WAC 51-50-1615 Tsunami loads.

1615.1 General. The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

USER NOTE: The intent of the Washington state amendments to ASCE 7 Chapter 6 (Tsunami Loads and Effects) is to require use of the Washington Tsunami Design maps to determine inundation limits, i.e., when a site is within a tsunami design zone, where those maps are available. If they are not available for a given site, ASCE 7 maps are to be used. For sites where the Washington state department of natural resources has parameters for tsunami inundation depth and flow velocity available, those parameters are required to be used in the energy grade line analysis methodology, and as a basis for comparison in the probabilistic tsunami hazard analysis in this chapter.

1615.2 Modifications to ASCE 7. The text of Chapter 6 of ASCE 7 shall be modified as indicated in this section.

1615.2.1 ASCE 7 Section 6.1.1. Modify the third paragraph and its exception in ASCE 7 Section 6.1.1 to read as follows:

The Tsunami Design Zone shall be determined using the Washington Tsunami Design Zone maps (WA-TDZ). The WA-TDZ maps are available at https://www.dnr.wa.gov/wa-tdz. For areas not covered by the extent of the WA-TDZ maps, the Tsunami Design Zone shall be determined using the ASCE Tsunami Design Geodatabase of geocoded reference points shown in Fig. 6.1-1. The ASCE Tsunami Design Geodatabase of geocoded reference points of runup and associated inundation Limits of the Tsunami Design Zone is available at http://asce7tsunami.online.

EXCEPTION: For coastal regions subject to tsunami inundation and not covered by WA-TDZ maps or Fig. 6.1-1, Tsunami Design Zone, inundation limits, and runup elevations shall be determined using the site-specific procedures of Section 6.7, or for Tsunami Risk Category II or III structures, determined in accordance with the procedures of Section 6.5.1.1 using Fig. 6.7-1.

1615.2.2 ASCE 7 Section 6.1.1. Add new fifth paragraph and user note to ASCE 7 Section 6.1.1 to read as follows:

Whenever a Tsunami Design Zone or Fig. 6.1-1 is referenced in ASCE 7 Chapter 6, it shall include the WA-TDZ maps, within the extent of those maps.

USER NOTE: Tsunami inundation depths and flow velocities may be obtained from the Washington state department of natural resources. See https://www.dnr.wa.gov/wa-tdz.

1615.2.3 ASCE 7 Section 6.2. Modify ASCE 7 Section 6.2 definitions to read as follows:

MAXIMUM CONSIDERED TSUNAMI: A probabilistic tsunami having a 2% probability of being exceeded in a 50-year period or a 2,475-year mean recurrence, or a deterministic assessment considering the maximum tsunami that can reasonably be expected to affect a site.

TSUNAMI DESIGN ZONE MAP: The Washington Tsunami Design Zone maps (WA-TDZ) designating the potential horizontal inundation limit of the Maximum Considered Tsunami, or outside of the extent of WA-TDZ maps, the map given in Fig. 6.1-1.

1615.2.4 ASCE 7 Section 6.2. Add new definitions to ASCE 7 Section 6.2 to read as follows:

SHORELINE AMPLITUDE: The Maximum Considered Tsunami amplitude at the shoreline, where the shoreline is determined by vertical datum in North American Vertical Datum (NAVD 88).

WASHINGTON TSUNAMI DESIGN ZONE MAP (WA-TDZ): The Washington department of natural resources maps of potential tsunami inundation limits for the Maximum Considered Tsunami, designated as follows:

Anacortes Bellingham area	MS 2018-02 Anacortes Bellingham
Elliott Bay Seattle	OFR 2003-14
Everett area	OFR 2014-03

Port Angeles and Port Townsend area	MS 2018-03 Port Angeles and Port Townsend
San Juan Islands	MS 2016-01
Southern Washington Coast	MS 2018-01
Tacoma area	OFR 2009-9

1615.2.5 ASCE 7 Section 6.5.1. Add new second paragraph to ASCE 7 Section 6.5.1 to read as follows:

6.5.1 Tsunami Risk Category II and III buildings and other structures. The Maximum Considered Tsunami inundation depth and tsunami flow velocity characteristics at a Tsunami Risk Category II or III building or other structure shall be determined by using the Energy Grade Line Analysis of Section 6.6 using the inundation limit and runup elevation of the Maximum Considered Tsunami given in Fig. 6.1-1.

Where tsunami inundation depth and flow velocity characteristics are available from the Washington state department of natural resources, those parameters shall be used to determine design forces in the Energy Grade Line Analysis in Section 6.6.

1615.2.6 ASCE 7 Section 6.5.1.1. Modify the first paragraph of ASCE 7 Section 6.5.1.1 to read as follows:

6.5.1.1 Runup evaluation for areas where no map values are given. For Tsunami Risk Category II and III buildings and other structures where no mapped inundation limit is shown in the Tsunami Design Zone map, the ratio of tsunami runup elevation above Mean High Water Level to Offshore Tsunami Amplitude, R/HT, shall be permitted to be determined using the surf similarity parameter ξ100, according to Eqs. (6.5-2a, b, c, d, or e) and Fig. 6.5-1.

1615.2.7 ASCE 7 Section 6.5.2. Add new second paragraph to ASCE 7 Section 6.5.2 to read as follows:

6.5.2 Tsunami Risk Category IV buildings and other structures. The Energy Grade Line Analysis of Section 6.6 shall be performed for Tsunami Risk Category IV buildings and other structures, and the site-specific Probabilistic Tsunami Hazard Analysis (PTHA) of Section 6.7 shall also be performed. Site-specific velocities determined by site-specific PTHA determined to be less than the Energy Grade Line Analysis shall be subject to the limitation in Section 6.7.6.8. Site-specific velocities determined to be greater than the Energy Grade Line Analysis shall be used.

EXCEPTIONS: For structures other than Tsunami Vertical Evacuation Refuge Structures, a site-specific Probabilistic Tsunami Hazard Analysis need not be performed where the inundation depth resulting from the Energy Grade Line Analysis is determined to be less than 12 ft (3.66 m) at any point within the location of the Tsunami Risk Category IV structure.
Where tsunami inundation depths and flow velocities are available for a site from the Washington state department of natural resources, those parameters shall be used as the basis of comparison for the PTHA above and to determine whether the exception applies, in lieu of the Energy Grade Line Analysis.

1615.2.8 ASCE 7 Section 6.6.1. Add new third paragraph to ASCE 7 Section 6.6.1 to read as follows:

6.6.1 Maximum inundation depth and flow velocities based on runup. The maximum inundation depths and flow velocities associated with the stages of tsunami flooding shall be determined in accordance with Section 6.6.2. Calculated flow velocity shall not be taken as less than 10 ft/s (3.0 m/s) and need not be taken as greater than the lesser of 1.5(ghmax)1/2 and 50 ft/s (15.2 m/s).

Where the maximum topographic elevation along the topographic transect between the shoreline and the inundation limit is greater than the runup elevation, one of the following methods shall be used:

1. The site-specific procedure of Section 6.7.6 shall be used to determine inundation depth and flow velocities at the site, subject to the above range of calculated velocities.

2. For determination of the inundation depth and flow velocity at the site, the procedure of Section 6.6.2, Energy Grade Line Analysis, shall be used, assuming a runup elevation and horizontal inundation limit that has at least 100% of the maximum topographic elevation along the topographic transect.

Where tsunami inundation depths and flow velocities are available from Washington state department of natural resources, those parameters shall be used to determine design forces in the Energy Grade Line Analysis in Section 6.6.2.

1615.2.9 ASCE 7 Section 6.7. Modify ASCE 7 Section 6.7 and add a user note to read as follows:

When required by Section 6.5, the inundation depths and flow velocities shall be determined by site-specific inundation studies complying with the requirements of this section. Site-specific analyses shall use an integrated generation, propagation, and inundation model that replicates the given offshore tsunami waveform amplitude and period from the seismic sources given in Section 6.7.2.

USER NOTE: Washington Tsunami Design Zone maps and inundation depths and flow velocities from Washington state department of natural resources are based on an integrated generation, propagation, and inundation model replicating waveforms from the seismic sources specific to Washington state. Model data can be obtained by contacting Washington state department of natural resources. See https://www.dnr.wa.gov/wa-tdz.

1615.2.10 ASCE 7 Section 6.7.5.1, Item 4. Modify ASCE 7 Section 6.7.5.1, Item 4 to read as follows:

6.7.5.1 Offshore tsunami amplitude for distant seismic sources. Offshore tsunami amplitude shall be probabilistically determined in accordance with the following:

4. The value of tsunami wave amplitude shall be not less than 80% of the shoreline amplitude value associated with the Washington state inundation models as measured in the direction of the incoming wave propagation.

1615.2.11 ASCE 7 Table 6.7-2. Modify ASCE 7 Table 6.7-2 to read as follows:

Table 6.7-2

Maximum Moment Magnitude

Subduction Zone	Moment Magnitude M_{Wmax}
Alaskan-Aleutian	9.2
Cascadia	9.0
Chile-Peru	9.5
Izu-Bonin-Mariana	9.0
Kamchatka-Kurile and Japan Trench	9.4

1615.2.12 ASCE 7 Section 6.7.5.2. Modify ASCE 7 Section 6.7.5.2 to read as follows:

6.7.5.2 Direct computation of probabilistic inundation and runup. It shall be permitted to compute probabilistic inundation and runup directly from a probabilistic set of sources, source characterizations, and uncertainties consistent with Section 6.7.2, Section 6.7.4, and the computing conditions set out in Section 6.7.6. The shoreline amplitude values computed shall not be lower than 80% of the shoreline

amplitude value associated with the Washington state inundation models as measured in the direction of the incoming wave propagation.

1615.2.13 ASCE 7 Section 6.7.6.2. Modify ASCE 7 Section 6.7.6.2 and add a user note to read as follows:

6.7.6.2 Seismic subsidence before tsunami arrival. Where the seismic source is a local earthquake event, the Maximum Considered Tsunami inundation shall be determined for an overall elevation subsidence value shown in Fig. 6.7-3(a) and 6.7-3(b) or shall be directly computed for the seismic source mechanism. The GIS digital map layers of subsidence are available in the ASCE Tsunami Design Geodatabase at http://asce7tsunami.online.

USER NOTE: The WA-TDZ maps include computed subsidence in the inundation. Subsidence data may be obtained from the Washington state department of natural resources. See https://www.dnr.wa.gov/wa-tdz.

1615.2.14 ASCE 7 Section 6.8.9. Modify the first sentence of ASCE 7 Section 6.8.9 to read as follows:

6.8.9 Seismic effects on the foundations preceding maximum considered tsunami. Where designated in the Tsunami Design Zone map as a site subject to a tsunami from a local earthquake, the structure shall be designed for the preceding coseismic effects.

[Statutory Authority: RCW 19.27.031 and 19.27.074. WSR 21-12-075, § 51-50-1615, filed 5/28/21, effective 6/28/21.]