



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

May 2018
Log No. _____

1. State Building Code to be Amended:

- | | |
|---|---|
| <input checked="" type="checkbox"/> International Building Code | <input type="checkbox"/> International Mechanical Code |
| <input type="checkbox"/> ICC ANSI A117.1 Accessibility Code | <input type="checkbox"/> International Fuel Gas Code |
| <input type="checkbox"/> International Existing Building Code | <input type="checkbox"/> NFPA 54 National Fuel Gas Code |
| <input type="checkbox"/> International Residential Code | <input type="checkbox"/> NFPA 58 Liquefied Petroleum Gas Code |
| <input type="checkbox"/> International Fire Code | <input type="checkbox"/> Wildland Urban Interface Code |
| <input type="checkbox"/> Uniform Plumbing Code | |

For the Washington State Energy Code, please see specialized [energy code forms](#)

Section(s): 1615

Title: Tsunami Loads

2. Proponent Name (Specific local government, organization or individual):

Proponent: The SBCC Tsunami TAG

Title: Tsunami TAG

Date: 1/6/2021

3. Designated Contact Person:

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4. Proposed Code Amendment. Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code additional pages may be attached. (Examples on the SBCC [website](#))

Code(s) 2018 International Building Code **Section(s)** 1615

1615.1 General. The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones (~~(defined in the Tsunami Design Geodatabase)~~) 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/programs-and-services/geology/geologic-hazards/Tsunamis#tsunami-hazard-maps>]. 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/programs-and-services/geology/geologic-hazards/Tsunamis#tsunami-hazard-maps>].

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:

<u>Anacortes Bellingham area</u>	<u>MS 2018-02 Anacortes Bellingham</u>
<u>Elliott Bay Seattle</u>	<u>OFR 2003-14</u>
<u>Everett area</u>	<u>OFR 2014-03</u>
<u>Port Angeles and Port Townsend area</u>	<u>MS 2018-03 Port Angeles and Port Townsend</u>
<u>San Juan Islands</u>	<u>MS 2016-01</u>
<u>Southern Washington Coast</u>	<u>MS 2018-01</u>
<u>Tacoma Area</u>	<u>OFR 2009-9</u>

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, $R_{\overline{X}}$, shall be permitted to be determined using the surf similarity parameter ξ_{100} , 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.

EXCEPTION: 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 ~~3.0 m~~ and need not be taken as greater than the lesser of $1.5(gh_{max})^{1/2}$ and 50 ft ~~15.2 m~~.

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/programs-and-services/geology/geologic-hazards/Tsunamis#tsunami-hazard-maps>].

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}
<u>Alaskan-Aleutian</u>	<u>9.2</u>
<u>Cascadia</u>	<u>9.0</u>
<u>Chile-Peru</u>	<u>9.5</u>
<u>Izu-Bonin-Mariana</u>	<u>9.0</u>
<u>Kamchatka-Kurile and Japan Trench</u>	<u>9.4</u>

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/programs-and-services/geology/geologic-hazards/Tsunamis#tsunami-hazard-maps].*

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.

- 5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.** Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

This proposal helps align the 2018 International Building Code (IBC) reference to the ASCE 7-16 with the Washington State Department of Natural Resources (DNR) mapping data. This will provide a more accurate scenario and help with life safety in the event of a tsunami. Having this new amendment will allow for a more detailed mapping reference for designers and jurisdictions to follow.

- 6. Specify what criteria this proposal meets.** You may select more than one.

- The amendment is needed to address a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- The amendment is needed to address a specific state policy or statute.
- The amendment is needed for consistency with state or federal regulations.
- The amendment is needed to address a unique character of the state.
- The amendment corrects errors and omissions.

- 7. Is there an economic impact:** Yes No

Explain: To be determined (TBD)

Please send your completed proposal to: sbcc@des.wa.gov