Significant Structure Model Recommendations

Reviewed and Approved by SELC Member Organizations

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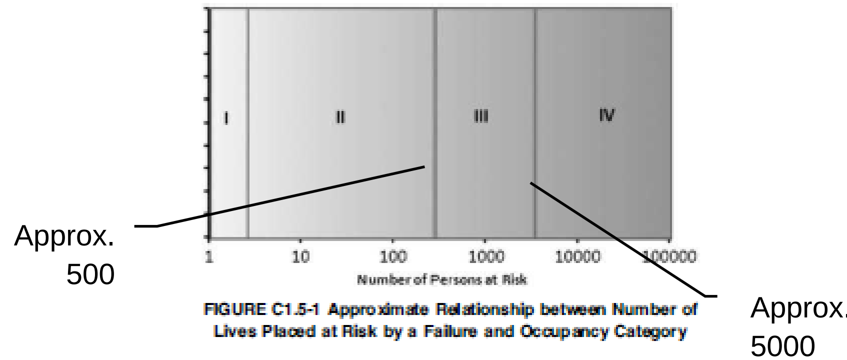
Significant Structure Model	**Commentary**
Structural engineering for the following structures should be under the responsible charge of a Licensed Structural Engineer:	*This document is intended to be a general description of structures that should be designed under the responsible charge of a Licensed Structural Engineer (SE). An SE is an engineer recognized by the Authority Having Jurisdiction (AHJ) to use the title SE and practice structural engineering. Structural engineering based on more complicated methods of analysis or whose failure could impact over approximately 500 lives should be designed by SE (See Figure 1).*  FIGURE C1.5-1 Approximate Relationship between Number of Lives Placed at Risk by a Failure and Occupancy Category ***Figure 1 (Reference: American Society of Civil Engineers Standard 7, Minimum Design Loads for Buildings and Other Structures (2016), Figure C1.5-1)*** *A wide range of structure types, all of which have specific code requirements and risk implications, are listed here. Each AHJ can select the structure types that are appropriate for it. The terminology and requirements here are from the International Building Code and the ASCE 7 Standard. Additionally, the requirements of several jurisdictions with partial practice restrictions were reviewed in the preparation of this document: Washington, Utah, Oregon, Georgia, Alaska, Guam, Northern Mariana Islands, California, and Nevada. Committees of the National Council of Structural Engineering Associations (NCSEA) and the Structural Engineering Institute (SEI) prepared the document.*

1. **Buildings and other structures representing a substantial hazard to human life in the event of structural failure or that are designated as essential facilities, or that have been engineered using advanced levels of analysis including but not limited to:**	*Commentary Item 1:* *The requirements in item 1 were developed using the IBC Table 1604.5 and ASCE 7 Table 1.5-1 for Risk Categories III and IV. Since codes and standards may be significantly reorganized in subsequent editions or may not be widely available, blanket references to any design document have been avoided. Instead, descriptions for structures in each category are used. Additionally, to reduce repetition, structure types in different risk categories were combined when possible. Terminology from the source document was maintained and any ambiguities should be clarified by the AHJ.*
a. Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. b. Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250. c. Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500. d. Foster care facilities, detoxification facilities, hospitals, nursing homes, psychiatric hospitals with an occupant load of 50 or more resident care recipients or having surgery or emergency treatment facilities. e. Correctional centers, detention centers, jails, prerelease centers, prisons, reformatories. f. Any other occupancy with an occupant load greater than 5,000. g. Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities including those required for emergency response. h. Buildings and other structures containing quantities of toxic or explosive materials that are sufficient to pose a threat to the public if released. i. Fire, rescue, ambulance and police stations and emergency vehicle garages. j. Designated earthquake, hurricane, or other emergency shelters. k. Designated emergency preparedness, communication	

and operations centers and other facilities required for emergency response. l. Aviation control towers, air traffic control centers and emergency aircraft hangars. m. Buildings and other structures having critical national defense functions. n. Water storage facilities and pump structures required to maintain water pressure for fire suppression. o. Buildings and other structures over 45-feet in height with lateral loadings which are: • subjected to ultimate design 3-second wind gust speeds corresponding to approximately a 3% or lower probability of exceedance in 50 years or • located in Seismic Design Category D and above. p. Buildings and other occupied structures over 60 feet in height or unoccupied structures over 100 feet	*Commentary Item 1.o.: Structures in Item 1-o are based on descriptions of categories included in the NCEES 16-hour SE exam. These categories reflect high wind and seismic loads and do not include one- and two-family residential housing structures. The AHJ has the discretion to include residential housing. This has been modified on November 14, 2019 to address the changes in the wind speed maps indicated in ASCE 7-16.* *Commentary Item 1.p.: This item acknowledges the effect of building height in the development of wind loads in ASCE 7-10. Several AHJ's require building heights of greater than 45 feet to 100 feet to be designed by an SE. The 60-foot value was a height that had a basis in a current code (ASCE 7 Wind Design Method) requirement for a more complicated wind analysis.*
2. **Bridges that require advanced levels of analysis or represent a substantial hazard to human life in the event of failure, including but not limited to:** a. Bridges with "nonductile components and connections" or "nonredundant members". b. Bridges which are classified as "critical or essential" as defined by the Federal Highway Administration or the	*Commentary Item 2: The requirements of other states were reviewed and state department of transportation members were consulted on restrictions that have some rationale for bridges. Bridges require the American Association of State Highway Officials, LRFD Bridge Design Specifications. Railroad bridges are not included at this time.* *Commentary Item 2.a.: AASHTO Section 1.3.3 and 1.3.4 imply that these conditions require a higher factor of safety because the sudden loss of load-carrying capability may result with overloads on non-ductile and nonredundant members. For those bridges with ductile components and redundancies, there is a reserve load-carrying capacity above the design values providing additional safety. Current designs preclude the use of nonductile components, but historic bridges may include these.* *Commentary Item 2.b.: AASHTO Section 1.3.5 describes measures to be taken for bridges based on Operational Importance. Critical or*

State Department of Transportation.	*essential bridges require a greater factor of safety. The definition of what is critical or essential is left up to the AHJ. Some states consider all bridges to be critical or essential. Others restrict the classification to bridges with greater traffic or if it is the only bridge for a critical defense route.*
c. Bridges with aero-elastic instability, aero-elastic phenomena, or those which require wind tunnel testing.	
d. Multi-span bridges in seismic zone 3 or 4; those which require the seismic acceleration spectrum to be determined using the Site Specific Procedure; or that require multi-modal or time history seismic analysis.	*Commentary Item 2.d.: The 16-hour SE exam specifically tests for knowledge regarding the special requirements for the highest seismic zones 3 or 4 for bridges. For bridges in these seismic zones and for bridges requiring the analysis methods indicated, an advanced level of knowledge is required. Table 4.7.4.3.1-1, Minimum Analysis Requirements for Seismic Effects stipulates the conditions when the more advanced analysis methods are required.*
e. Bridges designed for blast loading.	
f. Bridges which are cable-stayed or suspension type.	
g. Bridges with an average daily traffic (ADT) of greater than 10000 vehicles per day	*Commentary Item 2.g.: The basis for this requirement is similar to the requirements for IBC and ASCE in buildings regarding risk categories. Those bridges with higher vehicle loads will influence more people and because of this importance should be designed by an SE. The 10000 vehicle value was selected because it is near the bottom of the building Risk Category IV. A value of 5000 was deemed too low.*
h. Single or multi-span bridges with any span with length over 240 feet.	*Commentary Item 2.h.: Washington State is the only state that has a restriction for bridges based on bridge length. Their restriction includes bridges having a total span of more than two hundred feet and piers having a surface area greater than 10,000 square feet, though no basis is provided for these numbers. The 240-foot value is a restriction based on AASHTO Table 4.6.2.2.2b-1 Distribution of Live Loads for Moment in Interior Beam. For the more common scenario of concrete deck on concrete or steel beams, if the span is greater than 240 feet, the tabulated formulas for live load distribution cannot be used and a more rigorous analysis is required to distribute live loads.*

i. Bridges with a high degree of curvature including a central angle greater than 12 degrees within a single span, bridges with variable widths, bridges with non-parallel substructure units or high skewed substructures of greater than 45 degrees.	*Commentary Item 2.i.: These bridge configurations require consideration of torsion effects and non-uniform superstructure stiffnesses that require a three-dimensional analysis.*