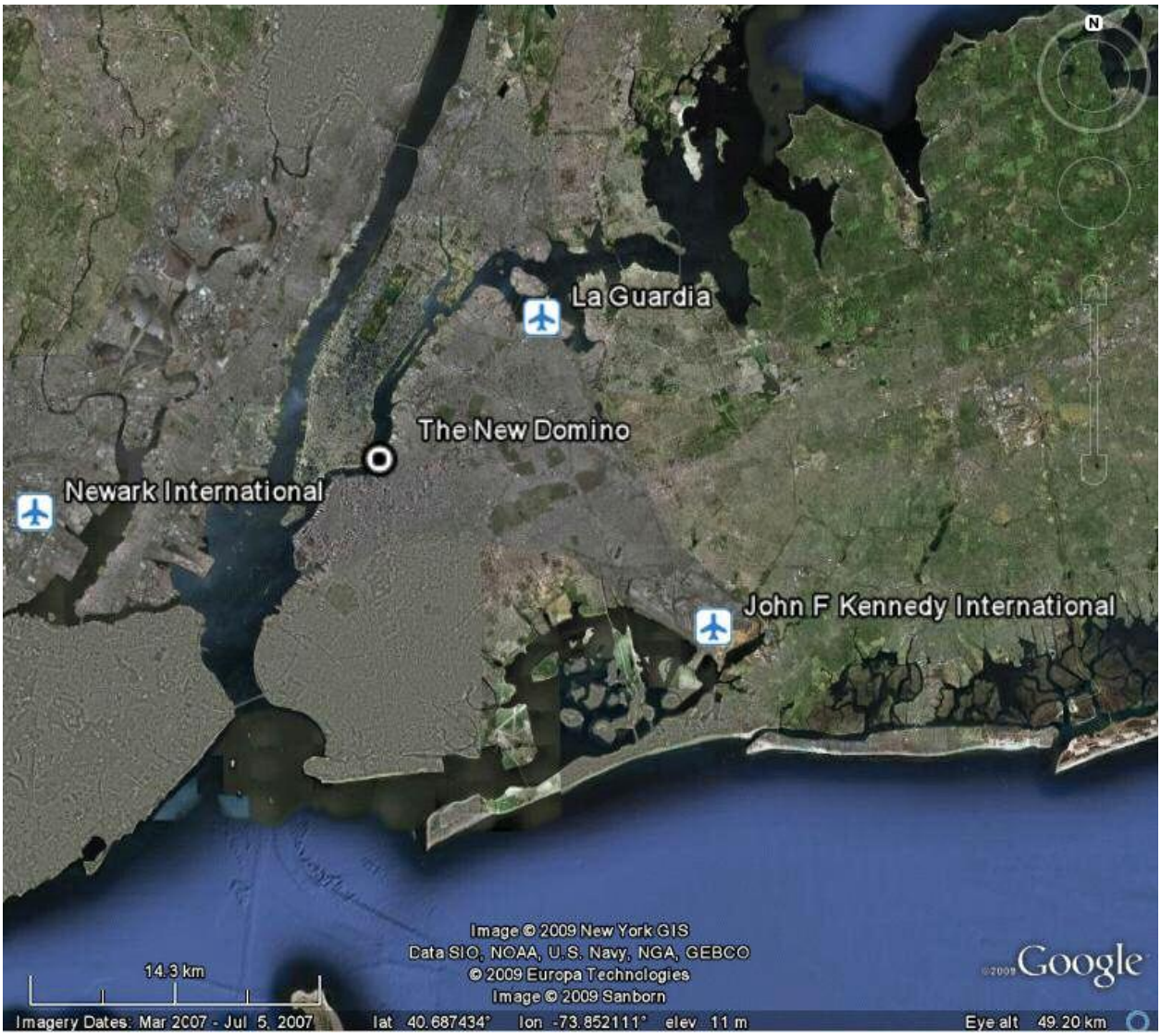
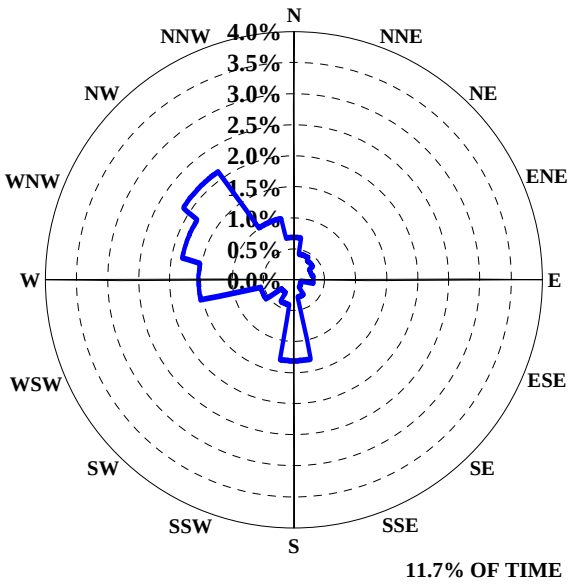
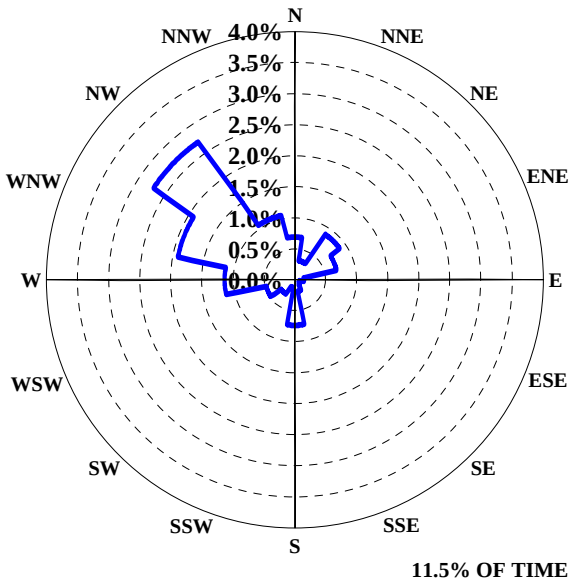


Image Credit: Google™ Earth

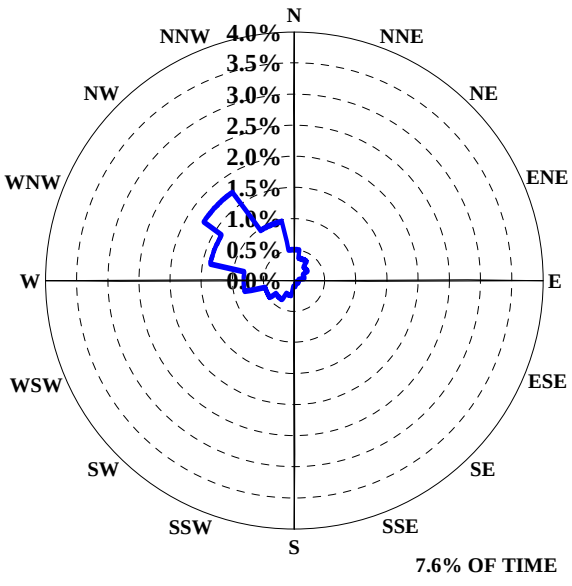
Proximity of Project Site to Area Airports	Figure No. **2a**	RWDI
The New Domino - Brooklyn, New York Project #08-1519	Date: October 9, 2009	



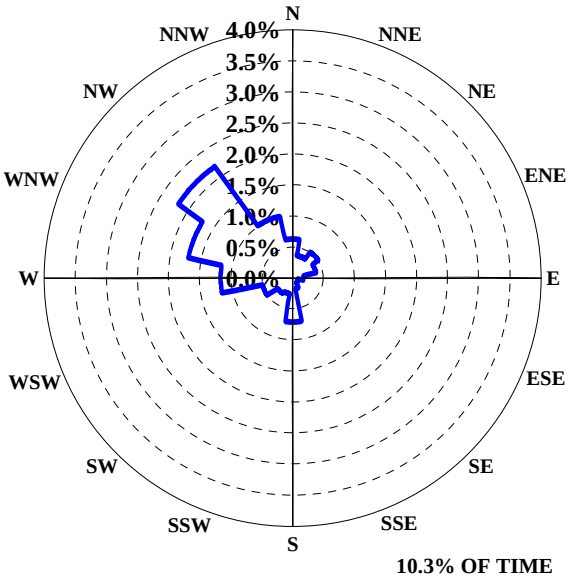
JFK IAP ANNUAL WINDS EXCEEDING 20 mph



LAGUARDIA IAP ANNUAL WINDS EXCEEDING 20 mph

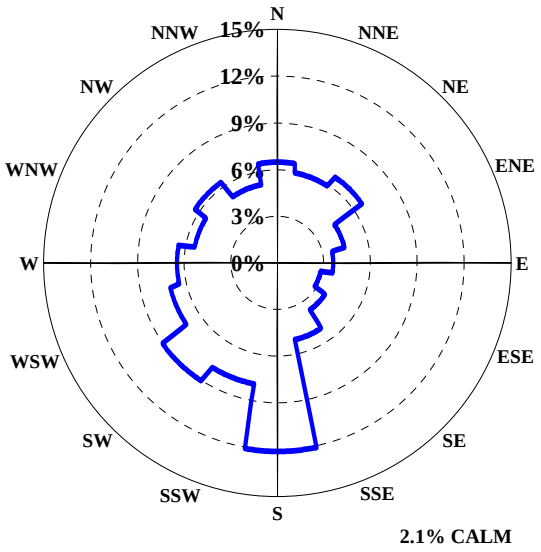


NEWARK IAP ANNUAL WINDS EXCEEDING 20 mph

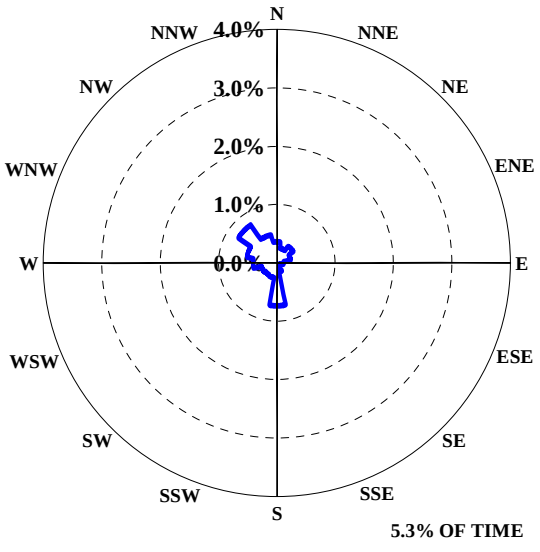


COMBINED IAPS ANNUAL WINDS EXCEEDING 20 mph

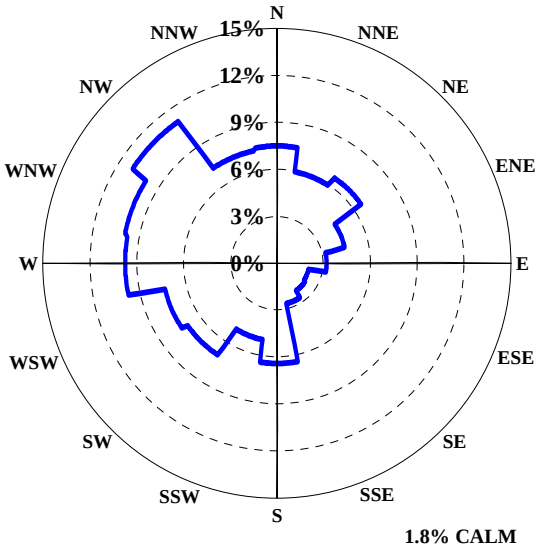
Directional Distribution (%) of Winds (Blowing From) **Station: JFK, LaGuardia and Newark International Airports (1948-2005)**	Figure No. **2b**	RWDI
The New Domino - Brooklyn, New York Project #: 08-1519	January 13, 2010	



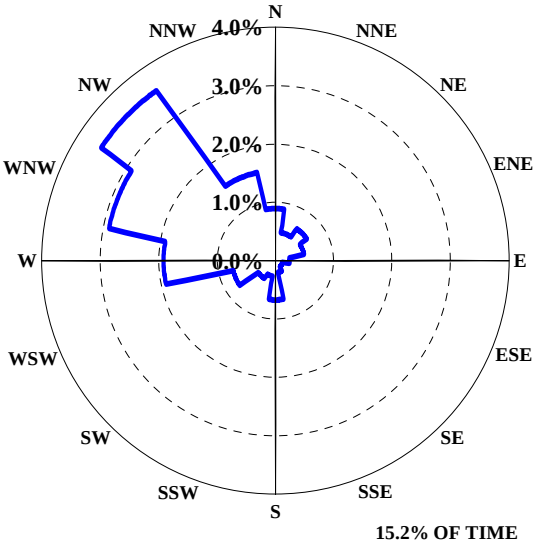
ALL SUMMER WINDS



SUMMER WINDS EXCEEDING 20 mph

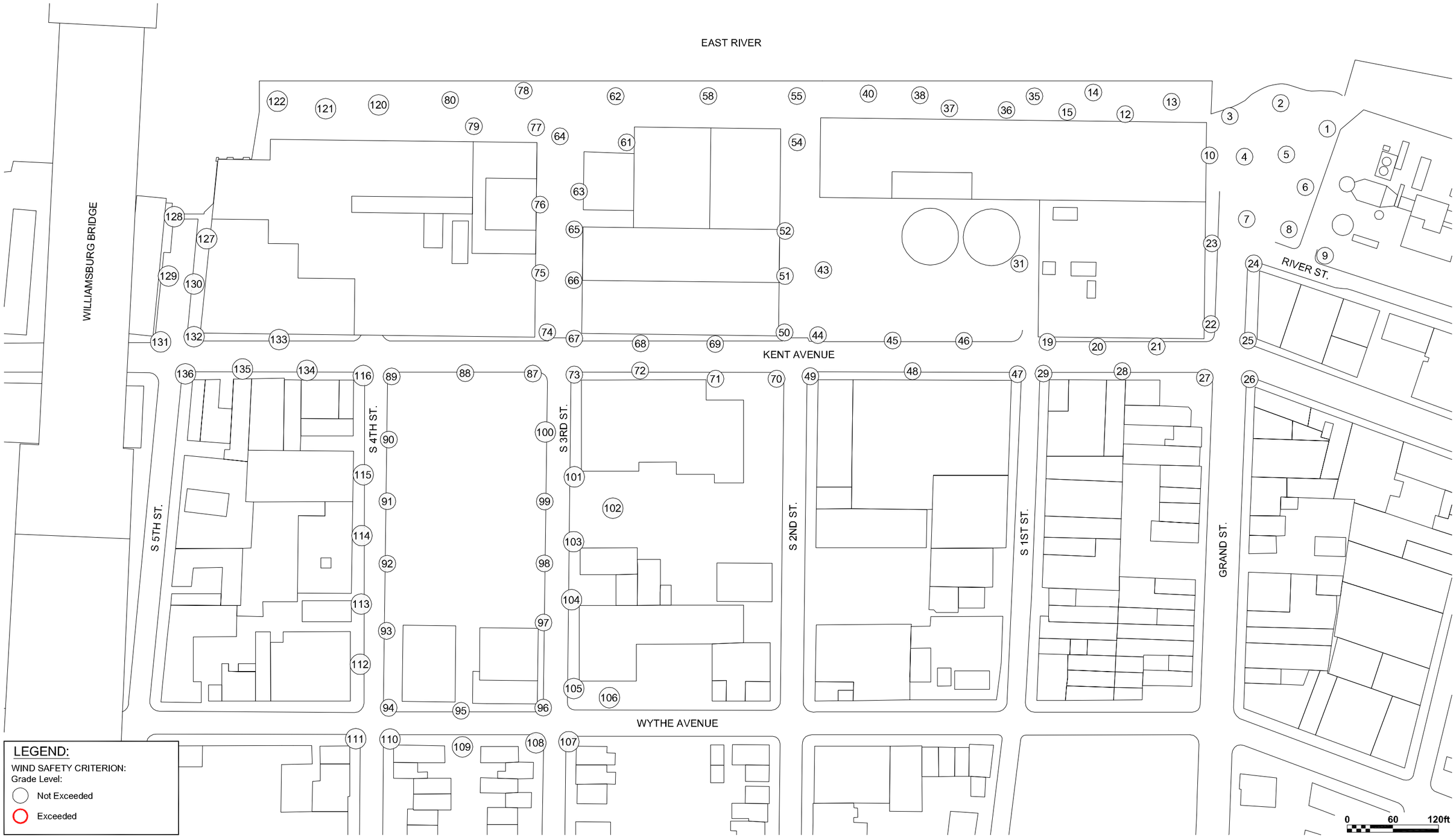


ALL WINTER WINDS



WINTER WINDS EXCEEDING 20 mph

Directional Distribution (%) of Winds (Blowing From) **Station: New York City (JFK, Laguardia and Newark), NY (1948 - 2005)**	Figure: **2c**	RWDI
The New Domino - Brooklyn, New York Project #: 08-1519	Date: January 13, 2010	



Pedestrian Wind Conditions - Configuration A
Summer (May to October)

The New Domino - Brooklyn, New York

True North

Project #08-1519

Drawn by:	NTN	Figure:	**3a**
Approx. Scale:			1"=120'
Date Revised:			Jan. 13, 2010

RWDI



Pedestrian Wind Conditions - Configuration B
Summer (May to October)

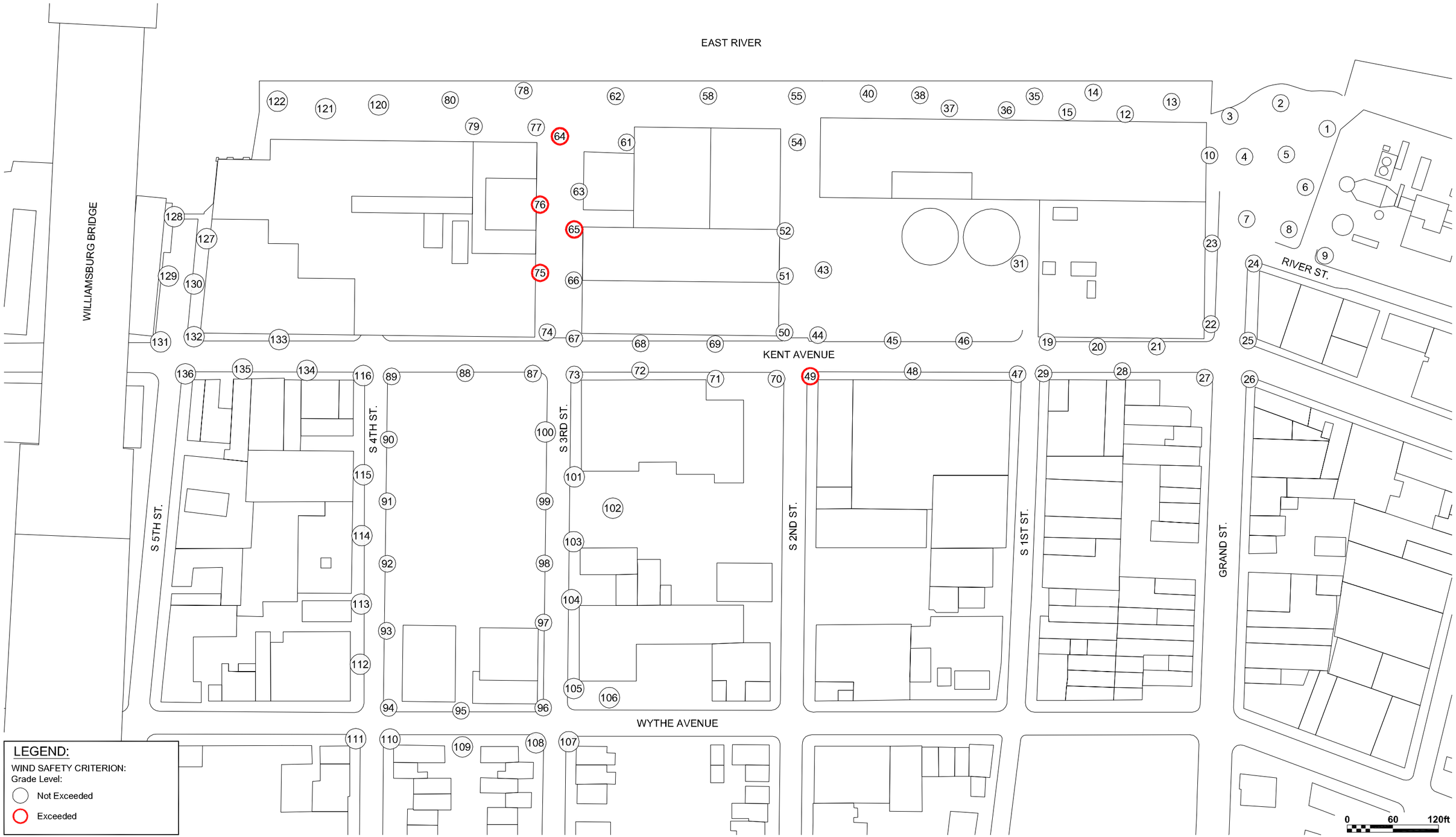
The New Domino - Brooklyn, New York

Project #08-1519

True North

Drawn by:	NTN	Figure:	3b
Approx. Scale:			1"=120'
Date Revised:			Jan. 13, 2010

RWDI



Pedestrian Wind Conditions - Configuration A
Winter (November to April)

The New Domino - Brooklyn, New York

Project #08-1519

True North

Drawn by:	NTN	Figure:	**4a**
Approx. Scale:			1"=120'
Date Revised:			Jan. 13, 2010

RWDI



Pedestrian Wind Conditions - Configuration B
Winter (November to April)

True North

The New Domino - Brooklyn, New York

Project #08-1519

Drawn by:	NTN	Figure:	4b
Approx. Scale:			1"=120'
Date Revised:			Jan. 13, 2010

RWDI

APPENDIX A

APPENDIX A – DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were received from AKRF and were used to construct the scale model of the New Domino development. 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.

Drawing Title	File Name	Date Received
Zoning Envelope Model	Zoning Envelope Model_080722.dwg	July 28, 2008
Landscape Proposals for Wind Mitigation	Q-plan-wind-mitigation.pdf	November 13, 2009