FAQs on ASCE Standards

What You Always Wanted to Ask

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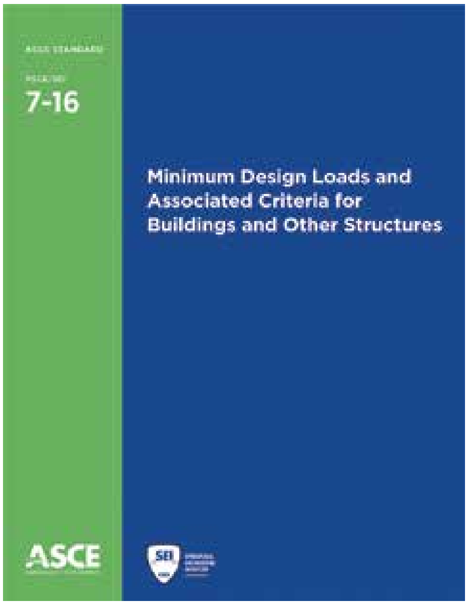
Welcome to this new quarterly column for STRUCTURE magazine. These articles will address some of the questions received (along with responses) about structural standards developed by the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE), such as ASCE 7 and ASCE 41. Questions received from engineers, building officials, and other design professionals are often considered for the development of future editions. Following are some questions received by SEI as well as responses to clarify the provisions.

ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Seismic Design for Tanks and Vessels: Chapter 13 vs. Chapter 15

Q: Would you please clarify when to use Chapter 13 *Nonstructural Components* versus Chapter 15 *Nonbuilding Structures*? For example, which chapter requirements govern the design of the anchorage for a small tank to a concrete roof structure: Chapter 13 (and to apply Table 13.6-1, Seismic Coefficients for Mechanical and Electrical Components), or Chapter 15 (specifically Section 15.7.5, Anchorage)?



A: There is an overlap between ASCE 7-16 Chapters 13 and 15. Tanks are found in Chapter 13, Table 13.6-1, and Chapter 15, Section 15.7, Tanks and Vessels. Philosophically, Chapter 13 covers relatively small components supported above grade in a building and Chapter 15 covers nonbuilding structures (large components) supported at grade. However, there is an overlap between the two chapters. Chapter 13 provisions can be applied to components supported at grade, and Chapter 15 Section 15.3 covers nonbuilding structures supported by other structures. The Section 15.3 rules apply to relatively large nonbuilding structures.

The intent of Section 15.7.5, in conjunction with 15.7.3, Strength and Ductility, is to make the anchor the seismic fuse on tanks and vessels. Forcing the anchor to yield and stretch has proven to be the most effective way to provide ductility for a tank or vessel and minimize or eliminate damage during a seismic event. These requirements work well for moderate to large diameter tanks and vessels but do not work for relatively small tanks and vessels. The practical anchor size used to anchor small tanks and vessels precludes the anchor from stretching and yielding. This is addressed in ASCE 7-22 for small tanks supported at grade; ASCE 7-22 Chapter 15 permits the design of the anchorage using any of the options in the American Concrete Institute's ACI 318-19, *Building Code Requirements for Structural Concrete*, Chapter 17 *Anchoring to Concrete*. In this case, *small* is defined as a tank or vessel less than or equal to 5 feet in diameter and less than or equal to 10 feet in height. The definition of a small tank and vessel was derived by determining the diameter that would limit the convective mass to 10 percent of the total liquid mass while holding the height to approximately one story.

For very small tanks supported on the roof of a building, Chapter 13 requirements are likely more applicable than the requirements of Chapter 15. This is because, as described above, it is unlikely that the anchorage provided for a small tank would yield under seismic loads, so the objectives behind the Section 15.7.5 provisions cannot be achieved.

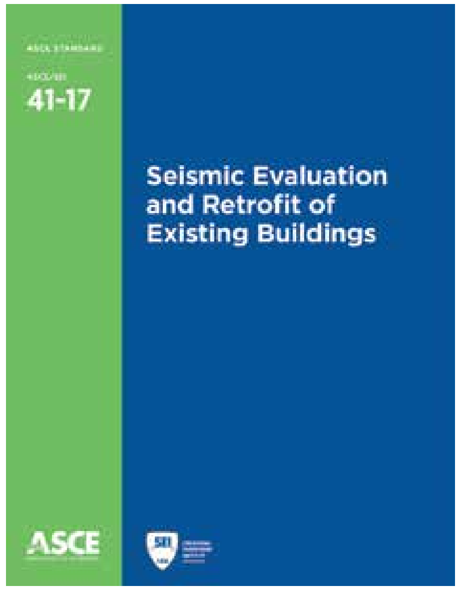
Can a Site Class Change from F to D on a Liquefiable Site?

Q: Does the exception in ASCE 7-16 Section 20.3.1, Site Class F, allow the Site Class of a liquefiable site to change from an F to a D for buildings with fundamental periods equal to or less than 0.5 seconds?

A: Yes, the exception to Condition 1 of Section 20.3.1 does allow the site class to change from Site Class F to Site Class D if the fundamental period of the structure is less than or equal to 0.5 seconds, but ONLY if the soil 1) does not meet any of the other conditions listed under Section 20.3.1 for Site Class F, 2) does not meet the requirements for Site Class E under the exceptions to Section 20.3.1 Conditions 3 and 4, 3) is not classified as Site Class E under the requirements of Section 20.3.2, Soft Clay Site Class E, and 4) is not classified as Site Class E under the requirements of Section 20.3.3, Site Classes C, D, and E. The exception to Condition 1 of Section 20.3.1 does not take precedence over the other requirements of Sections 20.3.1, 20.3.2, and 20.3.3.

Q: As a clarification, is it the intent of this standard that the exception in Section 12.13.9, Requirements for Foundations on Liquifiable Sites, allows foundation ties to be omitted when all the parameters are met, even if the Site Class would have been an F?

A: No. The exception under Section 12.13.9 does not allow foundation ties required by Section 12.13.8.2, Foundation Ties, to be omitted for spread footings founded on Site Class E and F soils. The exception under Section 12.13.9 simply avoids the ADDITIONAL requirements for ties in 12.13.9.2.1.1, Shallow Foundation Design, Foundation Ties, from being applied. Please note that the commentary Section C12.13.9.2 clarifies this requirement; "Shallow foundations are required to be interconnected by ties, regardless of the effects of liquefaction."



When are "Openings" Open?

Q: Can a building with large overhead doors on one side be designed as *enclosed* instead of *partially enclosed*. Their assertion is that the overhead doors are not openings because they are designed to be closed during a design wind event.

A: In ASCE 7-10, Chapter 26, *Wind Loads: General Requirements*, defines *enclosed, open,* and *partially enclosed*. Overhead doors can provide the degree of enclosure required to meet the definition of an enclosed building, provided that these doors are designed for the design wind pressures without excessive deflection. However, there are exceptions to this general situation. For example, doorways must be considered openings for a fire station because of the requirement that the doors be opened during the wind event to respond to emergencies. The same situation would be for ambulance garages or emergency room entrances. The open area around the doors should be considered when determining the enclosure classification of the building. In ASCE 7-16, the definition of *enclosed* was clarified by specifying the total area of the openings, A_o, permitted, and the definition of *partially open* was also added.

Wind Loads on Solar Arrays

Q: In ASCE 7-16 Section 29.4.4, Rooftop Solar Panels Parallel to the Roof Surface on Buildings of All Heights and Roof Slopes, there are two factors, γ_E and γ_a, that are confusing. The Array Edge Factor, γ_E, definition describes the location of the array on the roof and in relation to other arrays. When does the $\gamma_E = 1.5$ factor not apply?

Also, Figure 29.4-8 includes the Solar Panel Pressure Equalization factor, γ_a, which is based on the effective wind area. Is this Effective Wind Area based on each connection, as determined in Chapter 30, *Wind Loads: Components and Cladding*, or does it refer to the total area of the solar array?

A: The Array Edge Factor, γ_E, is used to determine how "exposed" the panel is and, thus, how susceptible the panel is to wind uplift. Therefore, if the panel is greater than 0.5 × the mean roof height, h, away from the edge of the roof, but the distance to the building edge (or to adjacent array), d_1, is greater than 4 feet or the distance between the rows, d_2, is greater than 4 feet, then the $\gamma_E = 1.5$ factor applies. However, if the distances are not greater than 4 feet, a value of $\gamma_E = 1.0$ can be used instead of $\gamma_E = 1.5$.

To determine the Effective Wind Area, A, refer to the definition contained in Chapter 26, Section 26.2: "For rooftop solar arrays, the effective wind area in Fig. 29.4-7 is equal to the tributary area for the structural element being considered, except that the width of the effective wind area need not be Less Than One-Third Its Length."

Wind Tributary Area for Components and Cladding

Q: Regarding components and cladding uplift, Section 30.2.3 Tributary Areas Greater than 700 ft^2(65m^2), of ASCE 7-16 states, "C&C elements with tributary areas greater than 700 ft^2 (65 m^2) shall be permitted to be designed using the provisions for main wind force resisting systems (MWFRS)." When using "the provisions for MWFRS," does this also mean that the member should be designed for the interaction of two directions of wind load? When designing strictly for C&C, the load being designed for is not directional, so it is unclear if this comes into effect for "the provisions for MWFRS" design.

A: Section 30.2.3 describes the situation where the component or cladding element has a large tributary area instead of the small, typical effective wind area. For an element with such a large tributary area, the high localized wind pressures associated with the loading of a component and cladding element are not present. Thus, the smaller design pressures used for the design of the MWFRS may be used in the design of this component or cladding element. Further, C&C loading may be bi-directional; consider a corner window system, for example. Wind pressures in both directions should be applied to the corner window simultaneously.

ASCE 41: Seismic Evaluation and Retrofit of Existing Buildings

Clarification for Tier 1

Q: Neither ASCE 41-13 nor ASCE 41-17 has a Tier 1 Immediate Occupancy checklist or evaluation requirements for Building Type C1: Concrete Moment Frames for High Seismicity Level. I am referring to the following sections in ASCE 41-13 and ASCE 41-17:

- ASCE 41-13: Section 16.9IO Immediate Occupancy Structural Checklist For Building Type C1: Concrete Moment Frames
- ASCE 41-17: section 17.11 Structural Checklist For Building Type C1: Concrete Moment Frames

Why does ASCE 41 not specify an Immediate Occupancy checklist for Concrete Moment Frames for High Seismicity Level?

A: There is no separate Tier I checklist for Building Type C1 for High Seismicity Level because the checklist for moderate level is also applicable for high level.▪

If you have a question to be considered for a future issue, send it to **sei@asce.org** with FAQ in the subject line. Visit **asce.org/sei** to learn more about ASCE/SEI Standards.

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