

fax memo

RWDI

To: Gene Watanabe
Company: Gensler
Fax #: 310-499-5850
Pages: 11 (Including cover sheet)
From: Paul Barnard
Re: Century City Entertainment Center Redevelopment

Date: March 29, 2001
RWDI Reference #: 01-400

We have completed the wind tunnel test for the existing configuration of the Century City Entertainment Center Redevelopment. This memo contains a brief explanation of the testing procedure as well as the criteria used to evaluate pedestrian winds. Table 1 and 2 present the wind comfort results for each measurement location on and around the study site. Please refer to Figure 1 to locate the position of each measurement location.

Sincerely,

Paul Barnard

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INTRODUCTION

The purpose of the study was to assess the wind environment around the existing site of the Century City Entertainment Center Redevelopment in terms of pedestrian comfort and safety. This objective was achieved through wind tunnel testing of a 1:400 scale model. The model included the proposed development and all relevant surrounding buildings and topography within a 1500 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 66 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 starting from true north and were reduced to the form of wind speed ratios, by dividing by the reference wind speed at the top of the simulated boundary layer.

Wind statistics recorded at the Santa Monica Municipal Airport in California between 1973 and 1999 were analysed for the Summer (May through October) and Winter (November through April) seasons. These wind statistics were combined with the wind tunnel data in order to predict the frequency of occurrence of full scale wind speeds.

EXPLANATION OF CRITERIA

The average gust wind speeds predicted to occur at each test location on the model were compared to pedestrian comfort criteria to determine the acceptability of the wind conditions for pedestrian use. The following table is an example of how these predicted full scale wind speeds are presented in this report.

Example Table: Pedestrian Wind Comfort and Safety Categories

COMFORT CATEGORY							SAFETY CATEGORY
	Sitting	Standing	Walking	Uncomfortable			
Gust Wind Speed (mph)	0 - 11	0 - 16	0 - 20	>20			≥55
Category Limit	≥80%	≥80%	≥80%	>20%			> 3 Events Annually (0.1% of the Time)
Loc.	Config.	Season	%	%	%	%	RATING
1			84	97	99	1	Sitting
2			51	69	82	18	Walking
3			46	66	79	21	Uncomfortable
							PASS
							PASS
							FAIL

Across the top of the table there are four comfort categories:

- **Sitting:** Gust speeds up to 11 mph - Low wind speed areas where one could read a newspaper without having it blown away. Suitable for use as outdoor cafes and other sitting areas.

- **Standing:** Gust speeds up to 16 mph - Slightly higher wind speeds that would be strong enough to rustle leaves. These wind speeds are typically comfortable at building entrances, bus stops or other areas where people may want to linger but not necessarily sit for extended periods of time.
- **Walking:** Gust speeds up to 20 mph - Winds that would lift leaves, cause movement to litter, hair and loose clothing. Appropriate for sidewalks, plazas, parks or playing fields where people are more likely to be active and receptive to some wind activity.
- **Uncomfortable:** Gust speeds greater than 20 mph - The effects of wind speeds at this level would range from small trees swaying and wind force being felt on the body (approximately 26 mph) to whole trees being in motion and inconvenience being felt when walking (approximately 52 mph gust). Winds of this magnitude would be considered a nuisance for most activities.

Along the left side of the table, the sensor location, test configuration and season are listed. The subsequent four columns show the percentage of time that the winds will fall within the wind speed ranges for each comfort category. For example at Location 1 the wind conditions are identified as comfortable for sitting 84% of the time and suitable for standing 97% of the time.

Wind conditions are considered acceptable for sitting, standing or walking if the wind speeds are within their specified ranges at least 80% of the time. This is based on research that suggests the public can tolerate a limited number of windy days before they perceive an area as having a wind problem. Using this criterion, each location has been given a comfort designation under the heading, "COMFORT CATEGORY." This designation indicates which activities can be conducted in the area. An uncomfortable designation means that the 80% criterion was not satisfied for walking.

Wind mitigation may be needed if the comfort designation listed is not consistent with the intended use of an area. For example, in the table, Location 2 has a walking designation since winds are comfortable for walking 82% of the time. If a café were proposed for this location, a sitting designation would be desired and the example shows that it would be comfortable to sit only 51% of the time.

Safety is also considered by the criteria. Wind speeds in excess of 55 mph can adversely affect a pedestrian's balance and footing. If winds of this magnitude occur more than 3 times per year (0.1% of the time), a FAIL designation is assigned under the heading, "SAFETY CATEGORY" as shown in the example table at Location 3. Wind control measures are typically required at locations that receive the FAIL rating.

These guidelines represent average wind tolerance. Regional differences in wind climate and variations in age, health, clothing, etc. can affect people's perception of the wind climate. For example, on very hot days, higher winds can be tolerated because the cooling effect of the wind would be considered pleasant. On colder days, people's tolerance of wind would be reduced, especially if they are unprepared or without appropriate clothing.

TEST RESULTS

Table 1 presents the wind comfort and safety results for the summer and winter seasons for each sensor location on the proposed development (see Figure 1). Table 2 presents a more detailed analysis of severe wind conditions at each measurement location. Please review this information. We will provide a detailed discussion about these results during our conference call scheduled for this afternoon.

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

Loc.	Season	COMFORT CATEGORY				RATING	SAFETY CATEGORY
		Gust Wind Speed (mph)	Sitting 0 - 11 Category Limit	Standing 0 - 16 ≥80%	Walking 0 - 20 ≥80%		
1	Summer	30	56	80	20	Walking	FAIL
	Winter	34	57	76	24	Uncomfortable	FAIL
2	Summer	64	87	97	3	Standing	PASS
	Winter	69	89	96	4	Standing	PASS
3	Summer	32	51	68	32	Uncomfortable	PASS
	Winter	42	64	78	22	Uncomfortable	PASS
4	Summer	55	87	98	2	Standing	PASS
	Winter	65	88	97	3	Standing	PASS
5	Summer	25	38	55	45	Uncomfortable	FAIL
	Winter	29	46	64	36	Uncomfortable	FAIL
6	Summer	24	36	51	49	Uncomfortable	FAIL
	Winter	28	45	63	37	Uncomfortable	FAIL
7	Summer	51	87	98	2	Standing	PASS
	Winter	54	84	94	6	Standing	PASS
8	Summer	46	82	97	3	Standing	PASS
	Winter	57	84	95	5	Standing	PASS
9	Summer	25	37	54	46	Uncomfortable	FAIL
	Winter	30	49	66	34	Uncomfortable	FAIL
10	Summer	26	42	61	39	Uncomfortable	PASS
	Winter	32	53	71	29	Uncomfortable	PASS
11	Summer	24	38	56	44	Uncomfortable	FAIL
	Winter	29	47	65	35	Uncomfortable	FAIL
12	Summer	60	93	99	1	Standing	PASS
	Winter	62	88	95	5	Standing	PASS
13	Summer	29	49	68	32	Uncomfortable	FAIL
	Winter	34	55	73	27	Uncomfortable	FAIL
14	Summer	50	82	94	6	Standing	PASS
	Winter	54	82	93	7	Standing	PASS
15	Summer	33	57	80	20	Walking	PASS
	Winter	37	61	80	20	Walking	PASS
16	Summer	48	79	96	4	Walking	PASS
	Winter	62	86	96	4	Standing	PASS
17	Summer	31	52	72	28	Uncomfortable	PASS
	Winter	40	65	81	19	Walking	PASS
18	Summer	28	44	63	37	Uncomfortable	PASS
	Winter	38	60	75	25	Uncomfortable	PASS
19	Summer	36	66	89	11	Walking	PASS
	Winter	45	73	89	11	Walking	PASS

Configuration - Existing

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

COMFORT CATEGORY		Sitting	Standing	Walking	Uncomfortable	RATING	SAFETY CATEGORY
Gust Wind Speed (mph)		0 - 11	0 - 16	0 - 20	>20		≥55
Category Limit		≥80%	≥80%	≥80%	>20%		> 3 Events Annually (0.1% of the Time)
Loc.	Season	%	%	%	%	RATING	RATING
20	Summer	27	44	63	37	Uncomfortable	PASS
	Winter	39	59	75	25	Uncomfortable	PASS
21	Summer	28	47	68	32	Uncomfortable	PASS
	Winter	34	57	75	25	Uncomfortable	PASS
22	Summer	41	73	93	7	Walking	PASS
	Winter	43	71	88	12	Walking	PASS
23	Summer	41	77	95	5	Walking	PASS
	Winter	41	70	86	14	Walking	PASS
24	Summer	52	90	98	2	Standing	PASS
	Winter	51	81	91	9	Standing	PASS
25	Summer	34	62	86	14	Walking	PASS
	Winter	37	63	82	18	Walking	PASS
26	Summer	45	77	95	5	Walking	PASS
	Winter	50	78	91	9	Walking	PASS
27	Summer	41	67	87	13	Walking	PASS
	Winter	44	70	86	14	Walking	PASS
28	Summer	41	69	90	10	Walking	PASS
	Winter	45	72	88	12	Walking	PASS
29	Summer	75	97	99	1	Standing	PASS
	Winter	71	91	96	4	Standing	PASS
30	Summer	68	94	99	1	Standing	PASS
	Winter	71	91	97	3	Standing	PASS
31	Summer	51	78	93	7	Walking	PASS
	Winter	58	82	92	8	Standing	PASS
32	Summer	49	82	96	4	Standing	PASS
	Winter	63	86	95	5	Standing	PASS
33	Summer	48	80	94	6	Standing	PASS
	Winter	62	85	95	5	Standing	PASS
34	Summer	49	79	93	7	Walking	PASS
	Winter	59	82	93	7	Standing	PASS
35	Summer	54	86	97	3	Standing	PASS
	Winter	63	86	95	5	Standing	PASS
36	Summer	54	90	98	2	Standing	PASS
	Winter	63	88	96	4	Standing	PASS
37	Summer	68	95	99	1	Standing	PASS
	Winter	75	94	98	2	Standing	PASS
38	Summer	75	98	100	0	Standing	PASS
	Winter	80	97	99	1	Sitting	PASS

Configuration - Existing

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

COMFORT CATEGORY		Sitting	Standing	Walking	Uncomfortable	RATING	SAFETY CATEGORY
Gust Wind Speed (mph)		0 - 11	0 - 16	0 - 20	>20		≥55
Category Limit		≥80%	≥80%	≥80%	>20%		> 3 Events Annually (0.1% of the Time)
Loc.	Season	%	%	%	%	RATING	RATING
39	Summer	59	91	98	2	Standing	PASS
	Winter	63	90	97	3	Standing	PASS
40	Summer	66	96	99	1	Standing	PASS
	Winter	65	90	96	4	Standing	PASS
41	Summer	52	84	96	4	Standing	PASS
	Winter	57	83	93	7	Standing	PASS
42	Summer	70	95	99	1	Standing	PASS
	Winter	70	92	97	3	Standing	PASS
43	Summer	64	93	99	1	Standing	PASS
	Winter	65	88	95	5	Standing	PASS
44	Summer	58	85	96	4	Standing	PASS
	Winter	61	84	93	7	Standing	PASS
45	Summer	32	50	70	30	Uncomfortable	PASS
	Winter	41	63	78	22	Uncomfortable	PASS
46	Summer	31	54	79	21	Uncomfortable	PASS
	Winter	39	64	82	18	Walking	PASS
47	Summer	57	86	96	4	Standing	PASS
	Winter	64	86	94	6	Standing	PASS
48	Summer	49	84	97	3	Standing	PASS
	Winter	52	81	92	8	Standing	PASS
49	Summer	36	64	85	15	Walking	PASS
	Winter	41	68	86	14	Walking	PASS
50	Summer	66	96	99	1	Standing	PASS
	Winter	63	89	96	4	Standing	PASS
51	Summer	50	81	96	4	Standing	PASS
	Winter	51	79	92	8	Walking	PASS
52	Summer	57	87	98	2	Standing	PASS
	Winter	59	84	94	6	Standing	PASS
53	Summer	51	80	96	4	Standing	PASS
	Winter	56	82	94	6	Standing	PASS
54	Summer	67	96	100	0	Standing	PASS
	Winter	69	92	97	3	Standing	PASS
55	Summer	58	88	98	2	Standing	PASS
	Winter	63	87	96	4	Standing	PASS
56	Summer	62	91	99	1	Standing	PASS
	Winter	65	88	96	4	Standing	PASS
57	Summer	56	85	98	2	Standing	PASS
	Winter	58	84	95	5	Standing	PASS

Configuration - Existing

Table 1: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

Loc.	Season	COMFORT CATEGORY				RATING	SAFETY CATEGORY
		Gust Wind Speed (mph) Category Limit	Sitting 0 - 11 ≥80%	Standing 0 - 16 ≥80%	Walking 0 - 20 ≥80%		
58	Summer	55	82	96	4	Standing	PASS
	Winter	59	84	94	6	Standing	PASS
59	Summer	55	84	97	3	Standing	PASS
	Winter	56	81	93	7	Standing	PASS
60	Summer	39	66	87	13	Walking	PASS
	Winter	44	70	87	13	Walking	PASS
61	Summer	50	80	95	5	Standing	PASS
	Winter	53	80	92	8	Standing	PASS
62	Summer	45	70	86	14	Walking	PASS
	Winter	53	78	90	10	Walking	PASS
63	Summer	58	85	97	3	Standing	PASS
	Winter	62	86	95	5	Standing	PASS
64	Summer	74	97	100	0	Standing	PASS
	Winter	70	91	96	4	Standing	PASS
65	Summer	62	92	99	1	Standing	PASS
	Winter	68	91	97	3	Standing	PASS
66	Summer	60	94	99	1	Standing	PASS
	Winter	64	90	96	4	Standing	PASS

Configuration - Existing

Table 2: Number of Severe Wind Events Occurring at the Pedestrian Level

Location	Summer	Winter	Annual	Safety Category Rating
1	0.21	4.28	4.49	FAIL
2	0.00	0.01	0.01	PASS
3	0.35	1.80	2.15	PASS
4	0.00	0.01	0.01	PASS
5	0.84	5.93	6.77	FAIL
6	1.23	6.20	7.43	FAIL
7	0.01	0.19	0.20	PASS
8	0.01	0.02	0.03	PASS
9	0.72	3.52	4.24	FAIL
10	0.36	2.05	2.41	PASS
11	0.53	3.91	4.44	FAIL
12	0.01	0.12	0.13	PASS
13	0.37	4.52	4.89	FAIL
14	0.01	0.10	0.11	PASS
15	0.10	1.31	1.41	PASS
16	0.00	0.01	0.01	PASS
17	0.11	0.75	0.86	PASS
18	0.26	1.30	1.56	PASS
19	0.01	0.15	0.16	PASS
20	0.23	1.29	1.52	PASS
21	0.14	1.27	1.41	PASS
22	0.03	0.74	0.77	PASS
23	0.08	2.12	2.20	PASS
24	0.13	2.19	2.32	PASS
25	0.09	2.27	2.36	PASS
26	0.01	0.20	0.21	PASS
27	0.02	0.65	0.67	PASS
28	0.02	0.57	0.59	PASS
29	0.02	0.24	0.26	PASS
30	0.00	0.02	0.02	PASS
31	0.01	0.11	0.12	PASS
32	0.00	0.03	0.03	PASS
33	0.00	0.09	0.09	PASS
34	0.01	0.15	0.16	PASS
35	0.00	0.05	0.05	PASS

Configuration - Existing

LEGEND:

PASS = 3.0 or fewer events annually

FAIL = More than 3.0 events annually

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

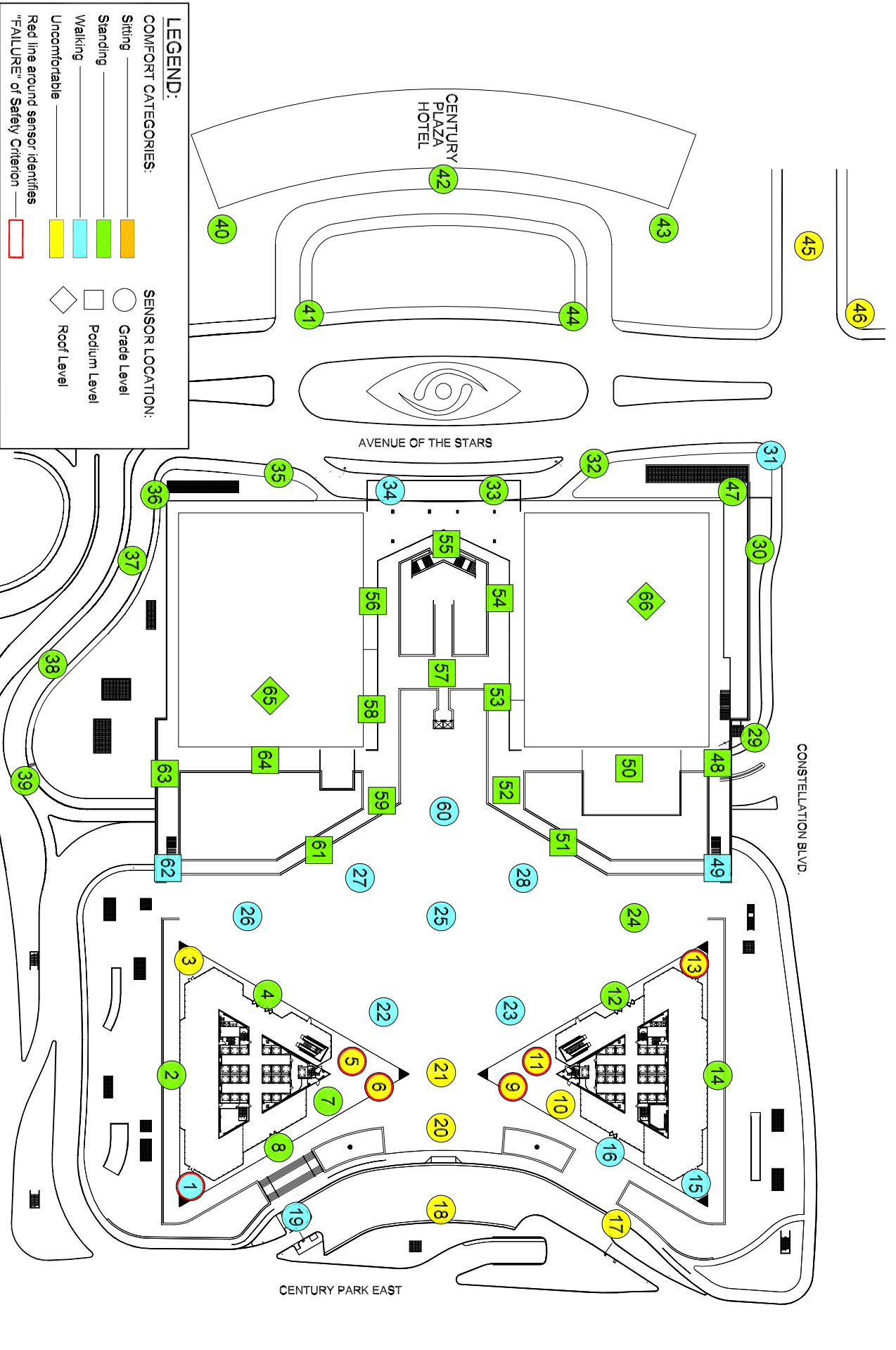
3 events annually is approx. 0.1% of the time

Table 2: Number of Severe Wind Events Occurring at the Pedestrian Level

Location	Summer	Winter	Annual	Safety Category Rating
36	0.00	0.03	0.03	PASS
37	0.00	0.00	0.00	PASS
38	0.00	0.00	0.00	PASS
39	0.00	0.02	0.02	PASS
40	0.00	0.06	0.06	PASS
41	0.01	0.08	0.09	PASS
42	0.00	0.01	0.01	PASS
43	0.05	0.28	0.33	PASS
44	0.04	0.24	0.28	PASS
45	0.15	1.08	1.23	PASS
46	0.07	0.55	0.62	PASS
47	0.01	0.05	0.06	PASS
48	0.03	0.44	0.47	PASS
49	0.03	0.46	0.49	PASS
50	0.00	0.16	0.16	PASS
51	0.03	0.59	0.62	PASS
52	0.02	0.35	0.37	PASS
53	0.00	0.11	0.11	PASS
54	0.00	0.01	0.01	PASS
55	0.00	0.05	0.05	PASS
56	0.00	0.30	0.30	PASS
57	0.00	0.12	0.12	PASS
58	0.00	0.14	0.14	PASS
59	0.01	0.28	0.29	PASS
60	0.02	0.64	0.66	PASS
61	0.01	0.29	0.30	PASS
62	0.01	0.13	0.14	PASS
63	0.00	0.08	0.08	PASS
64	0.00	0.31	0.31	PASS
65	0.00	0.01	0.01	PASS
66	0.00	0.05	0.05	PASS

Configuration - Existing

LEGEND:
 PASS = 3.0 or fewer events annually
 FAIL = More than 3.0 events annually
 Values are for the number of wind events per season greater than or equal to a gust wind speed of 55 mph
 3 events annually is approx. 0.1% of the time



Pedestrian Wind Condition - Summer

Century City Entertainment Center Redevelopment - Los Angeles, CA

Project #01-400

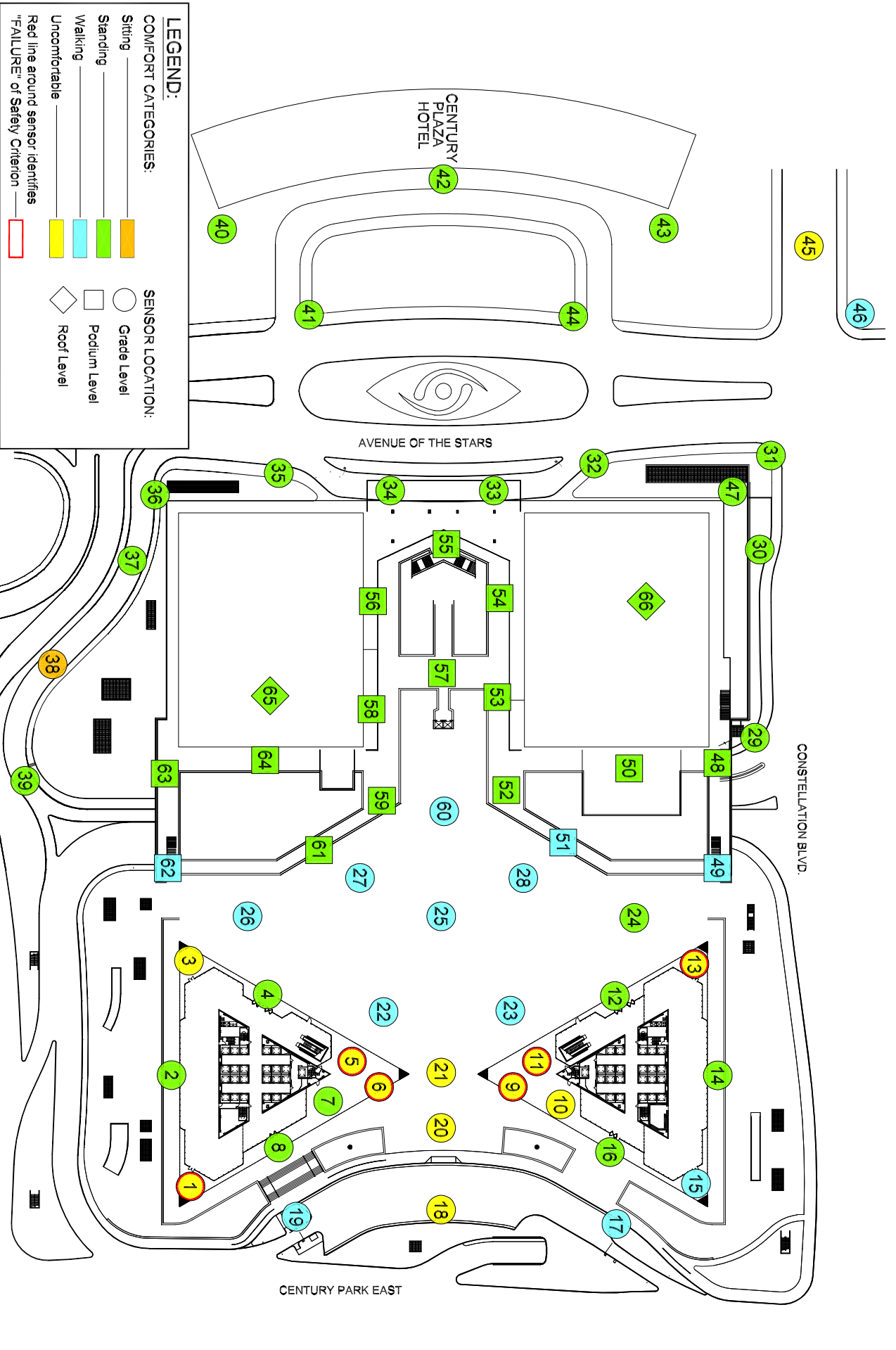


Drawn by: CAS Figure: 1

Approx. Scale: 1" = 130'

Date Revised: Mar. 29, 2001





Pedestrian Wind Condition - Winter



True North

Drawn by: CAS Figure: 2

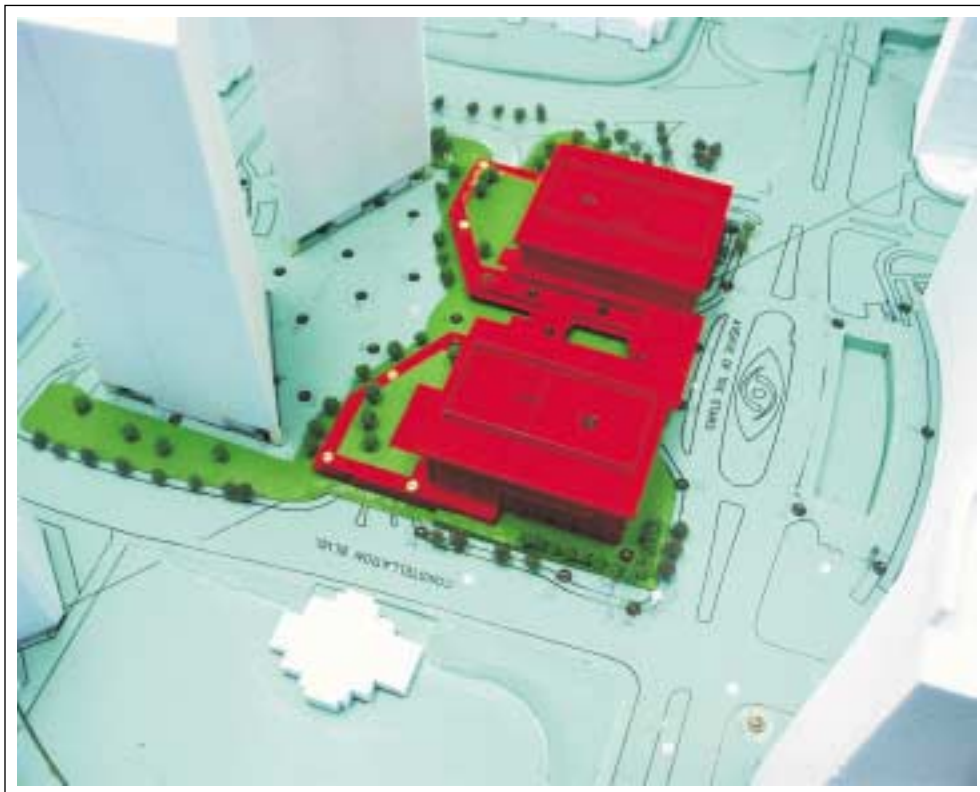
Approx. Scale: 1" = 130'

Date Revised: Mar. 29, 2001

Century City Entertainment Center Redevelopment - Los Angeles, CA

Project #01-400





Wind Tunnel Study Model
Existing Configuration

Century City Entertainment Center Redevelopment - L.A., CA

Project #01-400

Figure No.

3

Date:

April 10, 2001

RWDI