STATEWIDE ALTERNATE METHOD
NO. 24-03 - RESCINDED

Multi-Period Response Spectrum

Building Codes Division
Department of Consumer and Business Services

Statewide Alternate Methods are approved by the division administrator in consultation with the appropriate advisory board. The advisory board's review includes technical and scientific facts of the proposed alternate method. In addition:

- *Building officials shall approve the use of any material, design or method of construction addressed in a statewide alternate method;*
- *The decision to use a statewide alternate method is at the discretion of the applicant; and*
- *Statewide alternate methods do not limit the authority of the building official to consider other proposed alternate methods encompassing the same subject matter.*

Code reference: 2022 Oregon Structural Specialty Code (OSSC)—Section 1613

Date: Issued May 13, 2024 – Rescinded April 1, 2026

Subject: Multi-Period Response Spectrum

Overview:

For the development of seismic design ground motion values, the multi-period response spectrum paired with additional site classes is available in ASCE 7-22. This method better characterizes seismic hazard and design forces as compared to ASCE 7-16, which is the version of the standard referenced in the 2022 Oregon Structural Specialty Code (OSSC). This improved estimate of seismic hazard and design forces is especially pronounced for moderate- and long-period buildings. This statewide alternate method allows for the use of multi-period response spectra and additional site classes in accordance with ASCE 7-16 as modified with provisions from ASCE 7-22 as shown below.

Discussion:

ASCE 7-22 Section 11.4.5.1 introduces a multi-period spectrum available at 22 discrete periods compared to the two-point spectrum (i.e., calculated at 0.2 seconds and 1 second) of ASCE 7-16. Furthermore, ASCE 7-22 Chapter 20 establishes nine site classes (i.e., Site Class A, B, BC, C, CD, D, DE, E and F) compared to the six (i.e., Site Class A, B, C, D, E and F) in ASCE 7-16. These changes provide an improvement in the characterization of the seismic hazard and resulting design forces which can be advantageous for certain buildings, particularly those with moderate and longer fundamental periods.

The multi-period spectrum for the corresponding site class is provided in the USGS Seismic Design Geodatabase and can be accessed directly through the ASCE 7 Hazard Tool at https://ascehazardtool.org/. This multi-period spectrum can then be used within the equivalent lateral force, response spectrum, or linear response history procedure of ASCE 7-16 Chapter 12 with some modifications. Where ASCE 7-16 requires the use of seismic response parameters (e.g., S_1, S_s, S_{D1}, S_{DS}, etc.) rather than the full multi-period response spectrum (e.g., force demands on nonstructural components in Chapter 13), the seismic response parameters are also taken from the USGS Seismic Design Geodatabase consistent with the multi-period spectrum.

Other western U.S. states have also adopted ahead the multi-period response spectrum and updated site classes. The Washington State Building Code permits the use of the multi-period spectrum of ASCE 7-22 by modifying ASCE 7-16 through an emergency rule (WSR 22-11-010). The California Building Code Section 1617A also permits the use of the multi-period spectra of ASCE 7-22 for certain healthcare occupancies.

Note that this statewide alternate method is not written for use with ASCE 7-16 Chapters 15, 16, 17 or 18. This is not to say that the multi-period spectrum is not applicable to designs in accordance with these chapters. Rather, it was judged that an alternate means and methods approach was more appropriate in those cases. Since ASCE 7-16 Chapters 16, 17 and 18 already require peer review for essentially all projects pursuing these chapters, the use of the multi-period spectrum can be addressed directly within the performance-based design framework for such projects.

Conclusion:

Under application of the 2022 OSSC, ASCE 7-16 Section 11.4 may be replaced in its entirety by ASCE 7-22 Section 11.4 for design in accordance with ASCE 7-16 Chapters 12 and 13.

Where ASCE 7-22 Section 11.4 is used as permitted above, all of the following additional modifications to ASCE 7-16 shall be required:

1. ASCE 7-16 Section 11.2 shall be modified to include the definition of the USGS Seismic Design Geodatabase as "A U.S. Geological Survey (USGS) database of geocoded values of seismic design parameters and geocoded values of multi-period 5%-damped MCE_R response spectra." The USGS Seismic Design Geodatabase may be accessed through the ASCE 7 Hazard Tool at https://ascehazardtool.org.
2. The seismic response parameters S_S, S_1, S_{MS}, S_{M1}, S_{DS} and S_{D1} as defined in ASCE 7-22 Section 11.3 and calculated in accordance with ASCE 7-22 Section 11.4 shall be used throughout ASCE 7-16 Chapters 11, 12, 13, and 14 where they occur.
3. ASCE 7-16 Equations (12.8-2), (12.8-3) and (12.8-4) shall all be replaced with the following equation. Where the period T is less than the period at which S_a is maximum, the maximum value of S_a shall be used.

$$C_s = \frac{S_a}{\left(\frac{R}{I_e}\right)}$$

4. When the modal response spectrum analysis procedure is selected, the multi-period design response spectrum shall be used in ASCE 7-16 Section 12.9.1.2.
5. When the linear response history analysis procedure is selected, the multi-period design response spectrum shall be used as the target response spectrum in ASCE 7-16 Section 12.9.2.3.
6. ASCE 7-16 Chapter 20 shall be replaced in its entirety by ASCE 7-22 Chapter 20.
7. Where a site-specific ground motion analysis is performed, ASCE 7-16 Chapter 21 shall be replaced in its entirety by ASCE 7-22 Chapter 21.

The technical and scientific facts for the statewide alternate method are approved.

Signature on file	May 13, 2024
Alana Cox, Administrator **Building Codes Division**	**Date**

Contact: Visit the division website to contact a building code specialist.