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FINAL REPORT

A WIND-TUNNEL STUDY OF PEDESTRIAN-LEVEL WIND SPEEDS FOR THE RENOVATION OF THE GETTY VILLA

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EXECUTIVE SUMMARY

A wind-tunnel study of the pedestrian-level wind environment was conducted for the proposed Getty Museum renovation project. The wind study used a one-inch equals 75 foot scaled model of the Getty Museum site and surrounding area of approximately one mile. The exact topography of the area was incorporated into the model. Tests were conducted for the most frequent and strongest wind directions. The Malibu meteorological monitoring station data, which was felt to be the most appropriate nearby station due to the complex topography terrain, was used to estimate full-scale wind speeds from the wind-tunnel data. The 10% exceeded full-scale wind speeds were calculated from a computer code analysis previously used extensively for San Francisco and Los Angeles areas. The code was adjusted for the prevailing wind conditions at the Getty Villa site.

The main objective of the test was to predict the wind speeds that would exist on the site for the determination of the various corresponding comfort levels. One hundred surface points were measured to evaluate the site. Using the test data as input to the computer code analysis, wind speeds were calculated for four different daily time intervals. (Note, there was little seasonal differences observed in the wind speed meteorological data; therefore, the time of day became the most important variable to examine.) The time intervals calculated were: 12-3 pm, 3-6 pm, 6-9 pm and the 24 hour daily average for a relative comparison. The results of the calculation are presented in four contour plots of 10% exceeded mean wind speed that correspond to the four time intervals.

Wind speeds less than 7 mph are appropriate for all pedestrian activities including amphitheater/outdoor seating areas, while wind speeds 7-11 mph are appropriate for mild walking. Wind speeds of 12-15 mph are acceptable for brisk walking activities; however would be unacceptable for sitting activities and may, on occasion, be uncomfortable for leisurely walking. For the 12-3 pm time interval, wind speeds would vary from 3 to 15 mph over the entire site. Wind speeds around the parking structure and associated walkway/s and the architectural dig simulation site would range from 11-15 mph and be inappropriate for seating activities 10% to 20% of the time. The amphitheater area and nearby restaurants would have wind speeds ranging from 5 to 9 mph and would be mostly acceptable for seating activities. The remaining majority of the site would have relatively lower wind speeds that would range from 3 to 9 mph, with the majority less than 6 mph, as shown in the Figure 1 contour plot of 10% exceeded mean wind speeds.

For the 3-6 pm time period, the wind speeds would be approximately 2 mph greater, in all areas, than the 12-3 pm case. Wind speeds would approach 18 mph around the guest parking garage walkway/s and would range from 14 to 17 mph at the architectural dig simulation site. This area would be where the highest wind speeds would be encountered at the overall Getty Museum site. These speeds would be unacceptable for seating activities and even unpleasant for 10% to 20% of the time for walking activities. The amphitheater area would have wind speeds that range from 6 to 12 mph while the nearby restaurant area would have wind speeds that range from 8 to 11 mph and would be unpleasant 20% to 30% of the time for leisurely or seating activities. The remainder of the site would have wind speeds from 6 to 11 mph as illustrated in the Figure 2 wind speed contours.

For the 6-9 pm time interval, wind speeds would vary from 3 to 15 mph over the entire site and would be very similar to the 12-3 pm time period. Wind speeds around the parking structure and associated walkway/s and the architectural dig simulation site would range from 11-15 mph and be inappropriate for seating activities 10% to 20% of the time. The amphitheater area and nearby restaurants would have wind speeds ranging from 5 to 9 mph and would be mostly acceptable for seating activities. The remaining majority of the site would have relatively lower wind speeds that would range from 3 to 9 mph, with the majority less than 6 mph, as shown in the Figure 3 contour plot of 10% exceeded mean wind speeds.

Figure 4 displays the 10% exceeded mean wind speed for the daily 24-hour interval. It is presented for the relative comparison of wind speeds of Figures 1, 2 and 3.

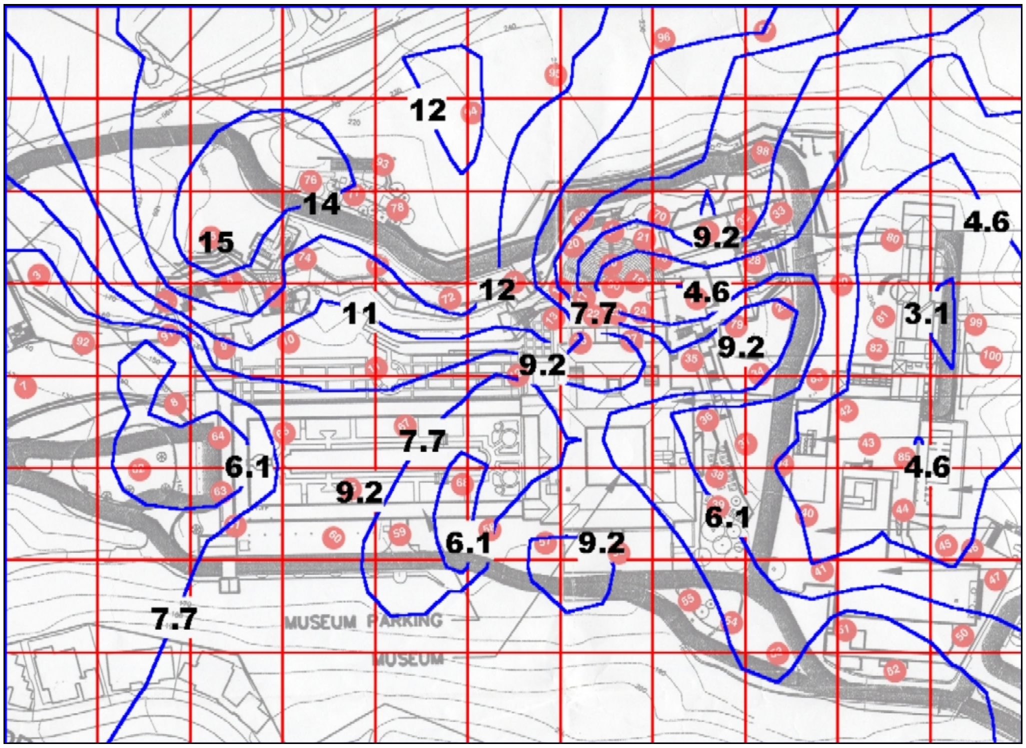

Figure 1. 10% Exceeded Mean Wind Speed Contours in MPH for 12:00 – 3:00 pm annually.

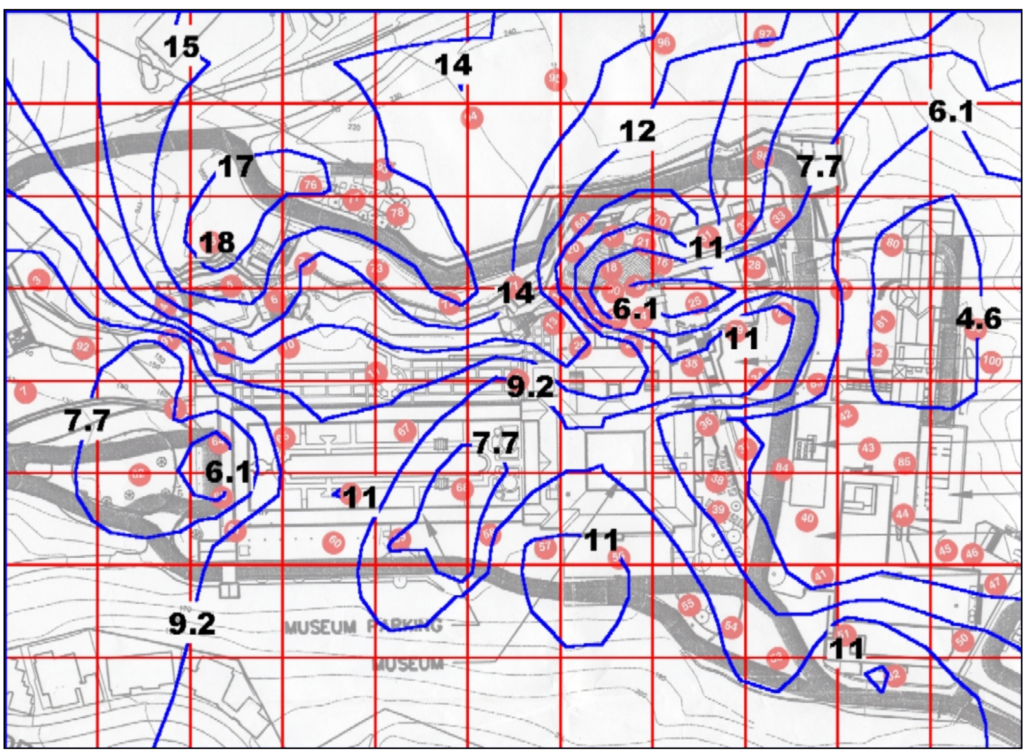

Figure 2. 10% Exceeded Mean Wind Speed Contours in MPH for 3:00 – 6:00 pm annually.

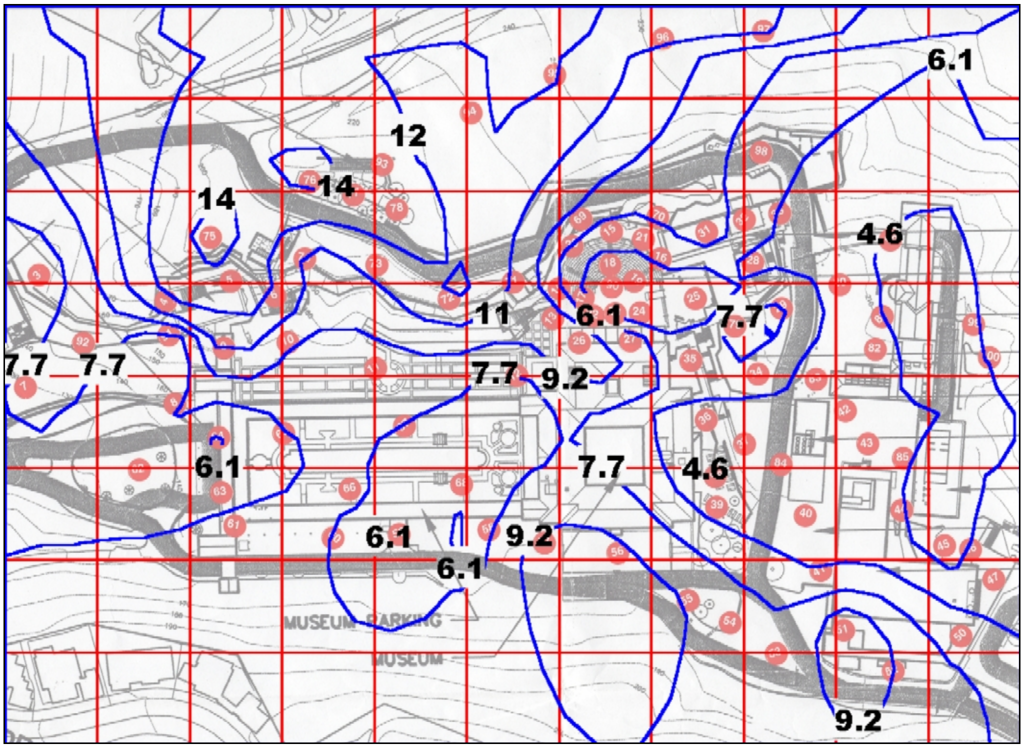

Figure 3. 10% Exceeded Mean Wind Speed Contours in MPH for 6:00 – 9:00 pm annually.

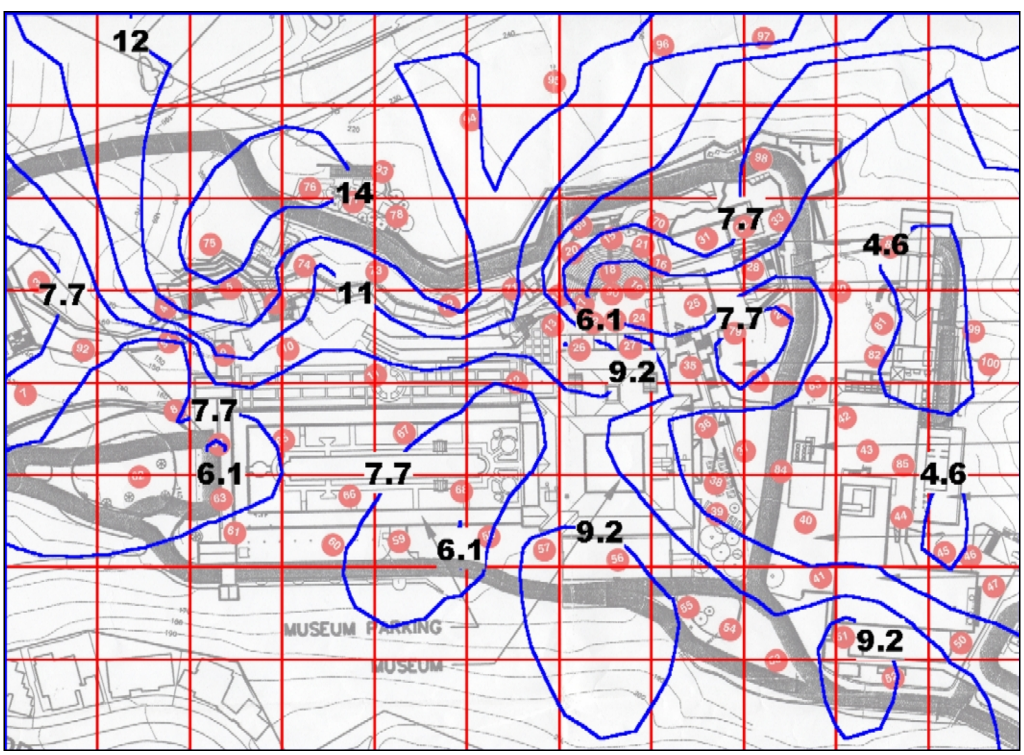

Figure 4. 10% Exceeded Mean Wind Speed Contours in MPH for 24 hour average annually.

1. INTRODUCTION

This report describes the methodology developed to address pedestrian-level winds in and around the Getty Villa renovation wind-tunnel study. The assessment is accomplished through wind-tunnel testing that couples full-scale meteorological data to physical modeling data. The primary application of this evaluation process is in the environmental impact assessment of proposed buildings and other construction projects that may substantially alter pedestrian-level winds in site areas. Working with the city of Los Angeles officials, guidelines for wind-testing procedures, analysis, and report-data presentation were established and these are methods employed in the present study. To date, since 1990, over twenty different wind-tunnel studies have been carried out by the author using this method, and it has been well received by the city of Los Angeles planning officials.

2. WIND ENVIRONMENT IN GETTY VILLA AREA

Wind in the Getty Villa area is monitored at several locations, including Malibu, Santa Monica and the Los Angeles International Airport. The Malibu meteorological monitoring station (South Coast Air Quality Management District Station No. 52104) was determined to best represent the wind environment at the Getty Villa site since it captured the north-south marine layer airflow that dominates the primarily east-west coastline that both Malibu and the Getty Villa site lie on. The marine layer air movement is driven by surface temperature differences between the land and ocean surfaces. Due to the relatively warmer ocean temperatures, than the San Francisco coast area for example, the annual variation in mean wind speeds is not substantial as illustrated in the meteorological data set (see Appendix X). Data describing the speed, direction, and frequency of occurrence of wind at the Malibu monitoring station were gathered hourly for 16 equally spaced wind directions for a one-year period from mid 1979 to mid 1980. Data from the station is recognized as being the highest quality and the most appropriate data available. The data from the Santa Monica area does not accurately describe the directional marine layer movement due to change in coastal alignment and the effect of local urban terrain. When using long-term records, it is important to select data recorded at a weather station whose monitoring height was high enough above ground level to minimize the influence of surface-level effects.

3. WIND EFFECTS OF COMPLEX TERRAIN FEATURES

The frequency of occurrence, speed, and level of turbulence of winds at street level are important to the comfort and safety of pedestrians in pedestrians areas. Tall structures or rapidly changing terrain may intercept the faster wind speeds that flow higher above the ground. Consequently, pedestrian-level wind speeds can be significantly changed when a taller structure, or sharply sloping terrain divert a portion of the higher-level wind speed either down the face of the structure or along the sloping terrain until that flow reaches pedestrian level. Because the diverted winds have higher speeds than those near the ground, the effects of those diverted winds can be substantial. Rough terrain, sometimes referred to as “complex terrain,” in and around Getty Villa site does rise many hundreds of feet above and below the Getty Villa buildings, and thus cause major accelerations of the wind speeds over the site that would otherwise not occur. Generally, as the heights of prevailing terrain in an area becomes more uniform, the ground-level effects of individual features and buildings in the area are reduced.

4. WIND-TUNNEL MODEL

A one-inch equals 75 foot scaled model was designed and built from the CAD plans provided at the beginning of the project. The model included exact topographic features over a diameter of about 3400 feet, with the center of the Getty Villa as the center of the turntable model. Areas beyond this diameter were simulated in the wind-tunnel test by “building “ the proper terrain topography, from seven and half minute USGS maps, for each wind direction that was tested. Winds speeds and turbulence intensities were measured at 100 representative locations in the test of the project for three prevailing wind directions. Figure 1 shows a photograph of the wind-tunnel model.

5. METHODOLOGY AND ASSUMPTIONS

For each surface wind-speed measurement made in the wind tunnel, it is desirable to estimate an associated full-scale wind speed frequency distribution. The determination of the full-scale wind distribution will, of course, depend upon the nature of the meteorological conditions at the site. For the present study, it was determined to use the full-scale mean wind speed exceeded 10% of the time from several different time periods during the day to determine its effect on the wind speed values. For the present test, four time periods were analyzed with the wind-tunnel data: i) the 24-hour a day interval; ii) the 12:00 p.m. to 3:00 p.m. interval; iii) the 3:00 p.m. to 6:00 p.m. interval; and, iv) the 6:00 p.m. to 9:00 p.m. interval. The meteorological data used were acquired at the weather station at the Malibu during the years 1979-1980 on an annual, hourly basis for 16 equally spaced wind directions. The measurements were taken hourly and averaged over one-minute time periods. Of the 16 measured wind directions, three primary wind directions comprised the greatest frequency of occurrence as well as the majority of strong wind occurrences. These wind directions were northeast (included the north-northeast and east-northeast wind directions), south (included the south-southeast and south-southwest wind directions); and west-southwest (included the southwest and west directions), These three wind sectors had associated occurrence rates of 36.2%, 18.8% and 29.0%, respectively, thus totaling 84% of all wind occurrences. The remaining wind directions comprised the other 16% frequency of occurrence. Calm conditions were distributed incrementally into all of the time.

In order to determine whether equivalent wind speeds are acceptable at specific locations, it is necessary to establish a set of "comfort" criteria that defines wind speeds that are usually acceptable for specific pedestrian uses. The term "10% exceeded speed" is used in the criteria to account for the frequency with which winds occur. The 10% exceeded speed is the speed that is exceeded on one day out of 10, or 10% of the time, for the specified time interval being considered, i.e., 3:00 p.m. to 6:00 p.m.

The wind intensity is defined in terms of the equivalent wind speed. This term denotes the wind speed averaged over an hour (hourly mean wind speed), modified to include the level of gustiness, or turbulence, expected on the site. The equivalent wind speed calculated in the present context assumes an unaltered wind with an inherent turbulence intensity of 15% of the hourly mean wind-speed value. The turbulence intensity is defined as the root mean square of the instantaneous deviations from the value of the mean velocity, divided by the mean velocity value. When turbulence intensity as a street level point is greater than 15%, the mean velocity for that point is multiplied by two times the turbulence intensity plus 0.7 to create the equivalent wind speed for that point. This equation follows relationships developed by Hunt et al. (1976) and Jackson (1978) in which winds with different turbulence intensities were compared to each other for their effects on pedestrians.

The method used to estimate the full-scale 10% exceeded wind speed assumed the ratio of pedestrian-level wind speed to reference height speed (both in the wind tunnel) was equal to the same ratio in full scale. The reference height used corresponds to the height of the weather station at the Malibu monitoring station (32 feet). The average of the measured wind-tunnel wind ratios for the three tested wind directions (at a given position and setting) was assumed to be the average wind ratio of the 13 untested wind directions. The justification for this procedure is that there is a symmetry-of-sorts of the wind flow, and although the technique is not 100% accurate, it does provide a reasonable estimate of the average wind speed that would occur from the untested 13 wind directions. Thus, the weighted cumulative averaged pedestrian-level 10% exceeded wind speed calculations account for all wind directions.

The ratio of the reference height wind speed to the wind speed at pedestrian-level is calculated from the results of the wind-tunnel experiment for each major direction at each observation location. For each, the calculation procedure to determine a given percent exceeded wind speed (in the present case this is 10%) involves three steps. First, a pedestrian-level wind speed is selected. Second, the specific pedestrian-level wind speed is used to calculate the reference height wind speed for each wind speed component (using the ratios from the wind-tunnel experiment). Third, the meteorological data is used to determine the percentage of time each of the reference level wind speeds is exceeded. The three steps are iterated, with changes in the pedestrian-level wind speed, until the percentage of the time the winds are exceeded equals the selected percentage of time, thus yielding the selected percent exceeded wind speed. The process may be repeated numerous times in 1% increments to develop pedestrian level wind speed frequency distributions.

For the present case, the 10% exceeded pedestrian-level wind speed is determined from wind-tunnel measurements made for the three wind directions. The wind-tunnel speed is scaled to the full-scale speed by use of the power-law relationship given by Davenport (1961). The Malibu meteorological data is used to find the distribution of speed as a function of time based on the wind-tunnel speed ratio. The meteorological data is adjusted to the appropriate α, power-law coefficient value which is set depending upon the local terrain of the test area; i.e., from Malibu conditions: $\alpha = 0.2 . \delta = 500$ feet

The individual wind direction meteorological data is expressed as a cumulative frequency distribution which is reasonably well described by the relation, N=exp(k1 log(S) + k2) where N is the number of hourly observations, or percent of total time, the wind speed exceeds the value S. S is the wind speed of interest; i.e., 11 mph, and k1, k2 are empirical constants fit to the data. The cumulative full-scale frequency distribution of wind, at a height of 32 feet, is then calculated and the desired percent-exceeded wind speed is mathematically described.

6. PRESENTATION OF RESULTS

The wind-tunnel test results are presented in table form as output from the computer program. Appendix 2 displays an output for four time intervals computed for the 100 locations. The 10% exceeded pedestrian-level wind speed (mph) is calculated and shown after the location column. The appropriate criterion is listed in the next column to the right (it is adjustable depending upon the location and in this sample case set to 11 mph). Next, the wind-tunnel speed ratios and corresponding contributions are presented for the three tested wind directions (northeast, south or southwest) and the “other” column is the average of the three test cases that is used to account for the untested cases, which accounts for only 14% of all occurrences. The contributions indicated the weighting of each 10% exceeded pedestrian-level wind speed calculated. For example, for location 1, 89.7% of the 10.59 mph wind speed is contributed from the west prevailing wind direction. In this way, the major influencing wind directions can be identified and the validity of not testing all wind directions can be determined; i.e., in Location #1, only 0.8% of the 10.59 mph is estimated to be caused by the untested wind directions.

These data of Appendix 2 are from a proposed high-rise structure in the heart of downtown Los Angeles near the intersection of Seventh and Figueroa Streets. For the existing setting Location

#2 exceeds the 11-mph criterion 1.0% of the time resulting in 10% exceeded pedestrian level wind of 11.19 mph, with 95.5% contribution coming from the west wind direction. In the project setting location #2 has an 11.79 mph wind with 2% exceedance of the criterion. Location #1 appears as a 13.40 mph 10% exceeded wind speed with a 5.0% exceedance of the 11-mph criterion, with 93.4% of the exceedance being attributed to the west wind. In the existing setting there was an exceedance for location #1.

In this fashion, a detailed analysis of the future wind environment around a site can be analyzed locating critical areas and the specific wind directions and frequencies that would create the condition. In this manner, intelligent planning decisions may be made that are based on quantitative data and not subjective opinions.

7. INTERPRETATION OF RESULTS

A set of “comfort” criteria defines equivalent wind speeds that are usually acceptable for specific pedestrian uses. The term “10% exceeded speed” is used in these criteria to account for the frequency with which such “equivalent” winds occur. The city of Los Angeles officials have agreed to the following criteria for recent wind-tunnel studies carried out by the author (White, 1991 and 1994). These should also be appropriate for the Getty Villa site as well: 10% exceeded speeds of 7 mph and less will be considered as comfortable for outdoor seating. Those 10% exceeded speed of 11 mph and less will be considered comfortable for standing and leisure walking, while those between 12 and 15 mph will be suitable for walking and other occasional uses. Ten percent exceeded speeds is excess of 15 mph will result in potentially uncomfortable pedestrian conditions. Ten percent exceeded speeds reaching or exceeding 36 mph create potential safety hazards for pedestrians.

The seating criterion of 7 mph equivalent wind speed not to be exceeded more than 10% of the time year round between 8 a.m. and 7 p.m. was based on the wind-speed seating criterion given by Penwarden (1973), Melbourne (1978), Arens (1981) and Arens et al. (1989). The interval time of interest was chosen when most of the population would be exposed to the wind. It was essentially an environmental quality decision based on the study of wind related complaints in shopping centers (Penwarden, 1973). Penwarden found that most complaints occurred when the limit of comfort (7 mph) was exceeded more than 10% of the time. The same also was found to be true for the 11-mph and 15-mph comfort criteria.

Additionally, Penwarden's suggestions for the onset of discomfort were based on mean speeds and did not contain effects of turbulence or gustiness in his assessment. This is precisely the reason the current method uses equivalent wind speeds instead of the mean speed. The equivalent wind speed incorporates the effects of turbulence to estimate what a mean wind speed with a 15% turbulence intensity (the unaltered value) would feel like or be equivalent to when turbulence effects are incorporated. This procedure follows the ideas of estimating equivalent wind speeds with variable levels of turbulence presented by Hunt et. al. (1976) in which winds of different turbulence intensities were compared to each other for their effects on pedestrians.

8. WIND-TUNNEL MEASUREMENTS

Wind speed and the corresponding turbulence intensity were measured using a TSI, Inc. Model 1210 single hot-wire anemometer probe. Using a LabVIEW data-acquisition system, data was acquired and digitally recorded for each measurement point at a sample rate of 1000 Hz for 30 seconds. This yielded 30,000 individual voltage values that were individually converted to instantaneous wind speed according to a hot-wire calibration curve that was acquired before the testing commenced. The 30,000 samples were then averaged to produce a single mean surface wind speed and the root-mean-square value for the turbulence intensity. The resulting mean speeds and turbulence intensities represent one-hour full-scale average time measurements when the wind-tunnel data is converted to the full scale.

The majority of the testing centered on the areas around the amphitheater, pedestrian walkways, outdoor eating areas, and suspected areas in which strong winds might be of concern. Tests were conducted for the three wind directions: south, southwest and east-northeast, which according to the wind data from the Malibu monitoring station were found to be the strongest and most frequent winds. The referred wind data are given in Appendix 3.

For each wind direction tested, the approach wind speed, as a function of height above the ground (boundary-layer velocity profile), was non-dimensionally simulated in the wind tunnel based upon the upwind surface terrain-roughness features (i.e., terrain up to 3000 feet upwind were modeled). This technique is known to provide accurate surface wind speed simulation of the full-scale case. Mean wind speeds and the fluctuating components of the speeds (i.e., turbulence intensities) were measured at 100 surface locations distributed around the Getty Museum renovation site. Figure 3 represents a contour map of the scaled models with the location points superimposed over the chosen test area.

A first step in the analysis (with the wind-tunnel data) was to measure the ratio of equivalent wind-speed to a reference height. This ratio is referred to as the "wind-speed ratio" or R-value. This particular value represents a pedestrian-level wind-speed magnitude that accounts for the effects of the local turbulence. A second step in the analysis is to input the wind-speed ratios into the computer code that integrates and scales the measured wind data with full-scale meteorological data to produce an averaged full-scale 10% exceeded equivalent wind speed. Using values of pedestrian-level turbulence measured in the wind-tunnel tests, full-scale 10% exceeded ground speeds were then numerically calculated. A collection of output files is provided as an attachment to this report. The description at the top of each attachment refers to the San Francisco Wind Ordinance Code for pedestrian comfort criteria, which was modified to account for the full-scale winds measured at the Malibu monitoring station. This computer code was originally developed by the city of San Francisco; however, it may be used for other cities/areas if appropriate adjustments are made to the full-scale meteorological data set, which have been performed for the present Getty Villa calculations.

9. DISCUSSION OF WIND-TUNNEL RESULTS

Contour plots of 10% exceeded mean wind speeds (in mph) are used to display the results for specific times during the day in Figures 1 through 3, and Figure 4 shows a contour plot of the

10% exceeded for the 24 hour period. The contours of each time frame represent the average conditions for the entire year and do not take into account seasonal effects. However, seasonal changes during the same time are small; and, accordingly, the time of day has a greater influence on the speeds than the seasonal variation. Standards for acceptable wind speeds have been determined both from previous testing and conducted studies of wind speeds as they relate to consumer comfort (Arens et al. 1989; White 1991 & 1994). Wind speeds under 7 mph are ideal for outdoor seating areas and wind speeds below 11 mph are comfortable for leisurely walking, wind speeds between 11 and 15 mph are generally acceptable for vigorous walking activities, although wind speeds greater than 15 mph can become uncomfortable for outdoor activities and even hazardous.

Figure 1 shows a contour of the wind speeds superimposed on a map of the proposed Getty Museum renovation site between the hours of 12-3 pm. Conditions in the courtyard and around the main structure maintain speeds between 4 and 9 mph in most of these areas, and are acceptable for walking but can be uncomfortable for seating. Areas of concern, however, include the amphitheater, its surrounding area and the area by the dig site and the walkway leading to the site. Values here range from 7 to 12 mph and may be unpleasant for seated activities held in the vicinity.

From 3-6pm, shown in Figure 6, the wind speeds increase over the entire area which are about 2 mph greater than the 12- 3 pm wind speeds. During this time, the areas surrounding the building and inside the courtyard are bordering uncomfortable for walking as speeds approach 11 mph, and the amphitheatre and adjacent outdoor restaurant areas would become unpleasant for seating. The winds around the dig site increase from a maximum of 15 mph for the 12-3 pm case to a maximum of 18 mph near the stairway. The conditions there may be unpleasant even for walking.

Wind velocities would decrease during the 6-9 pm time, as seen from Figure 3, and closely resemble the 12-3 pm case. Speeds around the museum's main building would remain below 10 mph. The amphitheater would be more pleasant with wind speeds less than 9 mph, although at the top of the amphitheater, near the dig site and stairway-walkway leading to the site, the wind speeds would increase to values between 9 and 14 mph. However, this situation still would be milder than the values obtained for the 12-3 pm case. The seating area adjacent to the theatre would be comfortable for seating, as wind speeds would not exceed 9 mph.

Figure 8 illustrates average wind velocities for a 24-hour period, and its contours are only slightly higher than those in Figure 7. The outside courtyard and walkways surrounding the main building would be comfortable for walking as wind speeds would be generally under 11 mph. Wind speeds near the upper level of the amphitheatre would exceed 9 mph, however, conditions would be more comfortable for seating below. The restaurant area would have wind speeds of 6 to 8 mph, making it only slightly uncomfortable for outdoor seating. The area near the dig site continues to be of concern as wind speeds would reach 14 mph.

10. SUMMARY AND CONCLUDING REMARKS

The present wind-tunnel investigation was performed in the Atmospheric Boundary Layer Wind Tunnel (ABLWT) located at University of California, Davis (UCD). The study was independent of the University. A detailed description of the facility is given in Appendix B. Testing was conducted using a one inch on the model equals 75 feet full scale) scaled-model built on a 1.15-m diameter turntable base and centered on Getty Museum. Figure B-1 presents a photo of the model installed inside the wind-tunnel test section. In full scale, the model would encompasses an area with a diameter of over one mile feet, which includes not only buildings of the Getty Museum but also the Amphitheater, the entrance gate, other buildings in the area and surrounding terrain. A small model scale was chosen due to the complexity of the terrain.

Since models used in a wind-tunnel simulation are typically orders of magnitude smaller than the full-scale object, it is not obvious that the results obtained will be corresponding to nature. However, results from wind-tunnel tests can be representative to full-scale conditions, as long as critical simulation of flow parameters between the model and full-scale are satisfied. For exact modeling, all flow parameters should be matched, which is impracticable, if not impossible. Thus, similitude parameters, critical to the modeling of the present wind-tunnel simulation, must be selected.

A wind-tunnel study of the pedestrian-level wind environment was conducted for the proposed Getty Museum renovation project. Tests were conducted for the most frequent and strongest wind directions. The Malibu meteorological monitoring station data, which was felt to be the most appropriate nearby station due to the complex topography terrain, was used to estimate full-scale wind speeds from the wind-tunnel data. The 10% exceeded full-scale wind speeds were calculated from a computer code analysis previously used extensively for San Francisco and Los Angeles areas. The code was adjusted for the prevailing wind conditions at the Getty Villa site.

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For the 3-6 pm time period, the wind speeds would be approximately 2 mph greater, at all areas, than the 12-3 pm case. Wind speeds would approach 18 mph around the guest parking garage walkway/s and would range from 14 to 17 mph at the architectural dig simulation site. This area would be where the highest wind speeds would be encountered at the overall Getty Museum site. These speeds would be unacceptable for seating activities and even unpleasant for 10% to 20% of the time for walking activities. The amphitheater area would have wind speeds that range from 6 to 12 mp,h while the nearby restaurant area would have wind speeds that range from 8 to 11 mph and would be unpleasant 20% to 30% of the time for leisurely or seating activities. The remainder of the site would have wind speeds from 6 to 11 mph as illustrated in the Figure 2 wind speed contours.

For the 6-9 pm time interval, wind speeds would vary from 3 to 15 mph over the entire site and would be very similar to the 12-3 pm time period. Wind speeds around the parking structure and associated walkway/s and the architectural dig simulation site would range from 11-15 mph and be inappropriate for seating activities 10% to 20% of the time. The amphitheater area and nearby restaurants would have wind speeds ranging from 5 to 9 mph and would be mostly acceptable for seating activities. The remaining majority of the site would have relatively lower wind speeds that would range from 3 to 9 mph, with the majority less than 6 mph, as shown in the Figure 3 contour plot of 10% exceeded mean wind speeds.

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Meteorological Data to be added in pdf format.

Figures and Miscellaneous

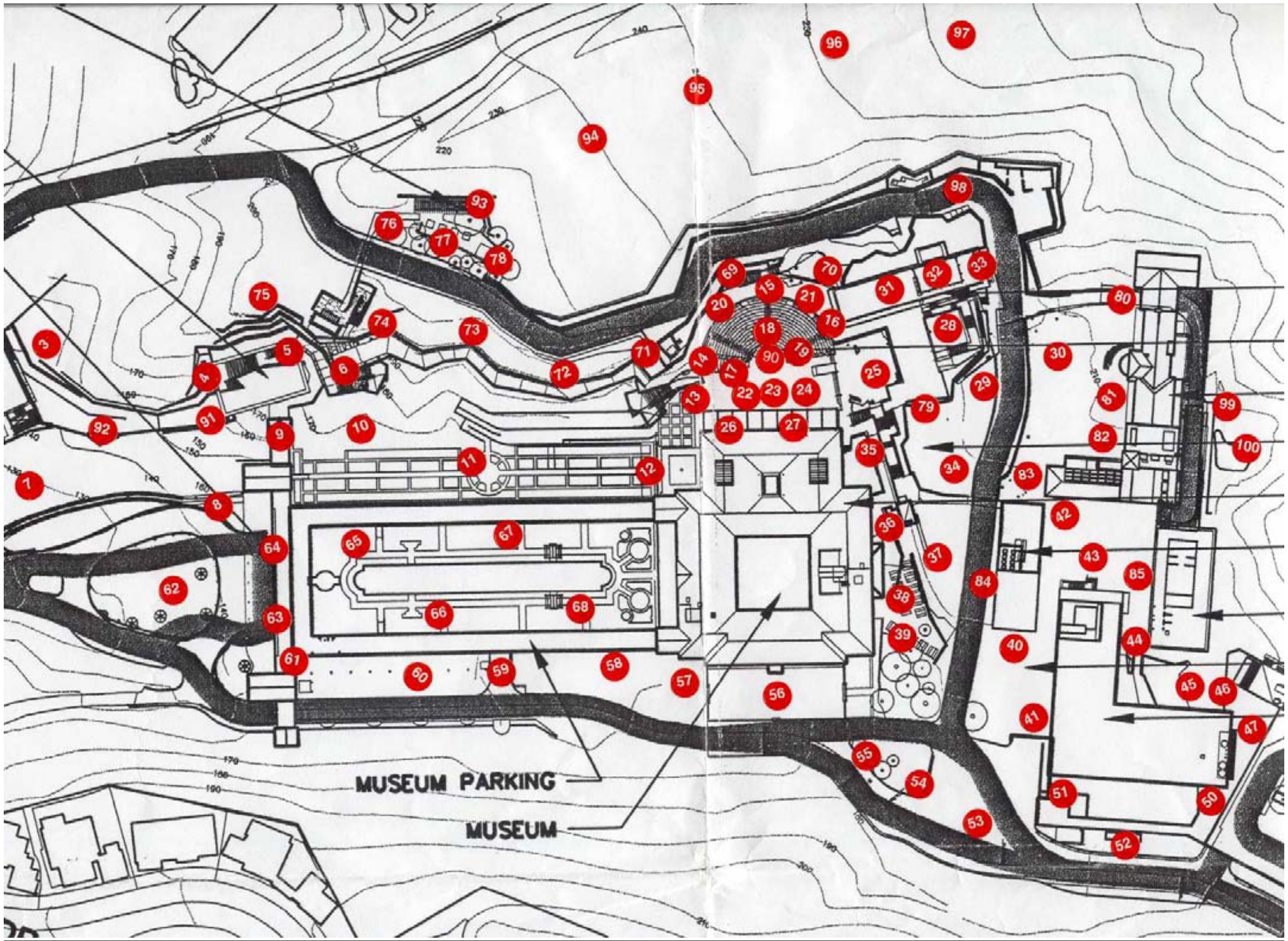

Figure 5. **Location of the surface measurement points for the computer calculations.**

Figure 6. Photograph of the wind-tunnel model of the Getty Villa site, scale is one inch equal 75 feet.

Figure 7. Photograph of the wind-tunnel model.

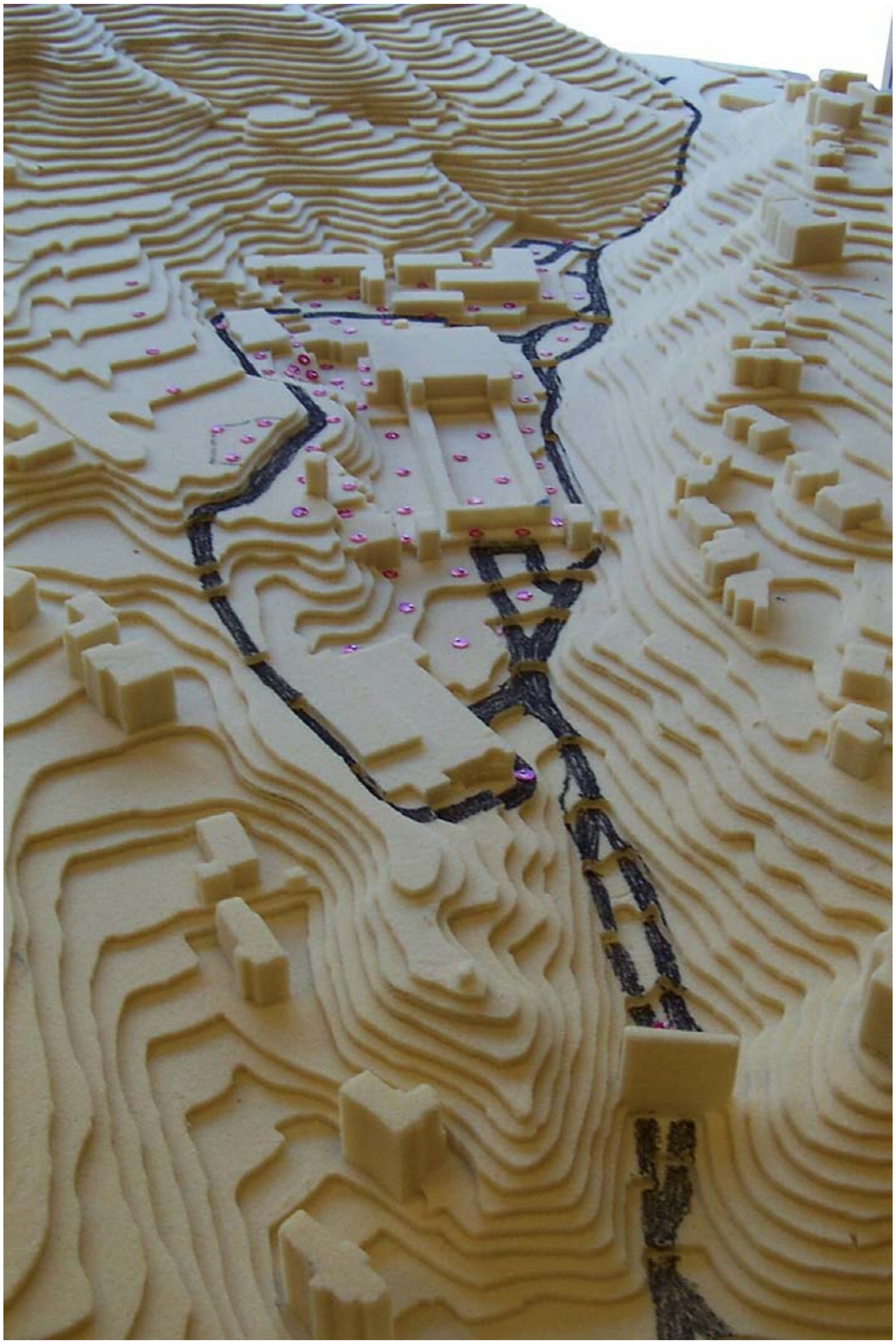

Figure 8. Photograph of wind-tunnel model illustrating complex terrain.

APPENDIX A:

WIND TUNNEL REDUCED DATA SETS

Wind-tunnel data to be added here.

APPENDIX B: THE ATMOSPHERIC BOUNDARY LAYER WIND

In the present investigation, the Atmospheric Boundary Layer Wind Tunnel (ABLWT) located at University of California, Davis was used (Figure B-1). Built in 1979 the wind tunnel was originally designed to simulate turbulent boundary layers comparable to wind flow near the surface of the earth. In order to achieve this effect, the tunnel requires a long flow-development section such that a mature boundary-layer flow is produced at the test section. The wind tunnel is an open-return type with an overall length of 21.3 m and is composed of five sections: the entrance, the flow-development section, the test section, the diffuser section, and the fan and motor.

The entrance section is elliptical in shape with a smooth contraction area that minimizes the free-stream turbulence of the incoming flow. Following the contraction area is a commercially available air filter that reduces large-scale pressure fluctuations of the flow and filters larger-size particles out of the incoming flow. Behind the filter, a honeycomb flow straightener is used to reduce large-scale turbulence.

The flow development section is 12.2 m long with an adjustable ceiling for longitudinal pressure-gradient control. For the present study, the ceiling was diverged ceiling so that a zero-pressure-gradient condition is formed in the stream wise direction. At the leading edge of the section immediately following the honeycomb flow straightener, four triangularly shaped spires are stationed on the wind-tunnel floor to provide favorable turbulent characteristics in the boundary-layer flow. Roughness elements are then placed all over the floor of this section to artificially thicken the boundary layer. For a free-stream wind speed of 4.0 m/s, the wind-tunnel boundary layer grows to a height of one meter at the test section. With a thick boundary layer, larger models could be tested and thus measurements could be made at higher resolution.

Dimensions of the test section are 2.44 m in stream wise length, 1.66 m high, and 1.18 m wide. Similar to the flow-development section, the test section ceiling can also be adjusted to obtain the desired stream wise pressure gradient. Experiments can be observed from both sides of the test section through framed Plexiglas windows. One of the windows is also a sliding door that allows access into the test section. When closed twelve clamps distributed over the top and lower edges are used to seal the door. Inside the test section, a three-dimensional probe-positioning system is installed at the ceiling to provide fast and accurate sensor placement. The traversing system scissor-type extensions, which provide vertical probe motion, are also made of aerodynamically shaped struts to minimize flow disturbances.

The diffuser section is 2.37 m long and has an expansion area that provides a continuous transition from the rectangular cross-section of the test section to the circular cross-sectional area of the fan. To eliminate upstream swirl effects from the fan and avoid flow separation in the diffuser section, fiberboard and honeycomb flow straighteners are placed between the fan and diffuser sections.

The fan consists of eight constant-pitch blades 1.83 m in diameter and is powered by a 56 kW (75 hp) variable-speed DC motor. A dual belt and pulley drive system is used to couple the motor and the fan.

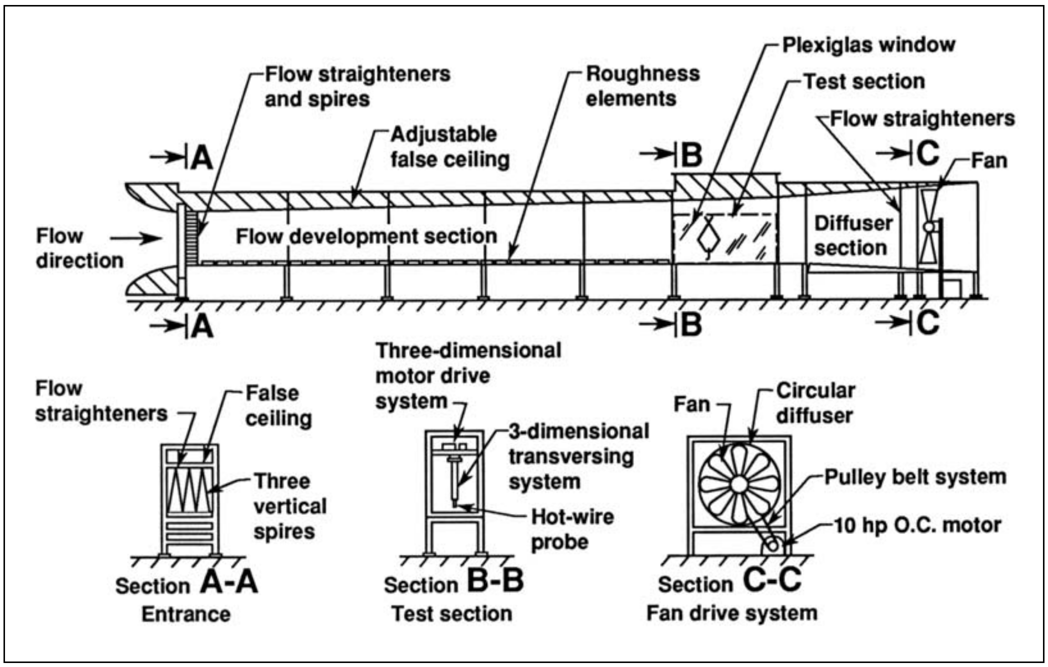

Figure B-1: Schematic diagram of the UC Davis Atmospheric Boundary Layer Wind Tunnel.

APPENDIX C:
WIND-TUNNEL ATMOSPHERIC FLOW SIMILARITY PARAMETERS

Wind-tunnel models of a particular test site are typically several orders of magnitude smaller than the full-scale size. In order to appropriately simulate atmospheric winds in the U.C. Davis Atmospheric Boundary Layer Wind Tunnel (ABLWT), certain flow parameters must be satisfied between a model and its corresponding full-scale equivalent. Similitude parameters can be obtained by non-dimensionalizing the equations of motion, which build the starting point for the similarity analysis. Fluid motion can be described by the following time-averaged equations.

Conservation of mass:

$$\frac{\partial \overline{U}_i}{\partial t_i} = 0 \text{ and } \frac{\partial \rho}{\partial t} + \frac{\partial(\rho \overline{U}_i)}{\partial x_i} = 0$$

Conservation of momentum:

$$\frac{\partial \overline{U}_i}{\partial t} + \overline{u}\ \frac{\partial \overline{U}_i}{\partial x_j} + 2\varepsilon_{ijk}\Omega_j \overline{U}_k = -\frac{1}{\rho_0}\frac{\partial \overline{\delta P}}{\partial x_i} - \frac{\overline{\delta T}}{T_0} g\delta_{i3} + \nu_0 \frac{\partial^2 \overline{U}_i}{\partial x_j} + \frac{\partial(\overline{-u_j u_i})}{\partial x_j}$$

Conservation of energy:

$$\frac{\partial \overline{\delta T}}{\partial t} + \overline{U}_i \frac{\partial \overline{\delta T}}{\partial x_i} = \left[\frac{\kappa_0}{\rho_0 c_{p_0}}\right] \frac{\partial^2 \overline{\delta T}}{\partial x_k \partial x_k} + \frac{\partial(\overline{-\theta u_i})}{\partial x_i} + \frac{\overline{\phi}}{\rho_0 c_{p_0}}$$

Here, the mean quantities are represented by capital letters while the fluctuating values by small letters. δP is the deviation of pressure in a neutral atmosphere. ρ_0 and T_0 are the density and temperature of a neutral atmosphere and ν_0 is the kinematic viscosity. In the equation for the conservation of energy, ϕ is the dissipation function, $\overline{\delta T}$ is the deviation of temperature from the temperature of a neutral atmosphere, κ_0 is the thermal diffusivity, and c_{p_o} is the heat capacity.

Applying the Boussinesq density approximation, application of the equations is then restricted to fluid flows where $\overline{\delta T} << T_0$. Defining the following non-dimensional quantities and then substituting into the above equations.

$$\overline{U}_i' = \overline{U}_i' / U_0 \ ;\ u_i' = u_i / U_0 \ ;\ x_i' = x_i / L_0 \ ;\ t' = tU_0 / L_0 \ ;\ \Omega_j' = \Omega_j / \Omega_0 \ ;\ \overline{\delta P}' = \overline{\delta P} / \rho_0 U_0^2 \ ;$$

$$\overline{\delta T}' = \overline{\delta T} / \delta T_0 \ ;\ g' = g / g_0 \ ;\ \overline{\varphi}' = \overline{\varphi} / \varphi_0$$

The equations of motion can be presented in the following dimensionless forms.

Continuity Equation:

$$\frac{\partial u_i'}{\partial k_i'} = 0 \text{ and } \frac{\partial \rho'}{\partial t'} + \frac{\partial(\rho' u_i')}{\partial x_i'} = 0$$

Momentum Equation:

$$\frac{\partial \overline{U}_i'}{\partial t'} + \overline{U}_j' \frac{\partial \overline{U}_i'}{\partial x_j'} + \frac{2}{Ro} \varepsilon_{ijk} \overline{U}_k' \Omega_j' = -\frac{\partial \overline{\delta P}'}{\partial x_i'} + \frac{1}{Fr^2} \overline{\delta T}' \delta_{3i} + \frac{1}{Re} \frac{\partial^2 \overline{U}_i'}{\partial x_j' \partial x_j'} + \frac{\partial(\overline{-u_j' u_i'})}{\partial x_j'}$$

Turbulent Energy Equation:

$$\frac{\partial \overline{\delta T}'}{\partial t'} + \overline{U}_i' \frac{\partial \overline{\delta T}'}{\partial x_i'} = Pr \cdot \frac{1}{Re} \frac{\partial^2 \overline{\delta T}'}{\partial x_k' \partial x_k'} + \frac{\partial(-\overline{\theta' u_i'})}{\partial x_i'} + \frac{1}{Re} \cdot Ec \cdot \overline{\varphi}'$$

Although the continuity equation gives no similarity parameters, coefficients from both other equations do provide the following desired similarity parameters.

1. Rossby number: $R_0 \equiv U_0 / L_0 \Omega_0$
2. Densimetric Froude number: $Fr \equiv U_0 / (g L_0 \delta T_0 / T_0)^{1/2}$
3. Prandtl number: $Pr \equiv \rho_0 c_{p_0} \nu_0 / \kappa_0$
4. Eckert number: $Ec \equiv U_0^2 / c_{p_0} \delta T_0$
5. Reynolds number: $Re \equiv U_0 L_0 / \nu_0$

In the dimensionless momentum equation, the Rossby number is extracted from the denominator of the third term on the left hand side. The Rossby number represents the ratio of advective acceleration to Coriolis acceleration due to the rotation of the earth. If the Rossby number is large, Coriolis accelerations are small. Since UC Davis ABLWT is not rotating, the Rossby number is infinite allowing the corresponding term in the dimensionless momentum equation to approach zero. In nature, however, the rotation of the earth influences the upper layers of the atmosphere; thus, the Rossby number is small and becomes important to match, and the corresponding term in the momentum equation is sustained.

Most modelers have assumed the Rossby number to be large, thus, neglecting the respective term in the equations of motion and ignoring the Rossby number as a criterion for modeling. Snyder (1981) showed that the characteristic length scale, L_0, must be smaller than 5 km in order to simulate diffusion under neutral or stable conditions in relatively flat terrain. Other researchers discovered similar findings. Since UC Davis ABLWT produces a boundary layer with a height of about one meter, the surface layer vertically extends 10 to 15 cm above the ground. In this region the velocity spectrum would be accurately modeled. The Rossby number can then be ignored in this region. Since testing is limited to the lower 10% to 15% of the boundary layer, the length in longitudinal direction, which can be modeled, has to be no more than a few kilometers.

Derived from the denominator of the second term on the right hand side of the dimensionless momentum equation, the square of the Froude number represents the ratio of inertial forces to buoyancy forces. High values of the Froude number infer that the inertial forces are dominant. For values equal or less than unity, thermal effects become important. Since the conditions inside the UC Davis ABLWT are inherently isothermal, the wind tunnel generates a neutrally stable boundary layer; hence, the Froude number is infinitely large allowing the respective term in the momentum equation to approach zero.

The third parameter is the Prandtl number, which is automatically matched between the wind-tunnel flow and full-scale winds if the same fluid is been used. The Eckert number criterion is important only in compressible flow, which is not of interest for a low-speed wind tunnel.

Reynolds number represents the ratio of inertial to viscous forces. The reduced scale of a wind tunnel model results in a Reynolds number several orders of magnitude smaller than in full scale. Thus, viscous forces are more dominant in the model than in nature. No atmospheric flow could be modeled, if strict adherence to the Reynolds number criterion was required. However, several arguments have been made to justify the use of a smaller Reynolds number in a model. These arguments include laminar flow analogy, Reynolds number independence, and dissipation scaling. With the absence of thermal and Coriolis effects, several test results have shown that the scaled model flow will be dynamically similar to the full-scale case if a critical Reynolds number is larger than a minimum independence value. The gross structure of turbulence is similar over a wide range of Reynolds numbers. Nearly all modelers use this approach today.

APPENDIX D:
WIND-TUNNEL ATMOSPHERIC BOUNDARY-LAYER SIMILARITY

Wind-tunnel simulation of the atmospheric boundary layer under neutrally stable conditions must also meet non-dimensional boundary-layer similarity parameters between the scaled-model flow and its full-scale counterpart. The most important conditions are:

1. The normalized mean velocity, turbulence intensity, and turbulent energy profiles.

2. The roughness Reynolds number, $Re_z = z_0 u_* / \nu$.

3. Jensen's length-scale criterion of z_0/H.

4. The ratio of H/δ for H greater than $H/\delta > 0.2$.

In the turbulent core of a neutrally stable atmospheric boundary layer, the relationship between the local flow velocity, U, versus its corresponding height, z, may be represented by the following velocity-profile equation.

$$\frac{U}{U_\infty} = \left(\frac{z}{\delta}\right)^\alpha$$

Here, U_∞ is the mean velocity of the inviscid flow above the boundary layer, δ is the height of the boundary layer, and α is the power-law exponent, which represents the upwind surface conditions. Wind-tunnel flow can be shaped such that the exponent α will closely match its corresponding full-scale value, which can be determined from field measurements of the local winds. The required power-law exponent, α, can then be obtained by choosing the appropriate type and distribution of roughness elements over the wind tunnel flow-development section.

Full-scale wind data suggest that the atmospheric wind profile at the site of the Lawrence Berkeley National Laboratory yields a nominal value of $\alpha = 0.3$. This condition was closely matched in the UC Davis Atmospheric Boundary Layer Wind Tunnel by systematically arranging an pattern of 2" x 4" wooden blocks of 12" in length along the entire surface of the flow-development section. The pattern generally consisted of alternating sets of four and five blocks in one row. A typical velocity profile is presented in Figure 23, where the simulated power-law exponent is $\alpha = 0.33$.

In the lower 20% of the boundary layer height, the flow is then governed by a rough-wall or "law-of-the-wall" logarithmic velocity profile.

$$\frac{U}{u_*} = \frac{1}{\kappa} \ln\left(\frac{z}{z_o}\right)$$

Here, u_* is the surface friction velocity, κ is von Karman's constant, and z_o is the roughness height. This region of the atmospheric boundary layer is relatively unaffected by the Coriolis force, the only region that can be modeled accurately by the wind tunnel (i.e., the lowest 100 m of the atmospheric boundary layer under neutral stability conditions). Thus, it is desirable to have the scaled-model buildings and its surroundings contained within this layer.

The geometric scale of the model should be determined by the size of the wind tunnel, the roughness height, z_o, and the power-law index, α. With a boundary-layer height of 1 m in the test section, the surface layer would be 0.2 m deep for the U.C. Davis ABLWT. For the current study, this boundary layer corresponds to a full-scale height of the order of 800 m. Since the highest elevation of the modeled site investigated in this study is about 160 m full-scale, a majority of the model is contained in this region of full-scale similarity.

Due to scaling effects, full-scale agreement of simulated boundary-layer profiles can only be attained in wind tunnels with long flow-development sections. For full-scale matching of the normalized mean velocity profile, an upwind fetch of approximately 10 to 25 boundary-layer heights can be easily constructed. To fully simulate the normalized turbulence intensity and energy spectra profiles, the flow-development section needs to be extended to about 50 and 100 to 500 times the boundary-layer height, respectively. These profiles must at least meet full-scale similarities in the surface layer region. However, with the addition of spires and other flow tripping devices, the flow development length can be reduced to less than 20 boundary layer heights for most engineering applications.

In the U.C. Davis Atmospheric Boundary Layer Wind Tunnel, the maximum values of turbulence intensity near the surface range from 35% to 40%, similar to that in full scale. Thus, the turbulent intensity profile, u'/u versus z, should agree reasonably with the full-scale, particularly in the region where testing is performed. Figure 24 displays a typical turbulence intensity profile of the boundary layer in the ABLWT test section.

The second boundary-layer condition involves the roughness Reynolds number, Re_z. According to the criterion given by Sutton (1949), Reynolds number independence is attained when the roughness Reynolds number is defined as follows.

$$Re_z = \frac{u_* z_0}{\nu} \geq 2.5$$

Here, u_* is the friction speed, z_0 is the surface roughness length and ν is the kinematic viscosity. Re_z larger than 2.5 ensures that the flow is aerodynamically rough. Therefore, wind tunnels with a high enough roughness Reynolds numbers simulate full-scale aerodynamically rough flows exactly. To generate a rough surface in the wind tunnel, roughness elements are placed on the wind tunnel floor. The height of the elements must be larger than the height of the viscous sub-layer in order to trip the flow. The UC Davis ABLWT satisfies this condition, since the roughness Reynolds number is about 40, when the wind tunnel free stream velocity, $U_{\infty,}$ is equal 3.8 m/s, the friction speed, u_*, is 0.24 m/s, and the roughness height, z_o, is 0.0025 m. Thus, the flow setting satisfies the Re number independence criterion and dynamically simulates the flow.

To simulate the pressure distribution on objects in the atmospheric wind, Jensen (1958) found that the surface roughness to object-height ratio in the wind tunnel must be equal to that of the atmospheric boundary layer, i.e., z_o/H in the wind tunnel must match the full-scale value. Thus, the geometric scaling should be accurately modeled.

The last condition for the boundary layer is the characteristic scale height to boundary layer ratio, H/δ. There are two possibilities for the value of the ratio. If $H/\delta \geq 0.2$, then the ratios must be matched. If $(H/\delta)_{F.S.} < 0.2$, then only the general inequality of $(H/\delta)_{W.T.} < 0.2$ must be met (F.S. stands for full-scale and W.T. stands for wind tunnel). Using the law-of-the-wall logarithmic profile equation, instead of the power-law velocity profile, this principle would constrain the physical model to the 10% to 15% of the wind tunnel boundary layer height.

Along with these conditions, two other constraints have to be met. First, the mean stream wise pressure gradient in the wind tunnel must be zero. Even if high- and low-pressure systems drive atmospheric boundary layer flows, the magnitude of the pressure gradient in the flow direction is negligible compared to the dynamic pressure variation caused by the boundary layer. The other constraint is that the model should not take up more than 5% to 15% of the cross-sectional area at any down wind location. This assures that local flow acceleration affecting the stream wise pressure gradient will not distort the simulation flow.

Simulations in the U.C. Davis ABLWT were not capable of producing stable or unstable boundary layer flows. In fact, proper simulation of unstable boundary layer flows could be a disadvantage in any wind tunnel due to the artificial secondary flows generated by the heating that dominate and distort the longitudinal mean-flow properties, thus, invalidating the similitude criteria. However, this is not considered as a major constraint, since the winds that produce annual an average dispersion are sufficiently strong, such that for flow over a complex terrain, the primary source of turbulence is due to mechanical shear and not due to diurnal or heating and cooling effects in the atmosphere.

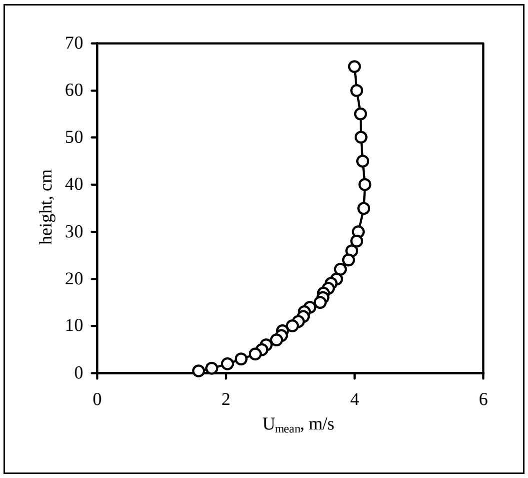

Figure D-1. Mean velocity profile for a typical wind direction in the wind tunnel. The power law exponent α is 0.33. The reference velocity at 65 cm height is 3.55 m/s.

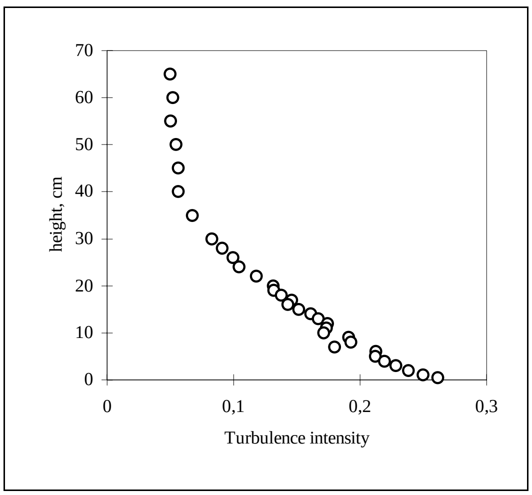

Figure D 2. Turbulence intensity profile for a typical wind direction in the wind tunnel.

APPENDIX E:

OUTPUT FROM THE COMPUTER CODE ANALYSIS

The Getty Villa
Malibu, California

Project
Wind Test Date: Aug-01

Full Year - 12-3 pm

The ratios of pedestrian-level wind speeds to the tower reference wind speeds at the SCAQMD meteorological station are shown in the first line of output for each location.

The second line of the output shows the pedestrian level wind speeds, in mph, which would be exceeded 10% of the time for each measurement location. A comfort criterion of 11 mph is used for areas of substantial public pedestrian use AND 7 mph for public seating areas. These criteria are not to be exceeded more than 10% of the time.

The third line of output for each location shows the criterion speed and the percentage of the time the criterion would be exceeded. The rows labeled CONTRIB tabulate the percentage contribution to the total or the exceedance from each wind direction. The SUMs are the equivalent number of events.

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
				Profile Ratios:	2.0000	2.0000	2.0000	2.0000	1,095 Obs
1				RATIOS	0.3918	0.4354	0.6534	0.4935	
	4.6			CONTRIB	77.75%	8.31%	5.68%	8.26%	110
		11.0	0.03	CONTRIB	41.78%	12.41%	3.76%	42.06%	0
2				RATIOS	0.8888	0.6886	0.7662	0.7812	
	10.1			CONTRIB	90.64%	7.30%	0.04%	2.01%	110
		11.0	7.48	CONTRIB	88.08%	9.77%	0.03%	2.12%	82
3				RATIOS	0.4752	0.2434	0.4550	0.3912	
	5.3			CONTRIB	97.95%	0.21%	0.08%	1.75%	109
		11.0	0.09	CONTRIB	99.94%	0.00%	0.06%	0.00%	1
4				RATIOS	0.8570	0.7516	1.2612	0.9566	
	9.9			CONTRIB	82.42%	7.30%	5.51%	4.77%	110
		11.0	7.06	CONTRIB	82.68%	10.35%	3.09%	3.88%	77
5				RATIOS	0.7194	0.3670	0.7360	0.6075	
	8.0			CONTRIB	97.76%	0.19%	0.17%	1.88%	110
		11.0	3.33	CONTRIB	98.06%	0.02%	0.06%	1.86%	36
6				RATIOS	0.9360	0.4556	1.2234	0.8717	
	10.5			CONTRIB	94.91%	0.09%	2.59%	2.41%	110
		11.0	8.19	CONTRIB	95.45%	0.07%	1.88%	2.60%	90
7				RATIOS	0.5474	0.4864	0.7060	0.5799	
	6.3			CONTRIB	87.00%	7.30%	1.83%	3.86%	110
		11.0	0.46	CONTRIB	87.85%	2.56%	0.35%	9.25%	5
8				RATIOS	0.4700	0.6178	0.7528	0.6135	
	5.6			CONTRIB	74.49%	10.60%	5.60%	9.32%	110
		11.0	0.60	CONTRIB	12.79%	75.58%	0.39%	11.24%	7
9				RATIOS	0.7956	0.4866	1.1024	0.7949	
	9.0			CONTRIB	90.13%	2.42%	4.52%	2.93%	110
		11.0	4.79	CONTRIB	95.31%	0.25%	0.97%	3.47%	52
10				RATIOS	0.6762	0.4254	0.7058	0.6025	
	7.6			CONTRIB	93.54%	4.15%	0.19%	2.12%	110
		11.0	2.72	CONTRIB	97.71%	0.10%	0.06%	2.13%	30
11				RATIOS	0.6646	0.4158	0.5608	0.5471	
	7.5			CONTRIB	94.33%	3.91%	0.04%	1.72%	110
		11.0	2.54	CONTRIB	98.85%	0.08%	0.01%	1.05%	28

Loca- tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
12				RATIOS	0.4414	0.4272	0.5870	0.4852	
	5.1			CONTRIB	85.57%	7.31%	2.51%	4.62%	109
		11.0	0.05	CONTRIB	74.63%	5.33%	0.88%	19.16%	1
13				RATIOS	0.8810	0.4562	0.5740	0.6371	
	9.8			CONTRIB	98.50%	0.25%	0.01%	1.24%	110
		11.0	6.49	CONTRIB	98.51%	0.09%	0.01%	1.40%	71
14				RATIOS	0.6794	0.5292	0.5226	0.5771	
	7.7			CONTRIB	90.84%	7.30%	0.02%	1.83%	110
		11.0	2.79	CONTRIB	96.99%	1.53%	0.01%	1.47%	31
15				RATIOS	0.5298	0.3756	0.5832	0.4962	
	6.0			CONTRIB	90.00%	7.30%	0.32%	2.38%	110
		11.0	0.30	CONTRIB	95.47%	0.24%	0.15%	4.14%	3
16				RATIOS	0.3460	0.4450	0.6174	0.4695	
	4.1			CONTRIB	73.01%	10.14%	5.76%	11.09%	110
		11.0	0.01	CONTRIB	33.70%	57.04%	9.27%	0.00%	0
17				RATIOS	0.4484	0.3580	0.2930	0.3665	
	5.1			CONTRIB	91.03%	7.30%	0.01%	1.65%	110
		11.0	0.05	CONTRIB	98.07%	0.82%	0.00%	1.11%	1
18				RATIOS	0.3618	0.3344	0.3776	0.3579	
	4.1			CONTRIB	89.75%	7.30%	0.17%	2.77%	110
		11.0	0.00	CONTRIB	88.81%	3.28%	0.15%	7.75%	0
19				RATIOS	0.3558	0.3682	0.4416	0.3885	
	4.1			CONTRIB	86.56%	7.76%	1.17%	4.51%	110
		11.0	0.00	CONTRIB	85.83%	13.23%	0.94%	0.00%	0
20				RATIOS	0.5698	0.3592	0.4504	0.4598	
	6.4			CONTRIB	94.00%	4.34%	0.03%	1.63%	109
		11.0	0.63	CONTRIB	99.93%	0.06%	0.01%	0.00%	7
21				RATIOS	0.4740	0.3808	0.5990	0.4846	
	5.4			CONTRIB	87.98%	7.31%	1.49%	3.23%	109
		11.0	0.09	CONTRIB	87.81%	0.91%	0.58%	10.70%	1
22				RATIOS	0.5512	0.3482	0.4442	0.4479	
	6.2			CONTRIB	93.85%	4.46%	0.03%	1.65%	109
		11.0	0.44	CONTRIB	99.93%	0.06%	0.01%	0.00%	5
23				RATIOS	0.4456	0.3512	0.3920	0.3963	
	5.0			CONTRIB	90.57%	7.31%	0.05%	2.07%	109
		11.0	0.04	CONTRIB	99.28%	0.70%	0.03%	0.00%	0
24				RATIOS	0.3796	0.3826	0.3422	0.3681	
	4.3			CONTRIB	89.79%	7.55%	0.05%	2.61%	110
		11.0	0.01	CONTRIB	84.85%	9.37%	0.02%	5.76%	0
25				RATIOS	0.1940	0.3066	0.3338	0.2781	
	0.5			CONTRIB	76.89%	1.46%	0.65%	20.99%	1,072
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
26				RATIOS	0.8358	0.4236	0.9914	0.7503	
	9.4			CONTRIB	96.74%	0.17%	0.89%	2.20%	110
		11.0	5.53	CONTRIB	97.14%	0.05%	0.25%	2.57%	61
27				RATIOS	0.7400	0.6280	0.8020	0.7233	
	8.4			CONTRIB	89.76%	7.30%	0.27%	2.67%	110
		11.0	4.30	CONTRIB	83.47%	13.46%	0.08%	2.99%	47
28				RATIOS	0.1384	0.1504	0.1352	0.1413	
	2.5			CONTRIB	60.39%	36.09%	0.02%	3.50%	22

		11.0	0.00	CONTRIB	0.00%	0.00%	0.00%	0.00%	0

Loca- tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
29				RATIOS	0.6410	0.5794	0.6550	0.6251	
	7.3			CONTRIB	89.91%	7.30%	0.14%	2.65%	110
		11.0	2.48	CONTRIB	89.97%	6.85%	0.04%	3.14%	27
30				RATIOS	0.3770	0.4676	0.4814	0.4420	
	4.4			CONTRIB	82.28%	10.14%	1.41%	6.17%	109
		11.0	0.01	CONTRIB	50.82%	48.53%	0.65%	0.00%	0
31				RATIOS	0.7190	0.3632	0.6184	0.5669	
	8.0			CONTRIB	98.22%	0.17%	0.05%	1.56%	110
		11.0	3.30	CONTRIB	98.88%	0.01%	0.02%	1.08%	36
32				RATIOS	0.6094	0.3244	0.4406	0.4581	
	6.8			CONTRIB	98.23%	0.38%	0.02%	1.37%	110
		11.0	1.33	CONTRIB	99.99%	0.01%	0.00%	0.00%	15
33				RATIOS	0.4940	0.2270	0.4258	0.3823	
	5.5			CONTRIB	98.41%	0.05%	0.05%	1.49%	109
		11.0	0.13	CONTRIB	99.29%	0.00%	0.02%	0.69%	1
34				RATIOS	0.5710	0.7490	0.4556	0.5919	
	6.5			CONTRIB	85.37%	11.24%	0.03%	3.37%	110
		11.0	1.43	CONTRIB	45.31%	51.16%	0.00%	3.52%	16
35				RATIOS	0.5670	0.5240	0.2746	0.4552	
	6.4			CONTRIB	91.12%	7.30%	0.00%	1.58%	110
		11.0	0.64	CONTRIB	94.22%	5.78%	0.00%	0.00%	7
36				RATIOS	0.3736	0.6602	0.1966	0.4101	
	4.3			CONTRIB	82.51%	13.12%	0.00%	4.37%	109
		11.0	0.74	CONTRIB	0.92%	99.08%	0.00%	0.00%	8
37				RATIOS	0.4336	0.4142	0.3378	0.3952	
	4.9			CONTRIB	90.46%	7.30%	0.02%	2.22%	110
		11.0	0.04	CONTRIB	94.13%	5.87%	0.01%	0.00%	0
38				RATIOS	0.3650	0.5010	0.1744	0.3468	
	4.2			CONTRIB	85.51%	12.08%	0.00%	2.41%	109
		11.0	0.02	CONTRIB	21.13%	77.76%	0.00%	1.11%	0
39				RATIOS	0.4482	0.3882	0.2750	0.3705	
	5.1			CONTRIB	90.98%	7.30%	0.01%	1.70%	110
		11.0	0.05	CONTRIB	96.55%	2.19%	0.00%	1.26%	1
40				RATIOS	0.3056	0.3962	0.4652	0.3890	
	3.6			CONTRIB	75.67%	10.45%	5.53%	8.36%	109
		11.0	0.00	CONTRIB	0.00%	95.02%	4.98%	0.00%	0
41				RATIOS	0.2344	0.7980	0.4222	0.4849	
	3.3			CONTRIB	43.71%	13.77%	5.53%	36.99%	109
		11.0	0.74	CONTRIB	0.00%	98.62%	0.00%	1.38%	8
42				RATIOS	0.2834	0.5756	0.4350	0.4313	
	3.5			CONTRIB	64.82%	13.23%	5.08%	16.87%	109
		11.0	0.15	CONTRIB	0.00%	99.98%	0.02%	0.00%	2
43				RATIOS	0.2774	0.4582	0.4332	0.3896	
	3.4			CONTRIB	69.30%	12.92%	5.53%	12.25%	109
		11.0	0.01	CONTRIB	0.00%	99.44%	0.56%	0.00%	0
44				RATIOS	0.3088	0.5332	0.3682	0.4034	
	3.6			CONTRIB	76.66%	13.04%	0.50%	9.80%	109
		11.0	0.05	CONTRIB	0.00%	99.99%	0.01%	0.00%	1
45				RATIOS	0.2534	0.3590	0.2644	0.2923	
	2.9			CONTRIB	81.80%	12.46%	0.14%	5.61%	110

					ENE	S	SW	OTHER	SUM
		11.0	0.00	CONTRIB	0.00%	100.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
46				RATIOS	0.3668	0.5084	0.4976	0.4576	
	4.3			CONTRIB	78.00%	11.77%	2.34%	7.89%	110
		11.0	0.03	CONTRIB	18.70%	80.86%	0.44%	0.00%	0
47				RATIOS	0.3160	0.4472	0.3364	0.3665	
	3.7			CONTRIB	81.64%	12.43%	0.17%	5.76%	109
		11.0	0.00	CONTRIB	0.00%	89.55%	0.04%	10.41%	0
48				RATIOS	0.3518	0.4832	0.4268	0.4206	
	4.1			CONTRIB	80.81%	11.80%	0.73%	6.65%	109
		11.0	0.01	CONTRIB	22.80%	76.99%	0.20%	0.00%	0
49				RATIOS	0.2944	0.5572	0.4922	0.4479	
	3.7			CONTRIB	64.56%	13.11%	5.60%	16.73%	109
		11.0	0.09	CONTRIB	0.00%	99.88%	0.12%	0.00%	1
50				RATIOS	0.5420	0.4014	0.6856	0.5430	
	6.2			CONTRIB	88.27%	7.30%	1.51%	2.91%	110
		11.0	0.39	CONTRIB	92.83%	0.38%	0.35%	6.44%	4
51				RATIOS	0.6462	0.6436	1.1044	0.7981	
	7.6			CONTRIB	79.30%	7.30%	5.73%	7.67%	110
		11.0	3.24	CONTRIB	70.77%	22.58%	1.47%	5.18%	35
52				RATIOS	0.6440	0.6084	0.8240	0.6921	
	7.4			CONTRIB	86.87%	7.30%	1.67%	4.16%	110
		11.0	2.74	CONTRIB	82.66%	13.03%	0.14%	4.16%	30
53				RATIOS	0.4660	0.5564	0.6912	0.5712	
	5.5			CONTRIB	78.00%	9.31%	5.50%	7.18%	110
		11.0	0.20	CONTRIB	34.81%	45.62%	0.72%	18.85%	2
54				RATIOS	0.5172	0.5404	0.8236	0.6271	
	6.0			CONTRIB	79.73%	7.63%	5.62%	7.02%	110
		11.0	0.36	CONTRIB	60.35%	16.34%	1.09%	22.22%	4
55				RATIOS	0.5770	0.5006	0.8904	0.6560	
	6.7			CONTRIB	81.91%	7.30%	5.58%	5.21%	110
		11.0	0.85	CONTRIB	85.52%	2.16%	0.72%	11.61%	9
56				RATIOS	0.6532	0.2644	0.9310	0.6162	
	7.4			CONTRIB	92.03%	0.01%	5.50%	2.45%	110
		11.0	2.45	CONTRIB	96.85%	0.00%	0.32%	2.83%	27
57				RATIOS	0.6796	0.5162	0.9034	0.6997	
	7.8			CONTRIB	86.81%	7.30%	2.58%	3.31%	110
		11.0	2.86	CONTRIB	94.64%	1.02%	0.23%	4.11%	31
58				RATIOS	0.5496	0.3330	0.6434	0.5087	
	6.2			CONTRIB	94.50%	2.41%	0.72%	2.36%	109
		11.0	0.44	CONTRIB	96.35%	0.04%	0.22%	3.40%	5
59				RATIOS	0.4072	0.2454	0.4908	0.3811	
	4.6			CONTRIB	94.34%	2.21%	1.01%	2.43%	110
		11.0	0.02	CONTRIB	94.65%	0.00%	0.61%	4.74%	0
60				RATIOS	0.6136	0.2536	0.5634	0.4769	
	6.8			CONTRIB	98.41%	0.02%	0.07%	1.50%	110
		11.0	1.43	CONTRIB	99.98%	0.00%	0.02%	0.00%	16
61				RATIOS	0.6260	0.6758	0.8280	0.7099	
	7.2			CONTRIB	84.13%	8.24%	2.27%	5.36%	110
		11.0	2.64	CONTRIB	67.59%	27.63%	0.15%	4.62%	29
62				RATIOS	0.3706	0.5770	0.7028	0.5501	
	4.6			CONTRIB	66.13%	12.80%	5.81%	15.26%	110

Loca-tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
		11.0	0.19	CONTRIB	3.13%	81.69%	0.81%	14.36%	2
63				RATIOS	0.2880	0.5780	0.5436	0.4699	
	3.7			CONTRIB	60.24%	13.16%	5.75%	20.85%	110
		11.0	0.16	CONTRIB	0.00%	99.84%	0.16%	0.00%	2
64				RATIOS	0.2608	0.4938	0.5340	0.4295	
	3.3			CONTRIB	59.65%	13.07%	5.88%	21.40%	109
		11.0	0.01	CONTRIB	0.00%	98.54%	1.46%	0.00%	0
65				RATIOS	0.6228	0.5300	0.5084	0.5537	
	7.1			CONTRIB	90.59%	7.30%	0.03%	2.07%	110
		11.0	1.76	CONTRIB	95.84%	2.48%	0.01%	1.67%	19
66				RATIOS	0.6848	0.5946	0.5016	0.5937	
	7.8			CONTRIB	90.74%	7.30%	0.02%	1.94%	110
		11.0	3.08	CONTRIB	90.15%	8.18%	0.00%	1.67%	34
67				RATIOS	0.5920	0.4206	0.5872	0.5333	
	6.7			CONTRIB	90.45%	7.30%	0.10%	2.15%	110
		11.0	0.99	CONTRIB	97.50%	0.25%	0.05%	2.21%	11
68				RATIOS	0.3098	0.5736	0.5778	0.4871	
	3.9			CONTRIB	62.46%	13.05%	5.75%	18.74%	110
		11.0	0.16	CONTRIB	0.00%	92.98%	0.26%	6.75%	2
69				RATIOS	0.7020	0.3560	0.7244	0.5941	
	7.8			CONTRIB	97.75%	0.18%	0.18%	1.89%	110
		11.0	3.07	CONTRIB	98.24%	0.01%	0.06%	1.69%	34
70				RATIOS	0.5376	0.3768	0.6842	0.5329	
	6.1			CONTRIB	88.32%	7.30%	1.63%	2.75%	110
		11.0	0.36	CONTRIB	93.32%	0.21%	0.38%	6.09%	4
71				RATIOS	0.9528	0.6234	0.9692	0.8485	
	10.8			CONTRIB	90.86%	6.92%	0.13%	2.08%	110
		11.0	9.02	CONTRIB	91.95%	5.74%	0.12%	2.19%	99
72				RATIOS	0.9796	0.8108	1.0554	0.9486	
	11.1			CONTRIB	89.85%	7.30%	0.25%	2.60%	110
		11.0	10.53	CONTRIB	90.25%	6.94%	0.27%	2.54%	115
73				RATIOS	0.8260	0.8602	0.8360	0.8407	
	9.4			CONTRIB	88.78%	7.92%	0.12%	3.19%	110
		11.0	6.09	CONTRIB	84.77%	11.99%	0.07%	3.17%	67
74				RATIOS	0.7350	0.9032	0.5856	0.7413	
	8.4			CONTRIB	86.82%	10.19%	0.03%	2.96%	110
		11.0	4.38	CONTRIB	80.16%	16.69%	0.01%	3.14%	48
75				RATIOS	1.1104	0.8996	1.1708	1.0603	
	12.6			CONTRIB	90.00%	7.30%	0.20%	2.51%	110
		11.0	19.42	CONTRIB	93.32%	3.76%	0.48%	2.44%	213
76				RATIOS	1.0266	0.9628	1.2502	1.0799	
	11.7			CONTRIB	87.97%	7.30%	0.97%	3.76%	110
		11.0	13.55	CONTRIB	89.24%	5.45%	1.46%	3.85%	148
77				RATIOS	0.9720	0.9176	1.1374	1.0090	
	11.1			CONTRIB	88.55%	7.30%	0.62%	3.53%	110
		11.0	10.29	CONTRIB	88.71%	7.10%	0.65%	3.54%	113
78				RATIOS	0.9828	0.9340	1.1284	1.0151	
	11.2			CONTRIB	88.75%	7.30%	0.50%	3.44%	110
		11.0	10.83	CONTRIB	89.22%	6.75%	0.56%	3.47%	119
79				RATIOS	0.7114	0.6436	0.6614	0.6721	
	8.1			CONTRIB	90.19%	7.30%	0.07%	2.44%	110

		11.0	3.99	CONTRIB	79.00%	18.33%	0.03%	2.64%	44

Loca-tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
80				RATIOS	0.1860	0.4698	0.3620	0.3393	
	2.5			CONTRIB	52.83%	13.48%	5.74%	27.96%	110
		11.0	0.01	CONTRIB	0.00%	97.38%	0.06%	2.56%	0
81				RATIOS	0.2136	0.6230	0.3012	0.3793	
	2.8			CONTRIB	57.32%	13.73%	1.25%	27.69%	109
		11.0	0.51	CONTRIB	0.00%	99.84%	0.00%	0.16%	6
82				RATIOS	0.2164	0.3572	0.4692	0.3476	
	2.7			CONTRIB	61.20%	12.86%	5.99%	19.95%	110
		11.0	0.00	CONTRIB	0.00%	52.51%	10.27%	37.22%	0
83				RATIOS	0.3768	0.4958	0.4128	0.4285	
	4.3			CONTRIB	83.22%	11.19%	0.25%	5.34%	109
		11.0	0.02	CONTRIB	32.23%	67.68%	0.09%	0.00%	0
84				RATIOS	0.2784	0.6408	0.4174	0.4455	
	3.5			CONTRIB	62.81%	13.42%	3.48%	20.29%	109
		11.0	0.73	CONTRIB	0.00%	100.00%	0.00%	0.00%	8
85				RATIOS	0.3348	0.3582	0.3986	0.3639	
	3.8			CONTRIB	86.82%	8.00%	0.76%	4.42%	114
		11.0	0.00	CONTRIB	65.40%	15.35%	0.54%	18.71%	0
86				RATIOS	0.2514	0.9056	0.5022	0.5531	
	3.6			CONTRIB	39.11%	13.78%	5.64%	41.47%	110
		11.0	0.76	CONTRIB	0.00%	96.14%	0.02%	3.85%	8
87				RATIOS	0.3380	0.9584	0.6540	0.6501	
	4.6			CONTRIB	49.02%	13.63%	5.69%	31.66%	110
		11.0	0.83	CONTRIB	0.23%	88.08%	0.13%	11.57%	9
88				RATIOS	0.5540	0.6704	0.6112	0.6119	
	6.4			CONTRIB	85.11%	9.89%	0.29%	4.71%	110
		11.0	1.26	CONTRIB	36.77%	57.97%	0.05%	5.21%	14
89				RATIOS	1.0110	1.3364	1.4628	1.2701	
	12.0			CONTRIB	76.61%	10.83%	4.61%	7.95%	110
		11.0	14.21	CONTRIB	78.67%	8.69%	3.93%	8.71%	156
90				RATIOS	0.3408	0.3222	0.2176	0.2935	
	3.8			CONTRIB	91.03%	7.08%	0.01%	1.88%	113
		11.0	0.00	CONTRIB	95.31%	4.69%	0.00%	0.00%	0
91				RATIOS	0.2538	0.2388	0.3950	0.2959	
	2.9			CONTRIB	81.24%	7.30%	5.59%	5.87%	110
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
92				RATIOS	0.4740	0.5466	0.8378	0.6195	
	5.6			CONTRIB	75.88%	8.70%	5.76%	9.66%	110
		11.0	0.23	CONTRIB	36.23%	30.39%	1.87%	31.51%	3
93				RATIOS	0.8976	0.8312	1.0746	0.9345	
	10.2			CONTRIB	88.32%	7.30%	0.81%	3.57%	110
		11.0	7.83	CONTRIB	86.94%	9.33%	0.44%	3.29%	86
94				RATIOS	0.8810	0.9294	1.0830	0.9645	
	10.1			CONTRIB	86.39%	8.01%	1.04%	4.56%	110
		11.0	7.45	CONTRIB	85.84%	9.80%	0.51%	3.84%	82
95				RATIOS	0.8858	1.0164	1.0712	0.9911	
	10.2			CONTRIB	85.03%	9.10%	0.83%	5.04%	110
		11.0	7.68	CONTRIB	84.79%	10.46%	0.44%	4.31%	84
96				RATIOS	0.8012	1.0384	0.9542	0.9313	
	9.3			CONTRIB	82.55%	10.88%	0.64%	5.93%	110

		11.0	5.77	CONTRIB	81.01%	14.42%	0.16%	4.42%	63

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
97				RATIOS	0.7490	1.0354	0.9444	0.9096	
	8.7			CONTRIB	79.93%	11.86%	1.10%	7.11%	110
		11.0	4.81	CONTRIB	77.66%	17.20%	0.18%	4.97%	53
98				RATIOS	0.5496	0.2314	0.4062	0.3957	
	6.1			CONTRIB	98.73%	0.02%	0.02%	1.22%	110
		11.0	0.42	CONTRIB	100.00%	0.00%	0.00%	0.00%	5
99				RATIOS	0.2946	0.6154	0.3010	0.4037	
	3.5			CONTRIB	74.51%	13.34%	0.08%	12.07%	110
		11.0	0.42	CONTRIB	0.00%	100.00%	0.00%	0.00%	5
100				RATIOS	0.3028	0.5184	0.3604	0.3939	
	3.6			CONTRIB	76.86%	13.03%	0.50%	9.62%	109
		11.0	0.03	CONTRIB	0.00%	99.99%	0.01%	0.00%	0

The Getty Villa
Malibu, California

Project Full Year - 3-6 pm
Wind Test Date: Aug-01

The ratios of pedestrian-level wind speeds to the tower reference wind speeds at the SCAQMD meteorological station are shown in the first line of output for each location.

The second line of the output shows the pedestrian level wind speeds, in mph, which would be exceeded 10% of the time for each measurement location. A comfort criterion of 11 mph is used for areas of substantial public pedestrian use AND 7 mph for public seating areas. These criteria are not to be exceeded more than 10% of the time.

The third line of output for each location shows the criterion speed and the percentage of the time the criterion would be exceeded. The rows labeled CONTRIB tabulate the percentage contribution to the total or the exceedance from each wind direction. The SUMs are the equivalent number of events.

Location	10.0% Exc. Ground Speed	Criterion Speed Exc.	Criterion % Time Exc.		ENE	S	SW	OTHER	SUM
				Profile Ratios:	2.0000	2.0000	2.0000	2.0000	1,095 Obs
1				RATIOS	0.3918	0.4354	0.6534	0.4935	
	5.3			CONTRIB	81.95%	11.90%	3.54%	2.61%	110
		11.0	0.10	CONTRIB	1.15%	3.43%	94.25%	1.16%	1
2				RATIOS	0.8888	0.6886	0.7662	0.7812	
	11.9			CONTRIB	90.45%	8.22%	1.10%	0.23%	110
		11.0	14.01	CONTRIB	92.44%	6.38%	0.89%	0.29%	153
3				RATIOS	0.4752	0.2434	0.4550	0.3912	
	6.2			CONTRIB	98.45%	0.03%	1.35%	0.16%	110
		11.0	0.01	CONTRIB	61.02%	0.00%	38.98%	0.00%	0
4				RATIOS	0.8570	0.7516	1.2612	0.9566	
	11.6			CONTRIB	86.58%	9.31%	2.84%	1.27%	110
		11.0	12.40	CONTRIB	88.08%	7.93%	2.52%	1.47%	136
5				RATIOS	0.7194	0.3670	0.7360	0.6075	
	9.4			CONTRIB	98.26%	0.03%	1.51%	0.20%	110
		11.0	4.94	CONTRIB	97.50%	0.01%	2.36%	0.13%	54
6				RATIOS	0.9360	0.4556	1.2234	0.8717	
	12.3			CONTRIB	97.22%	0.02%	2.36%	0.40%	110
		11.0	16.89	CONTRIB	97.68%	0.03%	1.74%	0.54%	185
7				RATIOS	0.5474	0.4864	0.7060	0.5799	
	7.4			CONTRIB	87.45%	9.47%	2.20%	0.87%	110
		11.0	0.26	CONTRIB	51.55%	4.62%	42.18%	1.66%	3
8				RATIOS	0.4700	0.6178	0.7528	0.6135	
	6.5			CONTRIB	78.82%	14.89%	3.22%	3.08%	110
		11.0	0.64	CONTRIB	1.20%	78.69%	19.06%	1.05%	7
9				RATIOS	0.7956	0.4866	1.1024	0.7949	
	10.5			CONTRIB	96.45%	0.25%	2.64%	0.66%	110
		11.0	8.01	CONTRIB	96.27%	0.15%	3.00%	0.58%	88
10				RATIOS	0.6762	0.4254	0.7058	0.6025	
	8.9			CONTRIB	97.74%	0.41%	1.56%	0.29%	110
		11.0	3.72	CONTRIB	96.85%	0.07%	2.92%	0.16%	41
11				RATIOS	0.6646	0.4158	0.5608	0.5471	
	8.7			CONTRIB	98.36%	0.38%	1.09%	0.16%	110
		11.0	3.36	CONTRIB	98.88%	0.06%	0.97%	0.08%	37

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	---Criterion--- % Time Exc.		ENE	S	SW	OTHER	SUM
12				RATIOS	0.4414	0.4272	0.5870	0.4852	
	6.0			CONTRIB	86.19%	10.36%	2.33%	1.12%	110
		11.0	0.05	CONTRIB	7.27%	5.18%	85.68%	1.87%	1
13				RATIOS	0.8810	0.4562	0.5740	0.6371	
	11.5			CONTRIB	99.63%	0.03%	0.27%	0.06%	110
		11.0	12.48	CONTRIB	99.57%	0.04%	0.32%	0.07%	137
14				RATIOS	0.6794	0.5292	0.5226	0.5771	
	9.1			CONTRIB	90.68%	8.27%	0.87%	0.18%	110
		11.0	3.75	CONTRIB	98.21%	1.19%	0.49%	0.11%	41
15				RATIOS	0.5298	0.3756	0.5832	0.4962	
	7.0			CONTRIB	95.44%	2.46%	1.70%	0.40%	110
		11.0	0.12	CONTRIB	59.84%	0.62%	38.48%	1.06%	1
16				RATIOS	0.3460	0.4450	0.6174	0.4695	
	4.8			CONTRIB	77.89%	14.31%	3.98%	3.82%	109
		11.0	0.08	CONTRIB	0.34%	5.78%	93.88%	0.00%	1
17				RATIOS	0.4484	0.3580	0.2930	0.3665	
	6.0			CONTRIB	91.12%	8.51%	0.24%	0.14%	110
		11.0	0.01	CONTRIB	91.30%	7.67%	0.00%	1.03%	0
18				RATIOS	0.3618	0.3344	0.3776	0.3579	
	4.9			CONTRIB	88.06%	9.90%	1.51%	0.53%	109
		11.0	0.00	CONTRIB	31.52%	11.66%	54.07%	2.75%	0
19				RATIOS	0.3558	0.3682	0.4416	0.3885	
	4.8			CONTRIB	85.78%	11.13%	2.03%	1.06%	110
		11.0	0.00	CONTRIB	7.39%	11.39%	81.22%	0.00%	0
20				RATIOS	0.5698	0.3592	0.4504	0.4598	
	7.5			CONTRIB	98.45%	0.43%	0.97%	0.14%	110
		11.0	0.30	CONTRIB	98.22%	0.14%	1.64%	0.00%	3
21				RATIOS	0.4740	0.3808	0.5990	0.4846	
	6.4			CONTRIB	88.67%	8.51%	2.13%	0.69%	110
		11.0	0.07	CONTRIB	12.70%	1.31%	84.44%	1.55%	1
22				RATIOS	0.5512	0.3482	0.4442	0.4479	
	7.2			CONTRIB	98.40%	0.45%	1.01%	0.15%	110
		11.0	0.16	CONTRIB	97.11%	0.18%	2.72%	0.00%	2
23				RATIOS	0.4456	0.3512	0.3920	0.3963	
	6.0			CONTRIB	90.24%	8.37%	1.13%	0.25%	110
		11.0	0.01	CONTRIB	74.81%	5.26%	19.93%	0.00%	0
24				RATIOS	0.3796	0.3826	0.3422	0.3681	
	5.1			CONTRIB	87.51%	10.86%	1.17%	0.46%	110
		11.0	0.00	CONTRIB	40.95%	45.23%	11.05%	2.78%	0
25				RATIOS	0.1940	0.3066	0.3338	0.2781	
	1.1			CONTRIB	86.58%	2.90%	1.30%	9.22%	1,000
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
26				RATIOS	0.8358	0.4236	0.9914	0.7503	
	11.0			CONTRIB	97.71%	0.03%	1.96%	0.31%	110
		11.0	9.94	CONTRIB	97.70%	0.03%	1.97%	0.31%	109
27				RATIOS	0.7400	0.6280	0.8020	0.7233	
	9.9			CONTRIB	88.86%	9.04%	1.61%	0.49%	110
		11.0	6.30	CONTRIB	87.22%	10.27%	2.14%	0.37%	69
28				RATIOS	0.1384	0.1504	0.1352	0.1413	
	3.8			CONTRIB	24.13%	56.91%	18.96%	0.00%	0
		11.0	0.00	CONTRIB	0.00%	0.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
29				RATIOS	0.6410	0.5794	0.6550	0.6251	
	8.6			CONTRIB	88.39%	9.67%	1.45%	0.48%	110
		11.0	3.09	CONTRIB	90.73%	5.93%	3.09%	0.25%	34
30				RATIOS	0.3770	0.4676	0.4814	0.4420	
	5.1			CONTRIB	82.44%	13.76%	2.11%	1.68%	109
		11.0	0.02	CONTRIB	4.30%	41.07%	54.63%	0.00%	0
31				RATIOS	0.7190	0.3632	0.6184	0.5669	
	9.4			CONTRIB	98.73%	0.03%	1.13%	0.12%	110
		11.0	4.88	CONTRIB	98.45%	0.01%	1.46%	0.07%	53
32				RATIOS	0.6094	0.3244	0.4406	0.4581	
	8.0			CONTRIB	99.25%	0.05%	0.62%	0.08%	110
		11.0	1.12	CONTRIB	99.64%	0.01%	0.35%	0.00%	12
33				RATIOS	0.4940	0.2270	0.4258	0.3823	
	6.5			CONTRIB	98.75%	0.01%	1.13%	0.10%	110
		11.0	0.02	CONTRIB	85.92%	0.00%	13.63%	0.45%	0
34				RATIOS	0.5710	0.7490	0.4556	0.5919	
	7.8			CONTRIB	83.26%	15.12%	0.93%	0.69%	110
		11.0	1.30	CONTRIB	23.65%	75.53%	0.43%	0.39%	14
35				RATIOS	0.5670	0.5240	0.2746	0.4552	
	7.6			CONTRIB	89.92%	9.94%	0.01%	0.12%	110
		11.0	0.30	CONTRIB	87.50%	12.50%	0.00%	0.00%	3
36				RATIOS	0.3736	0.6602	0.1966	0.4101	
	5.2			CONTRIB	76.09%	22.98%	0.02%	0.91%	110
		11.0	0.85	CONTRIB	0.08%	99.92%	0.00%	0.00%	9
37				RATIOS	0.4336	0.4142	0.3378	0.3952	
	5.8			CONTRIB	88.52%	10.27%	0.91%	0.29%	110
		11.0	0.01	CONTRIB	59.50%	37.10%	3.39%	0.00%	0
38				RATIOS	0.3650	0.5010	0.1744	0.3468	
	5.0			CONTRIB	83.34%	16.29%	0.01%	0.36%	109
		11.0	0.02	CONTRIB	2.59%	97.27%	0.00%	0.14%	0
39				RATIOS	0.4482	0.3882	0.2750	0.3705	
	6.0			CONTRIB	90.43%	9.28%	0.14%	0.15%	110
		11.0	0.01	CONTRIB	80.65%	18.30%	0.00%	1.05%	0
40				RATIOS	0.3056	0.3962	0.4652	0.3890	
	4.2			CONTRIB	79.76%	14.62%	2.93%	2.69%	109
		11.0	0.01	CONTRIB	0.00%	16.02%	83.98%	0.00%	0
41				RATIOS	0.2344	0.7980	0.4222	0.4849	
	3.6			CONTRIB	49.75%	26.48%	3.34%	20.43%	109
		11.0	1.05	CONTRIB	0.00%	99.66%	0.24%	0.10%	12
42				RATIOS	0.2834	0.5756	0.4350	0.4313	
	4.0			CONTRIB	67.24%	23.68%	2.77%	6.30%	109
		11.0	0.17	CONTRIB	0.00%	97.97%	2.03%	0.00%	2
43				RATIOS	0.2774	0.4582	0.4332	0.3896	
	3.9			CONTRIB	71.90%	20.91%	2.95%	4.24%	109
		11.0	0.01	CONTRIB	0.00%	64.08%	35.92%	0.00%	0
44				RATIOS	0.3088	0.5332	0.3682	0.4034	
	4.3			CONTRIB	72.87%	22.57%	1.76%	2.79%	110
		11.0	0.05	CONTRIB	0.00%	98.89%	1.11%	0.00%	1
45				RATIOS	0.2534	0.3590	0.2644	0.2923	
	3.5			CONTRIB	80.19%	16.93%	1.45%	1.43%	109
		11.0	0.00	CONTRIB	0.00%	100.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	Criterion Speed Exc.	Criterion % Time Exc.		ENE	S	SW	OTHER	SUM
46				RATIOS	0.3668	0.5084	0.4976	0.4576	
	5.0			CONTRIB	79.06%	16.25%	2.33%	2.35%	109
		11.0	0.04	CONTRIB	1.45%	64.49%	34.05%	0.00%	0
47				RATIOS	0.3160	0.4472	0.3364	0.3665	
	4.3			CONTRIB	80.12%	16.88%	1.50%	1.49%	110
		11.0	0.00	CONTRIB	0.00%	95.15%	3.74%	1.11%	0
48				RATIOS	0.3518	0.4832	0.4268	0.4206	
	4.8			CONTRIB	80.17%	16.09%	1.89%	1.86%	109
		11.0	0.01	CONTRIB	2.28%	77.37%	20.35%	0.00%	0
49				RATIOS	0.2944	0.5572	0.4922	0.4479	
	4.2			CONTRIB	67.20%	23.24%	3.27%	6.29%	109
		11.0	0.11	CONTRIB	0.00%	89.66%	10.34%	0.00%	1
50				RATIOS	0.5420	0.4014	0.6856	0.5430	
	7.2			CONTRIB	92.76%	4.42%	2.18%	0.64%	110
		11.0	0.22	CONTRIB	50.40%	0.69%	47.75%	1.17%	2
51				RATIOS	0.6462	0.6436	1.1044	0.7981	
	8.8			CONTRIB	83.29%	10.60%	3.74%	2.37%	110
		11.0	4.03	CONTRIB	72.25%	20.58%	5.99%	1.19%	44
52				RATIOS	0.6440	0.6084	0.8240	0.6921	
	8.7			CONTRIB	86.77%	10.10%	2.16%	0.96%	110
		11.0	3.42	CONTRIB	83.86%	11.52%	4.14%	0.49%	37
53				RATIOS	0.4660	0.5564	0.6912	0.5712	
	6.4			CONTRIB	82.05%	12.91%	2.82%	2.22%	110
		11.0	0.21	CONTRIB	3.28%	45.73%	49.21%	1.78%	2
54				RATIOS	0.5172	0.5404	0.8236	0.6271	
	7.0			CONTRIB	83.45%	11.17%	3.26%	2.12%	110
		11.0	0.25	CONTRIB	16.96%	24.27%	55.63%	3.14%	3
55				RATIOS	0.5770	0.5006	0.8904	0.6560	
	7.8			CONTRIB	86.26%	9.19%	3.11%	1.44%	110
		11.0	0.57	CONTRIB	66.33%	3.28%	28.41%	1.98%	6
56				RATIOS	0.6532	0.2644	0.9310	0.6162	
	8.6			CONTRIB	96.77%	0.00%	2.79%	0.44%	110
		11.0	3.25	CONTRIB	94.42%	0.00%	5.37%	0.21%	36
57				RATIOS	0.6796	0.5162	0.9034	0.6997	
	9.1			CONTRIB	90.76%	6.11%	2.37%	0.75%	110
		11.0	3.90	CONTRIB	94.52%	0.77%	4.24%	0.46%	43
58				RATIOS	0.5496	0.3330	0.6434	0.5087	
	7.2			CONTRIB	97.48%	0.23%	1.91%	0.38%	110
		11.0	0.24	CONTRIB	60.37%	0.07%	38.93%	0.63%	3
59				RATIOS	0.4072	0.2454	0.4908	0.3811	
	5.4			CONTRIB	97.36%	0.21%	2.02%	0.41%	109
		11.0	0.01	CONTRIB	13.30%	0.00%	86.04%	0.67%	0
60				RATIOS	0.6136	0.2536	0.5634	0.4769	
	8.0			CONTRIB	98.63%	0.00%	1.26%	0.11%	110
		11.0	1.31	CONTRIB	97.41%	0.00%	2.58%	0.00%	14
61				RATIOS	0.6260	0.6758	0.8280	0.7099	
	8.5			CONTRIB	84.72%	11.62%	2.29%	1.38%	110
		11.0	2.94	CONTRIB	64.65%	29.81%	4.86%	0.69%	32
62				RATIOS	0.3706	0.5770	0.7028	0.5501	
	5.2			CONTRIB	70.95%	18.90%	4.33%	5.81%	110
		11.0	0.28	CONTRIB	0.22%	60.73%	38.07%	0.99%	3

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
63				RATIOS	0.2880	0.5780	0.5436	0.4699	
	4.2			CONTRIB	63.50%	23.53%	4.08%	8.89%	109
		11.0	0.20	CONTRIB	0.00%	87.41%	12.59%	0.00%	2
64				RATIOS	0.2608	0.4938	0.5340	0.4295	
	3.8			CONTRIB	62.76%	23.15%	4.82%	9.27%	110
		11.0	0.04	CONTRIB	0.00%	40.56%	59.44%	0.00%	0
65				RATIOS	0.6228	0.5300	0.5084	0.5537	
	8.3			CONTRIB	89.67%	9.08%	1.00%	0.25%	110
		11.0	1.78	CONTRIB	96.44%	2.56%	0.84%	0.17%	19
66				RATIOS	0.6848	0.5946	0.5016	0.5937	
	9.2			CONTRIB	89.92%	9.29%	0.58%	0.21%	110
		11.0	4.12	CONTRIB	92.87%	6.68%	0.32%	0.13%	45
67				RATIOS	0.5920	0.4206	0.5872	0.5333	
	7.8			CONTRIB	95.71%	2.57%	1.42%	0.30%	110
		11.0	0.68	CONTRIB	92.37%	0.36%	6.95%	0.32%	7
68				RATIOS	0.3098	0.5736	0.5778	0.4871	
	4.4			CONTRIB	65.49%	23.07%	4.04%	7.40%	109
		11.0	0.20	CONTRIB	0.00%	78.66%	20.80%	0.53%	2
69				RATIOS	0.7020	0.3560	0.7244	0.5941	
	9.2			CONTRIB	98.24%	0.03%	1.54%	0.20%	110
		11.0	4.41	CONTRIB	97.30%	0.01%	2.57%	0.12%	48
70				RATIOS	0.5376	0.3768	0.6842	0.5329	
	7.1			CONTRIB	95.13%	2.03%	2.23%	0.61%	110
		11.0	0.20	CONTRIB	46.71%	0.38%	51.82%	1.09%	2
71				RATIOS	0.9528	0.6234	0.9692	0.8485	
	12.5			CONTRIB	97.47%	0.75%	1.49%	0.29%	110
		11.0	18.77	CONTRIB	95.53%	3.07%	1.00%	0.40%	206
72				RATIOS	0.9796	0.8108	1.0554	0.9486	
	13.1			CONTRIB	89.14%	8.80%	1.60%	0.46%	110
		11.0	21.38	CONTRIB	93.17%	4.99%	1.03%	0.80%	234
73				RATIOS	0.8260	0.8602	0.8360	0.8407	
	11.1			CONTRIB	86.71%	11.23%	1.42%	0.64%	110
		11.0	10.55	CONTRIB	87.16%	10.80%	1.38%	0.67%	115
74				RATIOS	0.7350	0.9032	0.5856	0.7413	
	10.0			CONTRIB	84.80%	13.69%	0.94%	0.58%	110
		11.0	6.60	CONTRIB	80.68%	18.20%	0.70%	0.42%	72
75				RATIOS	1.1104	0.8996	1.1708	1.0603	
	14.9			CONTRIB	89.43%	8.60%	1.54%	0.42%	110
		11.0	33.25	CONTRIB	94.57%	3.60%	0.81%	1.02%	364
76				RATIOS	1.0266	0.9628	1.2502	1.0799	
	13.8			CONTRIB	87.17%	10.03%	1.97%	0.83%	110
		11.0	25.61	CONTRIB	92.28%	5.05%	1.20%	1.48%	280
77				RATIOS	0.9720	0.9176	1.1374	1.0090	
	13.1			CONTRIB	87.32%	10.11%	1.82%	0.75%	110
		11.0	21.09	CONTRIB	91.80%	5.79%	1.21%	1.19%	231
78				RATIOS	0.9828	0.9340	1.1284	1.0151	
	13.2			CONTRIB	87.33%	10.18%	1.77%	0.72%	110
		11.0	21.92	CONTRIB	91.98%	5.68%	1.15%	1.19%	240
79				RATIOS	0.7114	0.6436	0.6614	0.6721	
	9.5			CONTRIB	88.69%	9.68%	1.24%	0.38%	110
		11.0	5.51	CONTRIB	82.93%	15.06%	1.76%	0.24%	60

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
80				RATIOS	0.1860	0.4698	0.3620	0.3393	
	2.4			CONTRIB	66.13%	16.20%	3.44%	14.23%	174
		11.0	0.01	CONTRIB	0.00%	94.13%	5.62%	0.25%	0
81				RATIOS	0.2136	0.6230	0.3012	0.3793	
	3.1			CONTRIB	58.58%	25.88%	2.22%	13.32%	109
		11.0	0.57	CONTRIB	0.00%	99.99%	0.00%	0.01%	6
82				RATIOS	0.2164	0.3572	0.4692	0.3476	
	1.7			CONTRIB	86.29%	3.35%	1.51%	8.86%	860
		11.0	0.01	CONTRIB	0.00%	4.85%	94.81%	0.34%	0
83				RATIOS	0.3768	0.4958	0.4128	0.4285	
	5.1			CONTRIB	81.96%	15.12%	1.59%	1.33%	110
		11.0	0.02	CONTRIB	4.00%	85.36%	10.64%	0.00%	0
84				RATIOS	0.2784	0.6408	0.4174	0.4455	
	4.0			CONTRIB	64.83%	24.44%	2.61%	8.13%	109
		11.0	0.83	CONTRIB	0.00%	99.73%	0.27%	0.00%	9
85				RATIOS	0.3348	0.3582	0.3986	0.3639	
	4.5			CONTRIB	85.57%	11.54%	1.87%	1.02%	109
		11.0	0.00	CONTRIB	8.43%	19.78%	69.38%	2.41%	0
86				RATIOS	0.2514	0.9056	0.5022	0.5531	
	3.9			CONTRIB	46.14%	26.48%	3.98%	23.39%	110
		11.0	1.22	CONTRIB	0.00%	98.66%	1.11%	0.24%	13
87				RATIOS	0.3380	0.9584	0.6540	0.6501	
	5.1			CONTRIB	53.31%	25.53%	3.97%	17.19%	110
		11.0	1.39	CONTRIB	0.01%	92.36%	6.87%	0.76%	15
88				RATIOS	0.5540	0.6704	0.6112	0.6119	
	7.5			CONTRIB	83.95%	13.30%	1.63%	1.12%	110
		11.0	1.11	CONTRIB	15.20%	78.34%	5.87%	0.59%	12
89				RATIOS	1.0110	1.3364	1.4628	1.2701	
	13.9			CONTRIB	79.78%	15.09%	2.65%	2.48%	110
		11.0	25.97	CONTRIB	86.04%	8.48%	1.62%	3.85%	284
90				RATIOS	0.3408	0.3222	0.2176	0.2935	
	4.6			CONTRIB	89.43%	10.18%	0.19%	0.20%	110
		11.0	0.00	CONTRIB	67.01%	32.99%	0.00%	0.00%	0
91				RATIOS	0.2538	0.2388	0.3950	0.2959	
	3.0			CONTRIB	88.73%	6.79%	2.38%	2.10%	184
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
92				RATIOS	0.4740	0.5466	0.8378	0.6195	
	6.5			CONTRIB	80.52%	12.34%	3.96%	3.18%	110
		11.0	0.23	CONTRIB	3.54%	31.40%	61.98%	3.08%	3
93				RATIOS	0.8976	0.8312	1.0746	0.9345	
	12.1			CONTRIB	87.42%	9.90%	1.91%	0.77%	110
		11.0	15.04	CONTRIB	90.16%	7.29%	1.52%	1.02%	165
94				RATIOS	0.8810	0.9294	1.0830	0.9645	
	11.9			CONTRIB	85.58%	11.36%	1.99%	1.08%	110
		11.0	14.09	CONTRIB	88.20%	8.79%	1.65%	1.36%	154
95				RATIOS	0.8858	1.0164	1.0712	0.9911	
	12.0			CONTRIB	84.44%	12.41%	1.92%	1.24%	110
		11.0	14.62	CONTRIB	87.24%	9.66%	1.56%	1.55%	160
96				RATIOS	0.8012	1.0384	0.9542	0.9313	
	10.9			CONTRIB	81.86%	14.74%	1.84%	1.56%	110
		11.0	9.76	CONTRIB	81.64%	14.96%	1.86%	1.53%	107

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
97				RATIOS	0.7490	1.0354	0.9444	0.9096	
	10.3			CONTRIB	79.72%	16.22%	2.03%	2.02%	110
		11.0	7.58	CONTRIB	76.78%	19.20%	2.36%	1.66%	83
98				RATIOS	0.5496	0.2314	0.4062	0.3957	
	7.2			CONTRIB	99.20%	0.00%	0.73%	0.06%	110
		11.0	0.15	CONTRIB	98.84%	0.00%	1.16%	0.00%	2
99				RATIOS	0.2946	0.6154	0.3010	0.4037	
	4.1			CONTRIB	71.12%	23.94%	1.34%	3.61%	109
		11.0	0.47	CONTRIB	0.00%	100.00%	0.00%	0.00%	5
100				RATIOS	0.3028	0.5184	0.3604	0.3939	
	4.2			CONTRIB	73.19%	22.31%	1.76%	2.74%	109
		11.0	0.03	CONTRIB	0.00%	98.69%	1.31%	0.00%	0

The Getty Villa
Malibu, California

Project Full Year - 6-9 pm
Wind Test Date: Aug-01

The ratios of pedestrian-level wind speeds to the tower reference wind speeds at the SCAQMD meteorological station are shown in the first line of output for each location.

The second line of the output shows the pedestrian level wind speeds, in mph, which would be exceeded 10% of the time for each measurement location. A comfort criterion of 11 mph is used for areas of substantial public pedestrian use AND 7 mph for public seating areas. These criteria are not to be exceeded more than 10% of the time.

The third line of output for each location shows the criterion speed and the percentage of the time the criterion would be exceeded. The rows labeled CONTRIB tabulate the percentage contribution to the total or the exceedance from each wind direction. The SUMs are the equivalent number of events.

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
				Profile Ratios:	2.0000	2.0000	2.0000	2.0000	1,095 Obs
1				RATIOS	0.3918	0.4354	0.6534	0.4935	
	4.6			CONTRIB	16.73%	50.51%	26.33%	6.43%	109
		11.0	0.56	CONTRIB	0.21%	0.62%	98.96%	0.21%	6
2				RATIOS	0.8888	0.6886	0.7662	0.7812	
	8.7			CONTRIB	57.00%	35.01%	6.69%	1.30%	110
		11.0	3.90	CONTRIB	29.41%	54.79%	15.05%	0.74%	43
3				RATIOS	0.4752	0.2434	0.4550	0.3912	
	3.2			CONTRIB	74.97%	10.09%	8.29%	6.65%	339
		11.0	0.01	CONTRIB	61.02%	0.00%	38.98%	0.00%	0
4				RATIOS	0.8570	0.7516	1.2612	0.9566	
	9.1			CONTRIB	32.85%	37.69%	24.04%	5.42%	110
		11.0	4.79	CONTRIB	18.14%	53.41%	26.54%	1.91%	52
5				RATIOS	0.7194	0.3670	0.7360	0.6075	
	6.6			CONTRIB	79.32%	7.53%	11.68%	1.47%	110
		11.0	0.81	CONTRIB	28.12%	0.07%	71.05%	0.76%	9
6				RATIOS	0.9360	0.4556	1.2234	0.8717	
	8.8			CONTRIB	70.34%	2.23%	24.34%	3.09%	110
		11.0	2.94	CONTRIB	57.89%	0.19%	40.09%	1.83%	32
7				RATIOS	0.5474	0.4864	0.7060	0.5799	
	5.7			CONTRIB	38.99%	40.96%	15.76%	4.28%	110
		11.0	0.61	CONTRIB	4.39%	2.03%	92.88%	0.70%	7
8				RATIOS	0.4700	0.6178	0.7528	0.6135	
	5.8			CONTRIB	11.13%	65.40%	18.02%	5.44%	110
		11.0	1.62	CONTRIB	0.47%	63.02%	36.09%	0.41%	18
9				RATIOS	0.7956	0.4866	1.1024	0.7949	
	7.9			CONTRIB	50.68%	20.73%	24.94%	3.66%	110
		11.0	1.45	CONTRIB	34.08%	0.87%	62.85%	2.20%	16
10				RATIOS	0.6762	0.4254	0.7058	0.6025	
	6.5			CONTRIB	63.40%	23.64%	11.23%	1.74%	110
		11.0	0.72	CONTRIB	19.81%	0.38%	79.00%	0.80%	8
11				RATIOS	0.6646	0.4158	0.5608	0.5471	
	6.3			CONTRIB	68.31%	23.95%	6.81%	0.92%	110
		11.0	0.22	CONTRIB	57.41%	0.99%	40.37%	1.23%	2

Location	10.0% Exc. Ground Speed	Criterion Speed Exc.	Criterion % Time Exc.		ENE	S	SW	OTHER	SUM
12				RATIOS	0.4414	0.4272	0.5870	0.4852	
	4.7			CONTRIB	32.80%	46.57%	15.95%	4.67%	109
		11.0	0.18	CONTRIB	2.26%	1.61%	95.54%	0.58%	2
13				RATIOS	0.8810	0.4562	0.5740	0.6371	
	8.1			CONTRIB	82.45%	11.11%	5.92%	0.52%	110
		11.0	1.21	CONTRIB	88.66%	0.46%	10.13%	0.75%	13
14				RATIOS	0.6794	0.5292	0.5226	0.5771	
	6.6			CONTRIB	57.40%	35.48%	6.16%	0.95%	110
		11.0	0.24	CONTRIB	60.85%	24.21%	13.26%	1.69%	3
15				RATIOS	0.5298	0.3756	0.5832	0.4962	
	5.2			CONTRIB	56.36%	29.08%	12.23%	2.33%	109
		11.0	0.18	CONTRIB	11.75%	0.41%	87.15%	0.70%	2
16				RATIOS	0.3460	0.4450	0.6174	0.4695	
	4.4			CONTRIB	9.31%	59.05%	25.36%	6.28%	110
		11.0	0.35	CONTRIB	0.07%	1.24%	98.69%	0.00%	4
17				RATIOS	0.4484	0.3580	0.2930	0.3665	
	4.4			CONTRIB	56.36%	37.11%	5.79%	0.74%	110
		11.0	0.01	CONTRIB	91.30%	7.67%	0.00%	1.03%	0
18				RATIOS	0.3618	0.3344	0.3776	0.3579	
	3.7			CONTRIB	42.03%	45.92%	9.54%	2.51%	109
		11.0	0.00	CONTRIB	31.52%	11.66%	54.07%	2.75%	0
19				RATIOS	0.3558	0.3682	0.4416	0.3885	
	3.8			CONTRIB	30.44%	52.73%	12.91%	3.92%	110
		11.0	0.00	CONTRIB	7.39%	11.39%	81.22%	0.00%	0
20				RATIOS	0.5698	0.3592	0.4504	0.4598	
	5.4			CONTRIB	68.52%	24.36%	6.30%	0.82%	109
		11.0	0.04	CONTRIB	87.44%	0.97%	11.59%	0.00%	0
21				RATIOS	0.4740	0.3808	0.5990	0.4846	
	4.8			CONTRIB	45.23%	34.97%	15.97%	3.83%	110
		11.0	0.23	CONTRIB	3.54%	0.37%	95.66%	0.43%	3
22				RATIOS	0.5512	0.3482	0.4442	0.4479	
	5.2			CONTRIB	68.36%	24.44%	6.34%	0.85%	109
		11.0	0.03	CONTRIB	86.24%	0.84%	12.92%	0.00%	0
23				RATIOS	0.4456	0.3512	0.3920	0.3963	
	4.4			CONTRIB	55.63%	36.00%	6.97%	1.40%	109
		11.0	0.01	CONTRIB	74.81%	5.26%	19.93%	0.00%	0
24				RATIOS	0.3796	0.3826	0.3422	0.3681	
	3.9			CONTRIB	37.98%	53.84%	6.39%	1.79%	109
		11.0	0.00	CONTRIB	40.95%	45.23%	11.05%	2.78%	0
25				RATIOS	0.1940	0.3066	0.3338	0.2781	
	2.7			CONTRIB	4.52%	75.99%	15.16%	4.32%	109
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
26				RATIOS	0.8358	0.4236	0.9914	0.7503	
	7.8			CONTRIB	74.86%	5.63%	17.12%	2.40%	109
		11.0	1.44	CONTRIB	49.79%	0.18%	48.44%	1.59%	16
27				RATIOS	0.7400	0.6280	0.8020	0.7233	
	7.4			CONTRIB	46.84%	39.58%	10.93%	2.64%	110
		11.0	2.28	CONTRIB	12.46%	60.48%	26.24%	0.82%	25
28				RATIOS	0.1384	0.1504	0.1352	0.1413	
	2.4			CONTRIB	3.61%	78.94%	17.05%	0.39%	31
		11.0	0.00	CONTRIB	0.00%	0.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	---Criterion--- % Time Exc.		ENE	S	SW	OTHER	SUM
29				RATIOS	0.6410	0.5794	0.6550	0.6251	
	6.5			CONTRIB	44.05%	44.38%	9.21%	2.36%	110
		11.0	0.97	CONTRIB	9.81%	32.26%	57.13%	0.80%	11
30				RATIOS	0.3770	0.4676	0.4814	0.4420	
	4.4			CONTRIB	18.38%	66.55%	11.40%	3.67%	110
		11.0	0.02	CONTRIB	4.21%	40.16%	55.63%	0.00%	0
31				RATIOS	0.7190	0.3632	0.6184	0.5669	
	6.6			CONTRIB	83.96%	7.41%	7.76%	0.87%	109
		11.0	0.59	CONTRIB	38.91%	0.08%	60.40%	0.61%	6
32				RATIOS	0.6094	0.3244	0.4406	0.4581	
	5.5			CONTRIB	77.54%	16.42%	5.43%	0.61%	125
		11.0	0.07	CONTRIB	94.03%	0.17%	5.80%	0.00%	1
33				RATIOS	0.4940	0.2270	0.4258	0.3823	
	3.6			CONTRIB	83.60%	8.56%	5.42%	2.43%	280
		11.0	0.01	CONTRIB	80.63%	0.00%	18.76%	0.61%	0
34				RATIOS	0.5710	0.7490	0.4556	0.5919	
	6.7			CONTRIB	18.00%	75.05%	5.83%	1.12%	110
		11.0	2.59	CONTRIB	1.46%	98.14%	0.21%	0.19%	28
35				RATIOS	0.5670	0.5240	0.2746	0.4552	
	5.6			CONTRIB	50.06%	48.87%	0.46%	0.60%	110
		11.0	0.08	CONTRIB	42.07%	57.93%	0.00%	0.00%	1
36				RATIOS	0.3736	0.6602	0.1966	0.4101	
	5.2			CONTRIB	4.38%	95.10%	0.02%	0.50%	110
		11.0	1.96	CONTRIB	0.03%	99.97%	0.00%	0.00%	21
37				RATIOS	0.4336	0.4142	0.3378	0.3952	
	4.4			CONTRIB	42.90%	49.82%	6.09%	1.20%	110
		11.0	0.01	CONTRIB	59.50%	37.10%	3.39%	0.00%	0
38				RATIOS	0.3650	0.5010	0.1744	0.3468	
	4.3			CONTRIB	17.24%	82.10%	0.05%	0.61%	110
		11.0	0.02	CONTRIB	2.29%	97.59%	0.00%	0.12%	0
39				RATIOS	0.4482	0.3882	0.2750	0.3705	
	4.4			CONTRIB	51.12%	42.53%	5.62%	0.72%	110
		11.0	0.01	CONTRIB	80.65%	18.30%	0.00%	1.05%	0
40				RATIOS	0.3056	0.3962	0.4652	0.3890	
	3.7			CONTRIB	12.86%	66.17%	15.84%	5.13%	110
		11.0	0.01	CONTRIB	0.00%	16.02%	83.98%	0.00%	0
41				RATIOS	0.2344	0.7980	0.4222	0.4849	
	6.4			CONTRIB	0.01%	93.84%	5.74%	0.41%	110
		11.0	2.90	CONTRIB	0.00%	99.88%	0.09%	0.04%	32
42				RATIOS	0.2834	0.5756	0.4350	0.4313	
	4.7			CONTRIB	1.18%	90.00%	7.37%	1.45%	110
		11.0	0.28	CONTRIB	0.00%	98.78%	1.22%	0.00%	3
43				RATIOS	0.2774	0.4582	0.4332	0.3896	
	3.9			CONTRIB	4.07%	81.31%	11.50%	3.12%	110
		11.0	0.01	CONTRIB	0.00%	64.08%	35.92%	0.00%	0
44				RATIOS	0.3088	0.5332	0.3682	0.4034	
	4.4			CONTRIB	3.84%	88.40%	6.29%	1.47%	110
		11.0	0.07	CONTRIB	0.00%	99.18%	0.82%	0.00%	1
45				RATIOS	0.2534	0.3590	0.2644	0.2923	
	3.1			CONTRIB	12.19%	79.59%	6.34%	1.89%	110
		11.0	0.00	CONTRIB	0.00%	100.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
46				RATIOS	0.3668	0.5084	0.4976	0.4576	
	4.6			CONTRIB	11.22%	73.91%	11.29%	3.58%	110
		11.0	0.04	CONTRIB	1.20%	62.91%	35.89%	0.00%	0
47				RATIOS	0.3160	0.4472	0.3364	0.3665	
	3.9			CONTRIB	12.20%	79.42%	6.38%	2.00%	110
		11.0	0.00	CONTRIB	0.00%	95.15%	3.74%	1.11%	0
48				RATIOS	0.3518	0.4832	0.4268	0.4206	
	4.3			CONTRIB	12.85%	75.38%	8.93%	2.84%	110
		11.0	0.01	CONTRIB	2.23%	77.86%	19.90%	0.00%	0
49				RATIOS	0.2944	0.5572	0.4922	0.4479	
	4.7			CONTRIB	1.72%	85.70%	10.29%	2.29%	110
		11.0	0.17	CONTRIB	0.00%	91.72%	8.28%	0.00%	2
50				RATIOS	0.5420	0.4014	0.6856	0.5430	
	5.4			CONTRIB	49.11%	30.40%	16.91%	3.58%	110
		11.0	0.59	CONTRIB	4.20%	0.25%	95.12%	0.43%	6
51				RATIOS	0.6462	0.6436	1.1044	0.7981	
	7.4			CONTRIB	19.93%	41.56%	31.88%	6.63%	110
		11.0	2.91	CONTRIB	3.47%	63.98%	31.42%	1.12%	32
52				RATIOS	0.6440	0.6084	0.8240	0.6921	
	6.8			CONTRIB	35.54%	45.39%	14.80%	4.27%	110
		11.0	1.49	CONTRIB	6.63%	51.73%	40.66%	0.98%	16
53				RATIOS	0.4660	0.5564	0.6912	0.5712	
	5.5			CONTRIB	17.59%	60.27%	16.84%	5.29%	110
		11.0	0.72	CONTRIB	0.96%	20.47%	78.04%	0.52%	8
54				RATIOS	0.5172	0.5404	0.8236	0.6271	
	5.9			CONTRIB	21.36%	47.42%	25.04%	6.18%	110
		11.0	0.72	CONTRIB	2.39%	12.10%	84.39%	1.12%	8
55				RATIOS	0.5770	0.5006	0.8904	0.6560	
	6.2			CONTRIB	30.50%	35.98%	27.76%	5.76%	110
		11.0	0.69	CONTRIB	5.90%	3.05%	89.51%	1.54%	8
56				RATIOS	0.6532	0.2644	0.9310	0.6162	
	6.2			CONTRIB	64.29%	0.07%	32.59%	3.05%	110
		11.0	0.75	CONTRIB	14.64%	0.00%	84.43%	0.93%	8
57				RATIOS	0.6796	0.5162	0.9034	0.6997	
	6.9			CONTRIB	45.18%	31.15%	19.58%	4.09%	110
		11.0	0.83	CONTRIB	17.95%	4.51%	75.67%	1.87%	9
58				RATIOS	0.5496	0.3330	0.6434	0.5087	
	5.3			CONTRIB	61.25%	21.64%	14.74%	2.36%	109
		11.0	0.58	CONTRIB	4.80%	0.03%	94.92%	0.26%	6
59				RATIOS	0.4072	0.2454	0.4908	0.3811	
	2.5			CONTRIB	55.93%	11.60%	20.45%	12.02%	513
		11.0	0.01	CONTRIB	11.56%	0.00%	87.86%	0.58%	0
60				RATIOS	0.6136	0.2536	0.5634	0.4769	
	5.6			CONTRIB	89.56%	0.22%	9.37%	0.85%	109
		11.0	0.16	CONTRIB	41.65%	0.00%	58.35%	0.00%	2
61				RATIOS	0.6260	0.6758	0.8280	0.7099	
	6.9			CONTRIB	26.26%	55.00%	14.25%	4.49%	110
		11.0	2.76	CONTRIB	2.86%	74.60%	21.94%	0.61%	30
62				RATIOS	0.3706	0.5770	0.7028	0.5501	
	5.3			CONTRIB	3.94%	70.46%	20.55%	5.05%	110
		11.0	0.86	CONTRIB	0.07%	33.61%	65.99%	0.32%	9

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
63				RATIOS	0.2880	0.5780	0.5436	0.4699	
	4.9			CONTRIB	1.06%	84.66%	11.87%	2.42%	110
		11.0	0.36	CONTRIB	0.00%	84.10%	15.90%	0.00%	4
64				RATIOS	0.2608	0.4938	0.5340	0.4295	
	4.3			CONTRIB	1.33%	79.42%	15.74%	3.51%	110
		11.0	0.06	CONTRIB	0.00%	27.29%	72.71%	0.00%	1
65				RATIOS	0.6228	0.5300	0.5084	0.5537	
	6.2			CONTRIB	51.44%	41.05%	6.26%	1.24%	110
		11.0	0.16	CONTRIB	46.99%	37.64%	13.54%	1.83%	2
66				RATIOS	0.6848	0.5946	0.5016	0.5937	
	6.8			CONTRIB	50.47%	42.57%	6.00%	0.95%	110
		11.0	0.68	CONTRIB	22.99%	73.63%	2.63%	0.75%	7
67				RATIOS	0.5920	0.4206	0.5872	0.5333	
	5.7			CONTRIB	59.01%	29.65%	9.61%	1.73%	109
		11.0	0.22	CONTRIB	22.45%	1.08%	75.50%	0.97%	2
68				RATIOS	0.3098	0.5736	0.5778	0.4871	
	4.9			CONTRIB	1.73%	81.62%	13.52%	3.13%	110
		11.0	0.40	CONTRIB	0.00%	65.68%	34.05%	0.27%	4
69				RATIOS	0.7020	0.3560	0.7244	0.5941	
	6.5			CONTRIB	79.70%	6.83%	11.96%	1.51%	109
		11.0	0.77	CONTRIB	24.65%	0.05%	74.63%	0.67%	8
70				RATIOS	0.5376	0.3768	0.6842	0.5329	
	5.3			CONTRIB	51.22%	27.52%	17.81%	3.45%	110
		11.0	0.59	CONTRIB	3.95%	0.13%	95.55%	0.37%	6
71				RATIOS	0.9528	0.6234	0.9692	0.8485	
	9.1			CONTRIB	62.36%	25.49%	10.46%	1.69%	110
		11.0	3.86	CONTRIB	50.52%	31.17%	17.11%	1.20%	42
72				RATIOS	0.9796	0.8108	1.0554	0.9486	
	9.8			CONTRIB	48.50%	38.03%	10.92%	2.55%	110
		11.0	6.23	CONTRIB	37.45%	48.04%	13.11%	1.40%	68
73				RATIOS	0.8260	0.8602	0.8360	0.8407	
	8.7			CONTRIB	33.91%	55.61%	8.11%	2.38%	110
		11.0	4.69	CONTRIB	14.01%	72.09%	12.96%	0.94%	51
74				RATIOS	0.7350	0.9032	0.5856	0.7413	
	8.3			CONTRIB	22.83%	70.07%	5.91%	1.20%	110
		11.0	4.19	CONTRIB	6.44%	89.16%	3.89%	0.51%	46
75				RATIOS	1.1104	0.8996	1.1708	1.0603	
	11.0			CONTRIB	50.31%	36.83%	10.50%	2.36%	110
		11.0	10.11	CONTRIB	50.53%	36.63%	10.45%	2.39%	111
76				RATIOS	1.0266	0.9628	1.2502	1.0799	
	10.7			CONTRIB	37.41%	45.47%	13.36%	3.76%	110
		11.0	8.92	CONTRIB	35.05%	47.79%	13.95%	3.22%	98
77				RATIOS	0.9720	0.9176	1.1374	1.0090	
	10.1			CONTRIB	38.01%	46.42%	12.17%	3.40%	110
		11.0	7.21	CONTRIB	30.79%	53.47%	13.64%	2.10%	79
78				RATIOS	0.9828	0.9340	1.1284	1.0151	
	10.2			CONTRIB	38.02%	47.13%	11.61%	3.24%	110
		11.0	7.50	CONTRIB	31.72%	53.30%	12.85%	2.13%	82
79				RATIOS	0.7114	0.6436	0.6614	0.6721	
	7.2			CONTRIB	45.70%	45.06%	7.39%	1.85%	110
		11.0	2.64	CONTRIB	7.97%	70.52%	21.05%	0.47%	29

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
80				RATIOS	0.1860	0.4698	0.3620	0.3393	
	3.8			CONTRIB	0.22%	90.90%	7.82%	1.06%	110
		11.0	0.01	CONTRIB	0.00%	94.13%	5.62%	0.25%	0
81				RATIOS	0.2136	0.6230	0.3012	0.3793	
	5.0			CONTRIB	0.07%	93.96%	5.55%	0.41%	110
		11.0	1.19	CONTRIB	0.00%	99.99%	0.00%	0.01%	13
82				RATIOS	0.2164	0.3572	0.4692	0.3476	
	3.3			CONTRIB	2.15%	67.21%	25.62%	5.02%	109
		11.0	0.01	CONTRIB	0.00%	4.85%	94.81%	0.34%	0
83				RATIOS	0.3768	0.4958	0.4128	0.4285	
	4.4			CONTRIB	16.46%	73.62%	7.52%	2.40%	110
		11.0	0.02	CONTRIB	3.68%	86.56%	9.76%	0.00%	0
84				RATIOS	0.2784	0.6408	0.4174	0.4455	
	5.2			CONTRIB	0.49%	92.47%	6.20%	0.84%	110
		11.0	1.85	CONTRIB	0.00%	99.88%	0.12%	0.00%	20
85				RATIOS	0.3348	0.3582	0.3986	0.3639	
	3.6			CONTRIB	29.11%	55.95%	11.43%	3.51%	110
		11.0	0.00	CONTRIB	8.43%	19.78%	69.38%	2.41%	0
86				RATIOS	0.2514	0.9056	0.5022	0.5531	
	7.3			CONTRIB	0.01%	93.73%	5.85%	0.42%	110
		11.0	3.78	CONTRIB	0.00%	99.44%	0.48%	0.08%	41
87				RATIOS	0.3380	0.9584	0.6540	0.6501	
	7.8			CONTRIB	0.09%	92.85%	6.31%	0.74%	110
		11.0	4.78	CONTRIB	0.00%	88.22%	11.57%	0.21%	52
88				RATIOS	0.5540	0.6704	0.6112	0.6119	
	6.3			CONTRIB	22.03%	66.82%	8.47%	2.68%	110
		11.0	2.36	CONTRIB	1.26%	85.77%	12.69%	0.28%	26
89				RATIOS	1.0110	1.3364	1.4628	1.2701	
	12.3			CONTRIB	12.75%	68.95%	13.81%	4.48%	110
		11.0	15.16	CONTRIB	18.74%	59.01%	13.49%	8.76%	166
90				RATIOS	0.3408	0.3222	0.2176	0.2935	
	3.5			CONTRIB	44.31%	49.23%	5.65%	0.80%	110
		11.0	0.00	CONTRIB	67.01%	32.99%	0.00%	0.00%	0
91				RATIOS	0.2538	0.2388	0.3950	0.2959	
	0.1			CONTRIB	42.28%	15.53%	17.26%	24.93%	1,095
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
92				RATIOS	0.4740	0.5466	0.8378	0.6195	
	5.8			CONTRIB	13.07%	51.02%	29.21%	6.71%	110
		11.0	0.73	CONTRIB	1.14%	14.63%	83.24%	0.99%	8
93				RATIOS	0.8976	0.8312	1.0746	0.9345	
	9.3			CONTRIB	38.70%	44.73%	12.98%	3.59%	110
		11.0	5.32	CONTRIB	23.26%	59.18%	16.05%	1.50%	58
94				RATIOS	0.8810	0.9294	1.0830	0.9645	
	9.5			CONTRIB	29.39%	54.37%	12.42%	3.81%	110
		11.0	6.00	CONTRIB	17.88%	65.97%	14.50%	1.64%	66
95				RATIOS	0.8858	1.0164	1.0712	0.9911	
	9.9			CONTRIB	24.19%	61.28%	11.04%	3.49%	110
		11.0	6.91	CONTRIB	16.18%	69.71%	12.26%	1.85%	76
96				RATIOS	0.8012	1.0384	0.9542	0.9313	
	9.5			CONTRIB	16.54%	71.23%	9.26%	2.97%	110
		11.0	6.30	CONTRIB	8.27%	80.34%	10.15%	1.25%	69

Loca- tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
97				RATIOS	0.7490	1.0354	0.9444	0.9096	
	9.2			CONTRIB	12.13%	75.17%	9.65%	3.06%	110
		11.0	6.04	CONTRIB	5.15%	83.18%	10.53%	1.14%	66
98				RATIOS	0.5496	0.2314	0.4062	0.3957	
	4.9			CONTRIB	92.83%	0.35%	6.25%	0.57%	110
		11.0	0.03	CONTRIB	94.26%	0.00%	5.74%	0.00%	0
99				RATIOS	0.2946	0.6154	0.3010	0.4037	
	5.0			CONTRIB	1.06%	92.77%	5.56%	0.61%	110
		11.0	0.95	CONTRIB	0.00%	100.00%	0.00%	0.00%	10
100				RATIOS	0.3028	0.5184	0.3604	0.3939	
	4.3			CONTRIB	4.06%	88.12%	6.30%	1.51%	110
		11.0	0.04	CONTRIB	0.00%	98.95%	1.05%	0.00%	0

The Getty Villa
Malibu, California

Project Full Year - All Hours
Wind Test Date: Aug-01

The ratios of pedestrian-level wind speeds to the tower reference wind speeds at the SCAQMD meteorological station are shown in the first line of output for each location.

The second line of the output shows the pedestrian level wind speeds, in mph, which would be exceeded 10% of the time for each measurement location. A comfort criterion of 11 mph is used for areas of substantial public pedestrian use AND 7 mph for public seating areas. These criteria are not to be exceeded more than 10% of the time.

The third line of output for each location shows the criterion speed and the percentage of the time the criterion would be exceeded. The rows labeled CONTRIB tabulate the percentage contribution to the total or the exceedance from each wind direction. The SUMs are the equivalent number of events.

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
				Profile Ratios:	2.0000	2.0000	2.0000	2.0000	8,760 Obs
1				RATIOS	0.3918	0.4354	0.6534	0.4935	
	4.9			CONTRIB	27.51%	37.91%	30.28%	4.31%	876
		11.0	0.27	CONTRIB	0.54%	21.15%	77.76%	0.55%	24
2				RATIOS	0.8888	0.6886	0.7662	0.7812	
	9.1			CONTRIB	64.49%	28.02%	6.05%	1.44%	876
		11.0	5.25	CONTRIB	54.90%	37.80%	6.49%	0.81%	460
3				RATIOS	0.4752	0.2434	0.4550	0.3912	
	4.6			CONTRIB	80.69%	7.86%	10.15%	1.30%	876
		11.0	0.01	CONTRIB	94.00%	0.00%	6.00%	0.00%	1
4				RATIOS	0.8570	0.7516	1.2612	0.9566	
	9.8			CONTRIB	40.43%	29.10%	26.86%	3.61%	876
		11.0	6.73	CONTRIB	37.06%	34.68%	25.88%	2.38%	590
5				RATIOS	0.7194	0.3670	0.7360	0.6075	
	7.1			CONTRIB	78.71%	7.30%	12.51%	1.48%	876
		11.0	1.55	CONTRIB	79.68%	0.43%	19.38%	0.50%	136
6				RATIOS	0.9360	0.4556	1.2234	0.8717	
	9.5			CONTRIB	67.51%	3.88%	26.34%	2.28%	876
		11.0	5.30	CONTRIB	66.89%	1.88%	29.58%	1.65%	465
7				RATIOS	0.5474	0.4864	0.7060	0.5799	
	6.0			CONTRIB	46.64%	31.61%	18.61%	3.14%	876
		11.0	0.56	CONTRIB	14.64%	37.14%	47.27%	0.95%	49
8				RATIOS	0.4700	0.6178	0.7528	0.6135	
	6.1			CONTRIB	23.87%	49.38%	22.44%	4.31%	876
		11.0	1.69	CONTRIB	0.57%	79.80%	19.14%	0.50%	148
9				RATIOS	0.7956	0.4866	1.1024	0.7949	
	8.5			CONTRIB	54.21%	15.76%	27.38%	2.64%	876
		11.0	3.21	CONTRIB	57.78%	6.52%	34.21%	1.49%	281
10				RATIOS	0.6762	0.4254	0.7058	0.6025	
	6.9			CONTRIB	67.07%	19.39%	11.86%	1.67%	876
		11.0	1.28	CONTRIB	75.44%	3.33%	20.67%	0.57%	112
11				RATIOS	0.6646	0.4158	0.5608	0.5471	
	6.6			CONTRIB	72.87%	19.86%	6.15%	1.12%	876
		11.0	0.96	CONTRIB	94.25%	3.35%	2.05%	0.35%	84

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
12				RATIOS	0.4414	0.4272	0.5870	0.4852	
	5.0			CONTRIB	42.00%	35.45%	19.10%	3.45%	876
		11.0	0.10	CONTRIB	5.23%	47.07%	46.36%	1.34%	8
13				RATIOS	0.8810	0.4562	0.5740	0.6371	
	8.5			CONTRIB	86.59%	9.67%	3.13%	0.62%	876
		11.0	2.93	CONTRIB	95.13%	3.47%	1.01%	0.39%	256
14				RATIOS	0.6794	0.5292	0.5226	0.5771	
	6.9			CONTRIB	65.92%	28.56%	4.33%	1.19%	876
		11.0	1.40	CONTRIB	70.47%	28.77%	0.40%	0.37%	122
15				RATIOS	0.5298	0.3756	0.5832	0.4962	
	5.5			CONTRIB	61.33%	23.31%	13.31%	2.05%	876
		11.0	0.10	CONTRIB	50.48%	8.96%	39.05%	1.52%	9
16				RATIOS	0.3460	0.4450	0.6174	0.4695	
	4.6			CONTRIB	20.96%	44.30%	30.24%	4.50%	876
		11.0	0.18	CONTRIB	0.17%	40.56%	59.27%	0.00%	16
17				RATIOS	0.4484	0.3580	0.2930	0.3665	
	4.6			CONTRIB	66.44%	29.99%	2.64%	0.94%	876
		11.0	0.01	CONTRIB	54.02%	45.37%	0.00%	0.61%	1
18				RATIOS	0.3618	0.3344	0.3776	0.3579	
	3.9			CONTRIB	52.25%	35.61%	9.81%	2.34%	876
		11.0	0.00	CONTRIB	20.17%	74.61%	3.46%	1.76%	0
19				RATIOS	0.3558	0.3682	0.4416	0.3885	
	4.0			CONTRIB	41.57%	40.24%	14.94%	3.24%	876
		11.0	0.01	CONTRIB	5.71%	88.01%	6.28%	0.00%	1
20				RATIOS	0.5698	0.3592	0.4504	0.4598	
	5.7			CONTRIB	73.69%	20.23%	5.07%	1.00%	876
		11.0	0.15	CONTRIB	96.25%	3.35%	0.40%	0.00%	13
21				RATIOS	0.4740	0.3808	0.5990	0.4846	
	5.1			CONTRIB	51.24%	27.27%	18.65%	2.84%	876
		11.0	0.09	CONTRIB	12.11%	12.51%	73.90%	1.48%	8
22				RATIOS	0.5512	0.3482	0.4442	0.4479	
	5.5			CONTRIB	73.33%	20.27%	5.36%	1.04%	876
		11.0	0.09	CONTRIB	95.78%	3.66%	0.56%	0.00%	8
23				RATIOS	0.4456	0.3512	0.3920	0.3963	
	4.6			CONTRIB	63.40%	28.72%	6.36%	1.52%	876
		11.0	0.01	CONTRIB	57.80%	40.66%	1.54%	0.00%	1
24				RATIOS	0.3796	0.3826	0.3422	0.3681	
	4.1			CONTRIB	50.55%	41.63%	5.88%	1.94%	876
		11.0	0.01	CONTRIB	8.24%	90.98%	0.22%	0.56%	1
25				RATIOS	0.1940	0.3066	0.3338	0.2781	
	2.8			CONTRIB	16.25%	58.87%	20.63%	4.24%	876
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
26				RATIOS	0.8358	0.4236	0.9914	0.7503	
	8.4			CONTRIB	72.48%	6.01%	19.53%	1.98%	876
		11.0	3.09	CONTRIB	72.99%	1.31%	24.64%	1.06%	271
27				RATIOS	0.7400	0.6280	0.8020	0.7233	
	7.9			CONTRIB	55.00%	31.06%	11.61%	2.33%	876
		11.0	3.33	CONTRIB	41.59%	45.88%	11.76%	0.78%	292
28				RATIOS	0.1384	0.1504	0.1352	0.1413	
	6.4			CONTRIB	0.00%	0.00%	0.00%	0.00%	0
		11.0	0.00	CONTRIB	0.00%	0.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
29				RATIOS	0.6410	0.5794	0.6550	0.6251	
	6.8			CONTRIB	53.85%	34.60%	9.33%	2.22%	876
		11.0	1.82	CONTRIB	42.97%	44.90%	11.59%	0.54%	159
30				RATIOS	0.3770	0.4676	0.4814	0.4420	
	4.5			CONTRIB	32.18%	51.05%	13.32%	3.45%	876
		11.0	0.14	CONTRIB	0.68%	98.41%	0.91%	0.00%	12
31				RATIOS	0.7190	0.3632	0.6184	0.5669	
	7.0			CONTRIB	84.13%	7.58%	7.25%	1.04%	876
		11.0	1.36	CONTRIB	90.98%	0.44%	8.26%	0.33%	119
32				RATIOS	0.6094	0.3244	0.4406	0.4581	
	5.9			CONTRIB	83.72%	11.31%	4.21%	0.76%	876
		11.0	0.40	CONTRIB	99.52%	0.36%	0.12%	0.00%	35
33				RATIOS	0.4940	0.2270	0.4258	0.3823	
	4.7			CONTRIB	87.60%	3.88%	7.53%	0.98%	876
		11.0	0.02	CONTRIB	97.57%	0.00%	1.83%	0.60%	2
34				RATIOS	0.5710	0.7490	0.4556	0.5919	
	6.7			CONTRIB	35.32%	59.79%	3.14%	1.75%	876
		11.0	2.48	CONTRIB	6.14%	93.58%	0.03%	0.25%	217
35				RATIOS	0.5670	0.5240	0.2746	0.4552	
	5.9			CONTRIB	61.13%	38.09%	0.04%	0.74%	876
		11.0	0.51	CONTRIB	26.94%	73.06%	0.00%	0.00%	45
36				RATIOS	0.3736	0.6602	0.1966	0.4101	
	5.0			CONTRIB	20.65%	78.30%	0.00%	1.05%	876
		11.0	1.84	CONTRIB	0.05%	99.95%	0.00%	0.00%	161
37				RATIOS	0.4336	0.4142	0.3378	0.3952	
	4.6			CONTRIB	55.53%	38.99%	4.00%	1.47%	876
		11.0	0.03	CONTRIB	11.94%	88.00%	0.07%	0.00%	3
38				RATIOS	0.3650	0.5010	0.1744	0.3468	
	4.3			CONTRIB	34.42%	64.62%	0.01%	0.95%	876
		11.0	0.26	CONTRIB	0.24%	99.75%	0.00%	0.01%	23
39				RATIOS	0.4482	0.3882	0.2750	0.3705	
	4.6			CONTRIB	62.90%	34.07%	2.09%	0.93%	876
		11.0	0.02	CONTRIB	29.82%	69.79%	0.00%	0.39%	2
40				RATIOS	0.3056	0.3962	0.4652	0.3890	
	3.9			CONTRIB	25.79%	49.93%	20.14%	4.14%	876
		11.0	0.02	CONTRIB	0.00%	95.36%	4.64%	0.00%	2
41				RATIOS	0.2344	0.7980	0.4222	0.4849	
	5.2			CONTRIB	0.21%	91.55%	5.56%	2.68%	876
		11.0	2.61	CONTRIB	0.00%	99.94%	0.01%	0.05%	228
42				RATIOS	0.2834	0.5756	0.4350	0.4313	
	4.5			CONTRIB	10.71%	76.43%	9.73%	3.13%	876
		11.0	0.78	CONTRIB	0.00%	99.94%	0.06%	0.00%	68
43				RATIOS	0.2774	0.4582	0.4332	0.3896	
	3.9			CONTRIB	16.49%	64.76%	14.97%	3.78%	876
		11.0	0.11	CONTRIB	0.00%	99.62%	0.38%	0.00%	9
44				RATIOS	0.3088	0.5332	0.3682	0.4034	
	4.3			CONTRIB	17.72%	73.33%	6.34%	2.61%	876
		11.0	0.43	CONTRIB	0.00%	99.98%	0.02%	0.00%	37
45				RATIOS	0.2534	0.3590	0.2644	0.2923	
	3.1			CONTRIB	28.62%	62.77%	6.09%	2.53%	876
		11.0	0.01	CONTRIB	0.00%	100.00%	0.00%	0.00%	0

Location	10.0% Exc. Ground Speed	Criterion Speed Exc.	Criterion % Time Exc.		ENE	S	SW	OTHER	SUM
46				RATIOS	0.3668	0.5084	0.4976	0.4576	
	4.7			CONTRIB	25.79%	57.05%	13.55%	3.61%	876
		11.0	0.30	CONTRIB	0.23%	99.00%	0.78%	0.00%	26
47				RATIOS	0.3160	0.4472	0.3364	0.3665	
	3.9			CONTRIB	28.47%	62.48%	6.45%	2.60%	876
		11.0	0.08	CONTRIB	0.00%	99.89%	0.03%	0.08%	7
48				RATIOS	0.3518	0.4832	0.4268	0.4206	
	4.4			CONTRIB	28.24%	58.62%	9.98%	3.16%	876
		11.0	0.20	CONTRIB	0.20%	99.62%	0.18%	0.00%	17
49				RATIOS	0.2944	0.5572	0.4922	0.4479	
	4.6			CONTRIB	11.52%	71.04%	13.90%	3.54%	876
		11.0	0.60	CONTRIB	0.00%	99.68%	0.32%	0.00%	53
50				RATIOS	0.5420	0.4014	0.6856	0.5430	
	5.8			CONTRIB	53.92%	23.97%	19.45%	2.67%	876
		11.0	0.34	CONTRIB	21.06%	6.14%	71.86%	0.93%	30
51				RATIOS	0.6462	0.6436	1.1044	0.7981	
	8.0			CONTRIB	29.01%	31.65%	35.22%	4.12%	876
		11.0	3.71	CONTRIB	21.72%	47.22%	29.73%	1.32%	325
52				RATIOS	0.6440	0.6084	0.8240	0.6921	
	7.2			CONTRIB	44.55%	34.73%	17.49%	3.23%	876
		11.0	2.44	CONTRIB	32.66%	49.04%	17.50%	0.80%	213
53				RATIOS	0.4660	0.5564	0.6912	0.5712	
	5.7			CONTRIB	29.69%	45.45%	20.79%	4.07%	876
		11.0	0.86	CONTRIB	1.02%	69.42%	29.00%	0.55%	75
54				RATIOS	0.5172	0.5404	0.8236	0.6271	
	6.3			CONTRIB	31.34%	35.83%	28.69%	4.14%	876
		11.0	0.94	CONTRIB	3.79%	50.13%	45.03%	1.06%	83
55				RATIOS	0.5770	0.5006	0.8904	0.6560	
	6.7			CONTRIB	37.92%	27.76%	30.61%	3.70%	876
		11.0	0.99	CONTRIB	17.87%	26.28%	54.47%	1.38%	87
56				RATIOS	0.6532	0.2644	0.9310	0.6162	
	6.8			CONTRIB	62.51%	0.50%	34.78%	2.22%	876
		11.0	1.47	CONTRIB	57.26%	0.00%	42.15%	0.59%	129
57				RATIOS	0.6796	0.5162	0.9034	0.6997	
	7.4			CONTRIB	50.62%	24.47%	21.98%	2.93%	876
		11.0	1.90	CONTRIB	51.82%	17.40%	29.68%	1.10%	167
58				RATIOS	0.5496	0.3330	0.6434	0.5087	
	5.7			CONTRIB	63.45%	17.69%	16.87%	1.99%	876
		11.0	0.29	CONTRIB	29.99%	0.68%	68.69%	0.64%	25
59				RATIOS	0.4072	0.2454	0.4908	0.3811	
	4.2			CONTRIB	62.18%	17.37%	18.36%	2.08%	876
		11.0	0.00	CONTRIB	53.05%	0.00%	44.29%	2.66%	0
60				RATIOS	0.6136	0.2536	0.5634	0.4769	
	5.9			CONTRIB	87.95%	1.65%	9.39%	1.01%	876
		11.0	0.46	CONTRIB	95.35%	0.00%	4.65%	0.00%	40
61				RATIOS	0.6260	0.6758	0.8280	0.7099	
	7.3			CONTRIB	37.51%	41.77%	17.14%	3.57%	876
		11.0	2.96	CONTRIB	19.73%	64.87%	14.62%	0.78%	259
62				RATIOS	0.3706	0.5770	0.7028	0.5501	
	5.4			CONTRIB	14.58%	54.12%	26.83%	4.47%	876
		11.0	1.06	CONTRIB	0.07%	74.82%	24.77%	0.33%	92

Location	10.0% Exc. Ground Speed	Criterion Speed Exc.	Criterion % Time Exc.		ENE	S	SW	OTHER	SUM
63				RATIOS	0.2880	0.5780	0.5436	0.4699	
	4.8			CONTRIB	8.94%	70.39%	16.97%	3.70%	876
		11.0	0.81	CONTRIB	0.00%	98.62%	1.38%	0.00%	71
64				RATIOS	0.2608	0.4938	0.5340	0.4295	
	4.3			CONTRIB	9.21%	63.60%	23.04%	4.15%	876
		11.0	0.24	CONTRIB	0.00%	96.63%	3.37%	0.00%	21
65				RATIOS	0.6228	0.5300	0.5084	0.5537	
	6.5			CONTRIB	61.05%	32.58%	4.93%	1.44%	876
		11.0	0.96	CONTRIB	56.66%	42.59%	0.36%	0.39%	84
66				RATIOS	0.6848	0.5946	0.5016	0.5937	
	7.1			CONTRIB	61.35%	33.88%	3.54%	1.23%	876
		11.0	2.02	CONTRIB	50.23%	49.32%	0.13%	0.32%	177
67				RATIOS	0.5920	0.4206	0.5872	0.5333	
	6.1			CONTRIB	64.69%	23.92%	9.69%	1.70%	876
		11.0	0.34	CONTRIB	75.38%	10.81%	13.01%	0.80%	30
68				RATIOS	0.3098	0.5736	0.5778	0.4871	
	4.9			CONTRIB	10.84%	65.96%	19.21%	3.99%	876
		11.0	0.79	CONTRIB	0.00%	95.60%	4.23%	0.17%	69
69				RATIOS	0.7020	0.3560	0.7244	0.5941	
	6.9			CONTRIB	78.66%	6.96%	12.88%	1.50%	876
		11.0	1.42	CONTRIB	79.03%	0.32%	20.19%	0.46%	124
70				RATIOS	0.5376	0.3768	0.6842	0.5329	
	5.7			CONTRIB	55.30%	21.88%	20.25%	2.58%	876
		11.0	0.32	CONTRIB	19.96%	2.98%	76.21%	0.86%	28
71				RATIOS	0.9528	0.6234	0.9692	0.8485	
	9.7			CONTRIB	66.73%	20.81%	10.82%	1.65%	876
		11.0	6.03	CONTRIB	63.16%	23.95%	11.68%	1.21%	528
72				RATIOS	0.9796	0.8108	1.0554	0.9486	
	10.4			CONTRIB	56.24%	29.93%	11.57%	2.26%	876
		11.0	8.09	CONTRIB	53.27%	33.19%	11.67%	1.87%	709
73				RATIOS	0.8260	0.8602	0.8360	0.8407	
	9.1			CONTRIB	46.64%	42.88%	8.09%	2.39%	876
		11.0	5.66	CONTRIB	38.02%	52.89%	7.87%	1.22%	496
74				RATIOS	0.7350	0.9032	0.5856	0.7413	
	8.4			CONTRIB	39.45%	55.41%	3.40%	1.74%	876
		11.0	4.70	CONTRIB	28.73%	69.72%	0.90%	0.65%	412
75				RATIOS	1.1104	0.8996	1.1708	1.0603	
	11.7			CONTRIB	57.80%	29.10%	10.97%	2.14%	876
		11.0	12.51	CONTRIB	60.64%	26.00%	10.79%	2.58%	1,096
76				RATIOS	1.0266	0.9628	1.2502	1.0799	
	11.3			CONTRIB	46.74%	34.95%	15.31%	3.00%	876
		11.0	11.07	CONTRIB	48.10%	33.33%	15.27%	3.30%	970
77				RATIOS	0.9720	0.9176	1.1374	1.0090	
	10.7			CONTRIB	47.86%	35.72%	13.59%	2.84%	876
		11.0	8.98	CONTRIB	46.31%	37.54%	13.59%	2.56%	787
78				RATIOS	0.9828	0.9340	1.1284	1.0151	
	10.8			CONTRIB	48.18%	36.26%	12.79%	2.77%	876
		11.0	9.29	CONTRIB	47.09%	37.53%	12.80%	2.58%	813
79				RATIOS	0.7114	0.6436	0.6614	0.6721	
	7.5			CONTRIB	55.96%	35.20%	6.94%	1.89%	876
		11.0	3.17	CONTRIB	37.35%	55.29%	6.85%	0.51%	278

Location	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
80				RATIOS	0.1860	0.4698	0.3620	0.3393	
	3.5			CONTRIB	2.59%	80.97%	12.78%	3.66%	876
		11.0	0.15	CONTRIB	0.00%	99.94%	0.04%	0.02%	13
81				RATIOS	0.2136	0.6230	0.3012	0.3793	
	4.0			CONTRIB	1.92%	91.26%	4.17%	2.65%	876
		11.0	1.44	CONTRIB	0.00%	99.99%	0.00%	0.01%	126
82				RATIOS	0.2164	0.3572	0.4692	0.3476	
	3.4			CONTRIB	10.57%	51.79%	33.22%	4.42%	876
		11.0	0.01	CONTRIB	0.00%	83.15%	16.26%	0.59%	0
83				RATIOS	0.3768	0.4958	0.4128	0.4285	
	4.5			CONTRIB	32.06%	57.32%	7.84%	2.78%	876
		11.0	0.24	CONTRIB	0.39%	99.51%	0.10%	0.00%	21
84				RATIOS	0.2784	0.6408	0.4174	0.4455	
	4.7			CONTRIB	8.41%	81.37%	7.30%	2.92%	876
		11.0	1.74	CONTRIB	0.00%	99.98%	0.02%	0.00%	152
85				RATIOS	0.3348	0.3582	0.3986	0.3639	
	3.8			CONTRIB	41.20%	42.84%	12.86%	3.10%	876
		11.0	0.01	CONTRIB	3.91%	91.75%	3.22%	1.12%	0
86				RATIOS	0.2514	0.9056	0.5022	0.5531	
	5.9			CONTRIB	0.09%	90.96%	6.29%	2.65%	876
		11.0	3.30	CONTRIB	0.00%	99.81%	0.08%	0.11%	289
87				RATIOS	0.3380	0.9584	0.6540	0.6501	
	6.7			CONTRIB	1.06%	85.34%	10.14%	3.46%	876
		11.0	3.88	CONTRIB	0.01%	94.25%	5.41%	0.33%	340
88				RATIOS	0.5540	0.6704	0.6112	0.6119	
	6.5			CONTRIB	36.47%	51.72%	8.97%	2.84%	876
		11.0	2.09	CONTRIB	4.69%	90.56%	4.36%	0.39%	183
89				RATIOS	1.0110	1.3364	1.4628	1.2701	
	12.8			CONTRIB	26.36%	52.47%	17.24%	3.93%	876
		11.0	16.18	CONTRIB	30.70%	43.86%	18.62%	6.81%	1,417
90				RATIOS	0.3408	0.3222	0.2176	0.2935	
	3.6			CONTRIB	57.81%	38.88%	2.23%	1.08%	876
		11.0	0.00	CONTRIB	16.88%	83.12%	0.00%	0.00%	0
91				RATIOS	0.2538	0.2388	0.3950	0.2959	
	3.0			CONTRIB	35.36%	31.22%	29.53%	3.90%	876
		11.0	0.00	CONTRIB	0.00%	0.00%	100.00%	0.00%	0
92				RATIOS	0.4740	0.5466	0.8378	0.6195	
	6.1			CONTRIB	24.04%	38.16%	33.40%	4.40%	876
		11.0	0.99	CONTRIB	1.06%	52.53%	45.49%	0.92%	86
93				RATIOS	0.8976	0.8312	1.0746	0.9345	
	9.8			CONTRIB	47.90%	34.48%	14.71%	2.90%	876
		11.0	6.95	CONTRIB	43.16%	40.42%	14.45%	1.97%	609
94				RATIOS	0.8810	0.9294	1.0830	0.9645	
	10.0			CONTRIB	40.94%	41.54%	14.29%	3.22%	876
		11.0	7.44	CONTRIB	37.44%	46.42%	13.87%	2.27%	652
95				RATIOS	0.8858	1.0164	1.0712	0.9911	
	10.3			CONTRIB	37.25%	47.01%	12.52%	3.22%	876
		11.0	8.15	CONTRIB	34.91%	50.41%	12.19%	2.50%	714
96				RATIOS	0.8012	1.0384	0.9542	0.9313	
	9.7			CONTRIB	31.48%	55.11%	10.28%	3.13%	876
		11.0	7.00	CONTRIB	27.23%	61.30%	9.55%	1.92%	613

Loca-tion	10.0% Exc. Ground Speed	---Criterion--- Speed Exc.	% Time Exc.		ENE	S	SW	OTHER	SUM
97				RATIOS	0.7490	1.0354	0.9444	0.9096	
	9.4			CONTRIB	27.28%	58.36%	11.06%	3.31%	876
		11.0	6.48	CONTRIB	22.45%	65.79%	9.99%	1.78%	568
98				RATIOS	0.5496	0.2314	0.4062	0.3957	
	5.2			CONTRIB	92.37%	2.15%	4.81%	0.66%	876
		11.0	0.09	CONTRIB	99.76%	0.00%	0.24%	0.00%	8
99				RATIOS	0.2946	0.6154	0.3010	0.4037	
	4.5			CONTRIB	12.82%	82.02%	3.08%	2.08%	876
		11.0	1.31	CONTRIB	0.00%	100.00%	0.00%	0.00%	114
100				RATIOS	0.3028	0.5184	0.3604	0.3939	
	4.2			CONTRIB	18.10%	72.86%	6.41%	2.63%	876
		11.0	0.34	CONTRIB	0.00%	99.98%	0.02%	0.00%	30