FAQs on ASCE Standards

What You Always Wanted to Ask

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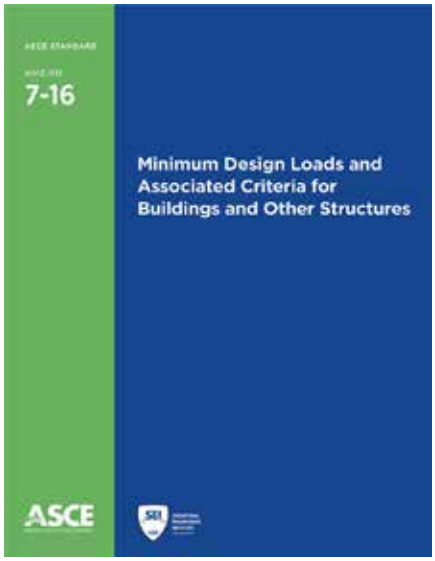
This quarterly article addresses some of the questions received about structural standards developed by the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE). In addition, questions received from engineers, building officials, and other design professionals are often considered to develop future editions. Following are some questions received by SEI and responses to clarify the provisions.



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

When do footings need to be interconnected with ties?

Q: ASCE 7-16 Section 20.3.1 Condition 1 states that soils vulnerable to potential failures, such as liquefiable soils, are classified as Site Class F. There is an exception that allows the ground motions (S_{DS}, S_{D1}) to be determined assuming the site is Site Class D, instead of F, and if the period is less than 0.5 seconds. Section 12.13.8.2 (and the International Building Code) requires footings that bear on Site Class E or F soils to be interconnected with ties. Section 12.13.9.2.1.1 has additional stricter tie requirements if the site has liquefiable soils with lateral spreading, bearing loss, or differential settlement issues. It is my understanding that structures with periods less than 0.5 seconds are still considered to be on Site Class F soils, and the requirements to tie footings together in Sections 12.13.8.2 and 12.13.9.2.1.1 still apply. Does Section 12.13.8.2 still require individual spread footings on sites with liquefiable soils to be interconnected with ties when the period of the structure is less than 0.5 seconds? Furthermore, does Section 12.13.9.2.1.1 still require individual spread footings on sites with liquefiable soils subject to lateral spreading, bearing loss, or differential settlement to be interconnected with ties when the period of the structure is less than 0.5 seconds?

A: The exception to ASCE 7-16 Section 20.3.1 Condition 1 does not automatically allow the site class to be set at Site Class D for structures with a fundamental period of vibration equal to or less than 0.5 seconds. One must apply the rules of Section 20.3 to determine the site class and the corresponding values of F_a and F_v. The site class might very well end up being Site Class E. This exception, however, does change the site class.

Considering the requirement for footings to be interconnected with ties, there are two triggers that require the use of foundation ties. ASCE 7-16 Section 12.13.8.2 requires that individual spread footings founded on Site Class E or F soils be interconnected with ties. An additional trigger requiring foundation ties is found in ASCE 7-16 Section 12.13.9. The foundation tie requirements of Section 12.13.9 are triggered by the structure being founded on liquefiable soils and not by site class. Depending on the amount of movement and bearing capacity loss (see the exception to Section 12.13.9) predicted from liquefaction, Section 12.13.9 may require foundation ties to be provided.

Specifically, the requirement for interconnecting ties for spread footings of Section 12.13.8.2 is triggered by the site class. If the structure is founded on Site Class E or F soils, interconnecting ties are required. If the exception to Section 20.3.1 Condition 1 allows the soil to be reclassified as Site Class D for a structure with a fundamental period less than or equal to 0.5 seconds, then the requirement for interconnecting ties for spread footings of Section 12.13.8.2 does not apply.

Furthermore, the requirement for interconnecting ties for spread footings of Section 12.13.9 is triggered by a liquefiable site and not by site class. Individual spread footings on sites with liquefiable soils subject to lateral spreading, bearing loss, or differential settlement may still be required to be interconnected with ties even when the period of the structure is less than 0.5 seconds.

Where is the seismic base of the building located?

Q: Does ASCE 7-16 Commentary Section C11.2 allow for the seismic base of a building to be located near grade level?

A: As noted in ASCE 7-16 Commentary Section C11.2, the location of the seismic base is affected by several factors. ASCE 7-16 Commentary Section C11.2 states, "For typical buildings on level sites with competent soils, the base is generally close to the grade plane." So, depending on the specific factors of the structure and location in question, the seismic base of the building can indeed be located near the grade plane. ASCE 7-16 Commentary Section C11.2 also gives a number of examples where this is not the case. You must exercise your professional judgment in determining the location of the seismic base. As noted in C11.2, it is conservative to use the lower elevation when in doubt.

Is ASD conversion of wind speeds still allowed in ASCE 7-16?

Q: Is the Allowable Stress Design (ASD) factor conversion of 0.6 still allowable (or appropriate) in the ASCE 7-16 standard? We understand that one of the major changes between ASCE 7-10 and ASCE 7-16 is an overall reduction in the wind speed, so we wanted to confirm if it is still appropriate to use 0.6 to convert the ultimate speeds to ASD values, for example, to use ASD product tables.

A: The quick answer is, "Yes, the 0.6 factor is still current with ASCE 7-16 to convert ultimate design pressures to allowable stress design pressures." The 0.6 factor comes from the inverse of the load factor that is rounded down. To be more precise, a conversion of ultimate wind speed

to allowable stress design wind speed can be determined by multiplying the ultimate wind speed from the maps in ASCE 7-16 by 1/1.6 or 0.625.

What is the difference between reducible live load for serviceability and reducible live load for strength design?

Q: In ASCE 7-16, Appendix CC, Section CC.2.1 describes a load combination of D + 0.5L for serviceability that states involving settlement or similar 'long-term' or 'permanent' effects. What is the justification or intent for reducing the live load by 50%? Is it to account for the transient nature of live loads, which is suggested by the terms 'long-term' and 'permanent'?

A: There is a significant difference between the loads used to evaluate the strength limit state and the serviceability limit state. Live loads given in Chapter 4 of ASCE 7 are intended for evaluating the strength limit states and are intentionally higher than live loads that have been measured during various live load surveys. The live loads in Chapter 4 represent the maximum loads that the structure may see during the life of the structure. The load combinations in Section 2.4 are intended for use in evaluating the strength limit state and not the serviceability limit state. In Appendix CC, short-term effects, where the full live load is used for evaluation, are described, and long-term effects, where 50% of the live load is used for evaluation, are also described. The use of long-term and short-term is related to the probability that the full magnitude of the load will be present over a given period. Specific examples are best used to explain these points. For example, cracks in drywall will occur under the full live load even if the live load is only present for a brief period. However, the long-term settlement of a structure is not affected by short durations of the full live load and is best evaluated under a reduced live load. The amount of live load assumed to be present to evaluate the serviceability limit state should ultimately be based on professional judgment and knowledge of the intended use of the structure in question. Appendix CC makes recommendations based on the experience and knowledge of the practicing structural engineers that make up the ASCE 7 committee.▪

If you have a question you want to be considered in 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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