APPENDIX J

Wind Impact Analysis

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David Reel
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Subject: Wind Safety Hazard Review of the Proposed Sacramento Commons Development, Sacramento

Dear Mr. Reel:

I have been asked to evaluate the Planned Unit Development Guidelines for the Sacramento Commons Project to determine if a project developed consistent with those guidelines could result in a potentially significant wind safety hazard. I have based this analysis on a review of project plans and sections (dated January 2015), a site visit, and my knowledge of basic building aerodynamics gained from nearly 40 years of wind tunnel studies and analysis of building-generated wind problems.

Existing Conditions

Wind Climatology

The project site lies in the southern portion of the Sacramento Valley, a broad, flat valley bounded by the coastal ranges to the west and the Sierra Nevada to the east. A sea-level gap in the Coast Range – the Carquinez Strait – is located approximately 50 miles southwest, and the intervening terrain is very flat. The prevailing wind direction is southwesterly, which is the wind direction when marine breezes flow through the Carquinez Strait. Marine breezes dominate during the spring and summer months, and show a strong daily variation. Highest average wind speeds occur in the afternoon and evening hours; lightest winds occur in the night and morning hours. During fall and winter, when the sea breeze diminishes, northerly winds occur more frequently, but southwesterly winds still predominate.

The source of long-term wind data closest to the project site is the Sacramento Executive Airport located about 4 miles south of the project site. Figure 1 shows a wind rose (a graphical diagram of wind direction/speed frequency) generated from 43 years of data from the Sacramento Executive Airport. For each wind direction, the frequency of the wind coming from that direction is plotted from the center (the longer the radiating bar, the more frequent the wind blows from that direction).[1] The various colors of the radiating bar provide the frequency of wind speed classes.

In terms of overall frequency, southwest winds are dominant in Sacramento, and southwest winds, in general, have the highest average speed. This direction represents marine winds flowing through the Delta.

Secondary maxima in frequency occur for southerly and southeasterly winds and from the northwest. Northeasterly, easterly and westerly winds are not common in Sacramento.

It is notable that the highest winds (20+ mph) show up in for only a few wind directions in the wind rose. The strongest winds occur from the southwest, southeast and northeast. The southwest strong winds are related to marine breezes, but the southeast wind extremes are associated with pre-frontal winter storms. The northwesterly extreme winds are associated with post-frontal conditions in the fall and winter months.

The wind data show that the most important wind directions in Sacramento, in terms of pedestrian safety, would be northwest, southwest and southeast.

Site Analysis

The area around the project site is a mixture of low-, mid- and high-rise development that generally provide wind shelter from most wind directions. The area is least sheltered for east winds, as the blocks due east of the site are occupied by smaller 1-2 story structures and surface parking.

The area north of the site is occupied by a row of larger structures along both sides of the Capitol Mall, some exceeded 25 stories., that shelter the site from northerly winds.

The area west of the site is occupied by the 15-story 500 N Street building and 25-story 450 N Street buildings. Further to the south the is a mixture of 3-6 story structures on the west side of 5th Street and the 12-story Pioneer Tower at the northeast corner of 5th Street and P Street.

[1]Wind direction refers to the direction from which the wind is moving. Thus, a westerly or west wind moves from west to east.

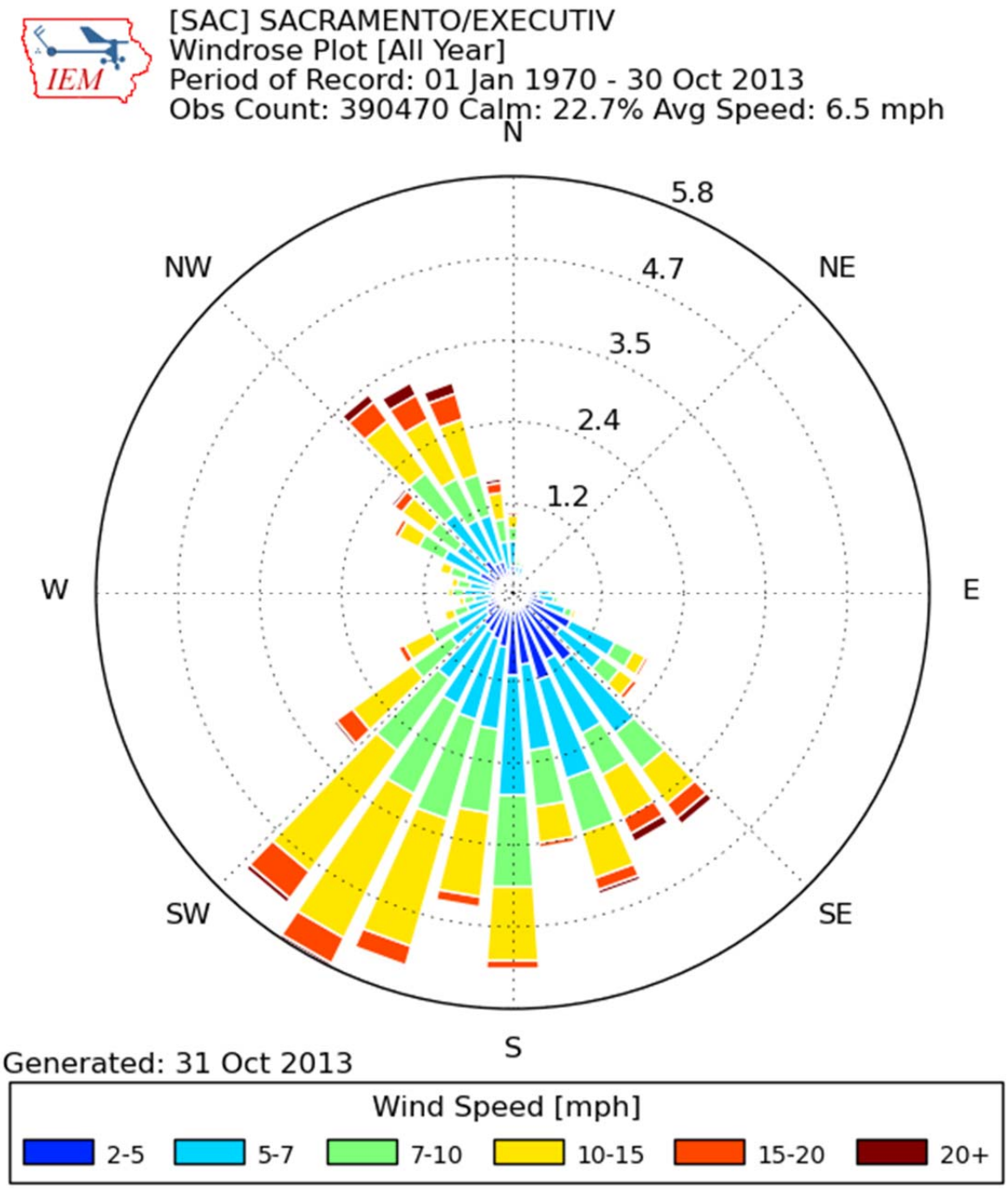

Figure 1: Wind Rose for Sacramento Executive Airport

The area south of the site is occupied by the 6-story Lincoln Plaza North development, 3 story apartments and the Central Utility Plant which is generally low-rise in nature but includes a tower that is 140 feet in height. Across the P Street/7th Street intersection from the site is a pair of 16-story buildings.

Overall, the site is very sheltered by existing structures for northwest winds and moderately sheltered from southwest and southeast winds. It has little shelter from east winds due to the openness of the blocks across 7th Street, but the wind data shows that winds from the east are very infrequent and not strong

Discussion

Pedestrian wind acceptability criteria are not established in any set of guidelines or standards adopted by a professional association. California Environmental Quality Act (CEQA) guidance does not list any specific criterion for the evaluation of wind effects of a project. Determining the actual effects of wind on pedestrians is a subjective exercise that can depend on a variety of factors such as age of the pedestrian, stature, type of activity being undertaken, and psychological state.

Two cities in northern California (City of San Francisco and City of Oakland) have established both standards and criteria for the evaluation of wind impacts. CEQA significance levels in San Francisco and Oakland are based on pedestrian hazard. For the purposes of CEQA, San Francisco and Oakland have established a pedestrian wind hazard criterion of 1 occurrence per year of winds greater than 36 mph as representing a significant adverse impact.

In both the above jurisdictions, compliance with the wind code can be determined through wind tunnel testing of scale models in a wind tunnel, but wind tunnel testing is not required except for the largest of structures. Both jurisdictions also accept a site and design review examining whether the factors known to cause high ground-level winds exist with construction of the project. The strength of ground-level wind accelerations near buildings is controlled by exposure, massing and orientation. The potential for accelerated winds can be evaluated based on a review of site exposure, building heights and building orientations to identify locations where exposure, massing or orientation to the prevailing winds would suggest that increased winds would affect pedestrian spaces.

Exposure is a measure of the extent that the building extends above surrounding structures or terrain into the wind stream. A building that is surrounded by taller structures or sheltered by terrain is not likely to cause adverse wind accelerations at

ground level, while even a comparatively small building could cause wind effects if it is freestanding and exposed.

Massing is important in determining wind impact because it controls how much wind is intercepted by the structure and whether building-generated wind accelerations occur above-ground or at ground level. In general, slab-shaped buildings have the greatest potential for wind acceleration effects. Buildings that have an unusual shape, rounded faces or utilize set-backs have a lesser wind effect. A general rule is that the more complex the building is geometrically, the lesser the probable wind impact at ground level.

Building orientation determines how much wind is intercepted by the structure, a factor that directly determines wind acceleration. In general, buildings that are oriented with the wide axis across the prevailing wind direction will have a greater impact on ground-level winds than a building oriented with the long axis along the prevailing wind direction.

For the purposes of this review, I have considered the project site plan and reviewed the design criteria included in the Planned Unit Development Guidelines for the Sacramento Commons Project to evaluate whether development consistent with the requirements set forth in the Planned Unit Development Guidelines for the Sacramento Commons Project has the potential to result in winds greater than 36 mph one or more times per year. Since the ambient wind (undisturbed by buildings) in Sacramento seldom exceeds 36 mph, a project must substantially increase winds at pedestrian levels for this level to be exceeded. I reviewed the exposure, orientation and massing of all structures and all phases of the proposed development to see if the project had the potential to substantially increase ground-level winds in pedestrian corridors or public spaces within or near the project site.

Based on my review of the Planned Unit Development Guidelines for the Sacramento Commons Project including the location, massing, height, and design requirements set forth therein, I have concluded that development consistent with the requirements set forth in the Planned Unit Development Guidelines for the Sacramento Commons does not have the potential to result in a wind safety hazard by substantially increasing winds at pedestrian levels. For this reason, future wind tunnel testing is not required to conclude that development consistent with the requirements set forth in the Planned Unit Development Guidelines for the Sacramento Commons does not have the potential to result in a significant wind safety hazard. However, if a building is proposed within the project site that does not comply with the location, massing, height, and design requirements set forth in the Planned Unit Development Guidelines for the Sacramento

Commons Project, further analysis and potentially wind tunnel testing would be required to determine whether the proposed changes have the potential to result in a significant wind safety hazard.

I hope you find this analysis useful. Please call me if you have any questions.

Sincerely,

Donald Ballanti
Consulting Meteorologist