SEAW Wind Engineering Committee	**WHITE PAPER WEC #2-2016**

ASCE 7 Site Specific Exposure Determination	**Date: June 01, 2016**
ABSTRACT: This white paper is intended to present an accepted method for site specific wind exposure classification in lieu of the simplified definition criteria of ASCE 7 Section 26.7. (Chapter and Section Number Referenced are specifically from the ASCE Standard 7-10 edition)	**Task Group Members:** *Scott Douglas, P.E, S.E., Chair* *Russell Larsen, P.E., S.E.* *Don Scott, P.E, S.E.* *Steve Pfeiffer, P.E., S.E.* *Larry Liu, P.E., S.E.*

COMMITTEE MISSION STATEMENT:

- *Provide guidelines for wind design and analysis issues that are not straightforwardly given in the Standard.*
- *Provide guidance for wind design and analysis for conditions and techniques which are not in the Standard.*
- *Participate in ICC/ASCE 7 code and standard processes to monitor/testify on wind design and analysis issues.*

The recommendations in this White Paper represent the opinion of the Task Group and the SEAW Wind Engineering Committee. It is intended for use as a design aid reference by engineers and building officials in conjunction with their own judgement and the actual project design criteria and assumptions.

I. INTRODUCTION:

ASCE 7 Sections 27.3, 28.3, and 29.3 present exposure dependent wind pressure coefficients that increase with height. Defined exposure categories are established within Section 26.7. Alternatively, the exception clauses of ASCE 7 Sections 26.7.3, 27.3.1, 28.3.1, and 29.3.1 allow accepted alternate methods for determination of the exposure and velocity pressure coefficient, K_z.

The Structural Engineers Association of Washington (SEAW) Wind Engineering Committee feels that a site specific determination of exposure for intermediate values of MWFRS and C&C velocity pressure is a rational, reasonable and acceptable engineering method and approach for the determination of velocity pressure coefficients.

II. RECOMMENDATIONS:

The SEAW Wind Committee recommends that, when appropriate, designers consider an intermediate exposure where minor bodies of water or other similar upwind changes in ground surface roughness allow for the use of an exposure less severe than that defined in Section 26.7.3. ASCE 7 commentary Section C27.3.1 provides an upwind fetch based calculation method

producing a height dependent intermediate velocity pressure coefficient appropriate for this purpose. To clarify the implementation of site specific exposure evaluation, the SEAW Wind Engineering Committee recommends the following guidelines when considering roughness and exposure:

- Regarding the terrain roughness used in the upwind fetch analysis, ASCE 7 Table C26.7.2 provides suggested alpha (α) and gradient height (z_g) values in addition to the similar values provided in Table 26.7-1 for a defined exposure. The SEAW Wind Engineering Committee urges the designer to review upwind site photography or aerial imagery to reasonably establish relevant terrain roughness conditions.

- Regarding upwind fetch width, ASCE 7 Section 26.7.1 requires consideration of the more severe of 45 degree azimuth zones to either side of the upwind direction. The SEAW Wind Engineering Committee suggests the average fetch distance over distinct roughness conditions within each zone be considered within established upwind zones of the site. Examples of such zones are given in ASCE 7 Section C27.3.1 and Figure C26.7-5.

- The SEAW Wind Committee recommends that the velocity pressure coefficient, K_z, at a site shall not be taken less than the K_z determined from the ASCE 7 definition of Exposure B, unless otherwise verified through wind tunnel evaluation. Similarly, the designer is reminded that Component and Cladding velocity pressure shall be based upon the Exposure resulting in the greatest wind load in any direction according to ASCE 7 Section 26.7.4.4.

III. COMMENTARY:

Minor bodies of water (such as lakes, streams or rivers), open areas of land, or similar minor terrain features alter the boundary layer profile upwind of a building site. Strict application of exposure conditions defined in ASCE 7 Section 26.7.3 can yield wind effects greater than intended or reasonable. One example of this condition is a building site adjacent to a small lake or river within an urban setting. Some areas in North Seattle, specifically the suburbs of Green Lake and Ballard which surround Greenlake Park, Lake Union, and the Lake Washington Ship Canal (see Figure 1), would be categorized as Exposure D under the definitions of ASCE 7 Section 26.7.3 due to the length of Surface Roughness D in the upwind direction. However, determination of a site-specific exposure using the methods of ASCE 7 C27.3.1 would generate a shoreline intermediate velocity pressure distribution nearing ASCE 7 Exposure C at the ground surface and converging toward Exposure B at greater heights, as shown in Figure 2. From this example, application of Exposure D would be overly conservative at the shores of similar bodies of water. Similarly, the use of Exposure B at the ground surface shoreline would underestimate wind demand.

In addition, the strict application of ASCE 7 Section 26.7.3 exposure definitions at larger bodies of water, especially those with irregular shorelines such as the majority of Lake Washington and many areas of Puget Sound, may also result in wind effects greater than that determined by a more detailed analysis such as that documented in ASCE Section C26.7.3.

Finally, the designer is advised to adequately document the considered exposure in order to satisfy IBC 2015 Section 1603.1.3 requiring indication of site exposure by wind direction.

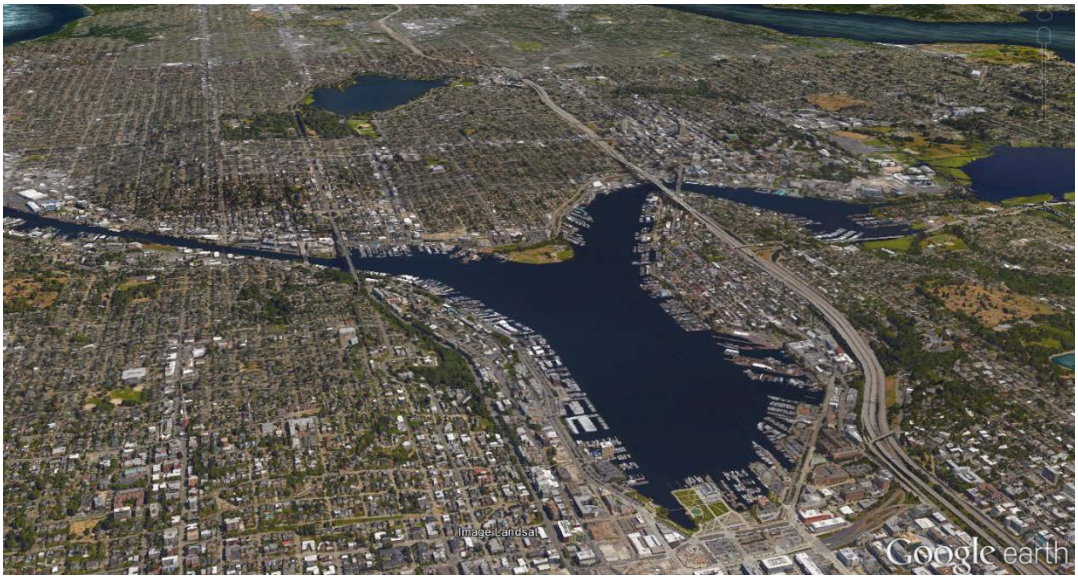

Figure 1: North Seattle, Lake Union, Green Lake, and the Lake Washington Ship Canal

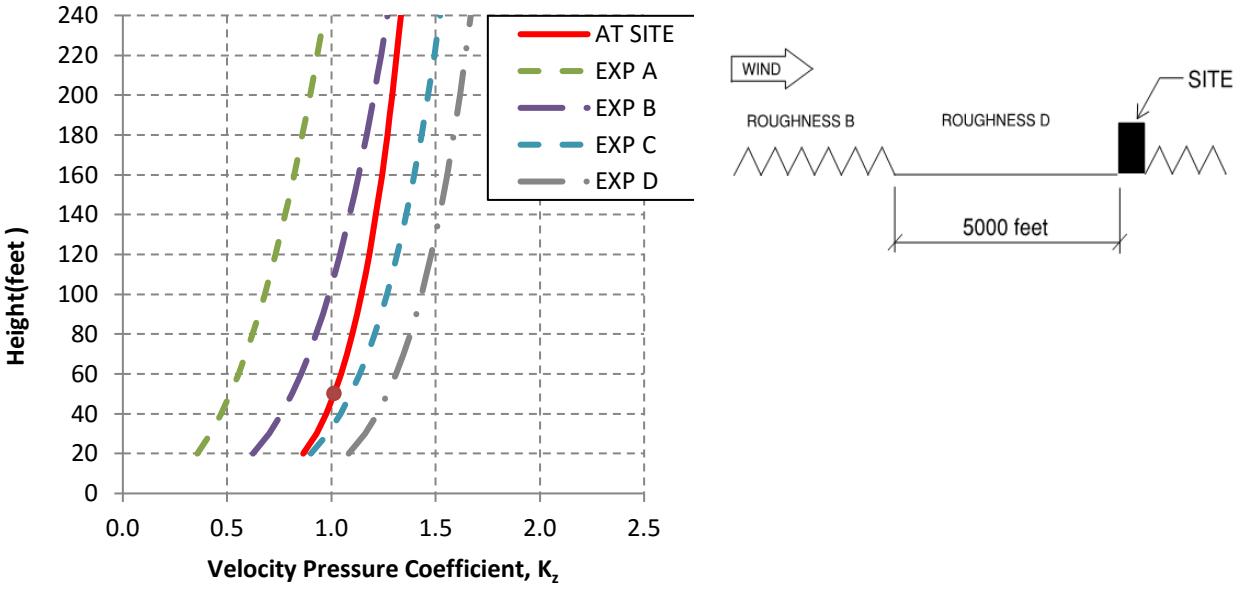

Figure 2: Velocity Pressure Coefficient calculated at a site with 5000 foot Roughness D upwind fetch preceded by Roughness B