STATE OF WASHINGTON

# STATE BUILDING CODE COUNCIL

May 2018

Log No. _____

**1. State Building Code to be Amended:**

- ☒ International Building Code
- ☐ ICC ANSI A117.1 Accessibility Code
- ☐ International Existing Building Code
- ☐ International Residential Code
- ☐ International Fire Code
- ☐ Uniform Plumbing Code
- ☐ International Mechanical Code
- ☐ International Fuel Gas Code
- ☐ NFPA 54 National Fuel Gas Code
- ☐ NFPA 58 Liquefied Petroleum Gas Code
- ☐ Wildland Urban Interface 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: 12/30/2020**

**3. Designated Contact Person:**

**Name: Ray Shipman**
**Title: Building Code Specialist**
**Address: 1500 Jefferson Building, Olympia, WA 98504**

**Office Phone: (360) 407-8047**
**Cell: ( )**
**E-Mail address: Ray.Shipman@des.wa.gov**

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.

**Commented [jcs1]:** Once we have the WA geodatabase, this can be reinstated.

**User Note:** The intent of the Washington State amendments to ASCE 7 is to require use of the Washington Tsunami Design maps to determine inundation limits, 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 lieu of the energy grade line analysis methodology 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 ["main" webpage URL for 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].

**Commented [jcs2]:** DNR to provide a webpage with links to maps. Webpage will include "welcome," purpose/intent of maps, and limitations. Should also contain contact information for DNR to get design parameters (see User Note for IBC 1615.2.2 below).

**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 load design parameters can be obtained by contacting Washington State Department of Natural Resources. See ["main" webpage URL for 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 definition to ASCE 7 Section 6.2 to read as follows:

***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* |

**Commented [jcs3]:** Verify with Daniel and Alex these are the correct map versions. (Note: OK for DNR to change names of maps to something unique, but should have basis noted on the maps themselves—fine print OK.)

**Commented [DA(4R3]:** Removed maps that use the "1a" scenario," which is based on the last event in 1700, not an approximate 2500-year event.

**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 associated with the Washington Tsunami Design Zone maps are available, those parameters shall be used to determine design forces in lieu of the Energy Grade Line Analysis in Section 6.6.*

**Commented [jcs5]:** Does DNR data include outflow depths and velocities?

**Commented [DA(6R5]:** Yes, the DNR maps show the maximum inundation depth and current speeds.

**Commented [jcs7]:** No option to use EGL analysis if data is available. Could be either more or less conservative than ASCE 7, depending on location, etc.

**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, $R_{2\%}$, shall be permitted to be determined using the surf similarity parameter $\xi_{100}$, 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 associated with the Washington Tsunami Design Zone maps are available for a site, 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 $1.5(gh_{max})^{½}$ 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 inundation depth and tsunami flow velocity characteristics associated with the Washington Tsunami Design Zone maps are available, those parameters shall be used to determine design forces in lieu of the Energy Grade Line Analysis in Section 6.6.2.*

**1615.2.9 ASCE 7 Section 6.7.** Add a user note to ASCE 7 Section 6.7 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 the ASCE Tsunami Design Geodatabase of geocoded reference points of Offshore Tsunami Amplitude and dominant waveform period shown in Fig. 6.7-1 as input to an inundation numerical model or 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. The ASCE Tsunami Design Geodatabase of geocoded reference points of Offshore 328-ft (100-m) depth, Tsunami Amplitude, $H_T$, and Predominant Period, $T_{TSU}$, of the Maximum Considered Tsunami is available at http://asce7tsunami.online.

***User Note:*** *Washington Tsunami Design Zone maps are based on an 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 ["main" webpage URL for maps].*

**Commented [jcs8]:** Do designers still need to pay attention to 6.6.3 (terrain roughness) and 6.6.4 (tsunami bores)? Note: 6.6.5 should probably still apply (amplification due to other buildings).

**Commented [DA(9R8]:** Yes, I they should. And our maps use "bare-earth DEMs" and a Manning's Roughness Coefficient of 0.025-0.3. This is the same mentioned in 6.6.3, with the exception to "buildings of at least urban density" which is given 0.04. To my knowledge, there has not been an in-depth sensitivity study between these values.

**Commented [ED(10]:** Maybe I am misreading the way this is referenced above and thus my comment is moot, but would we want it to simply say:

Site specific analyses shall use an integrated generation, propagation, and inundation model. Model parameters can be obtained by contacting Washington State Department of Natural Resources. See ["main" webpage URL for contact info].

We have the Source to Site information for both CSZ and SF for all of Washington. They would ideally be using this everywhere, thereby dropping the need for the 100m bathy offshore points.

**Commented [jcs11]:** Since the idea is somebody might want to do something different from the WA DNR models, is this what we want to say? Note that the change to ASCE 7 Section 6.5.2 above already says to use the WA DNR data for comparison.

**Commented [DA(12R11]:** I think this works.

**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 offshore tsunami wave amplitude shall be not less than 80% of the *offshore amplitude* value *associated with the Washington State inundation models*.

**1615.2.11 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.

**1615.2.12 ASCE 7 Section 6.7.6.2.** Modify ASCE 7 Section 6.7.6.2 to read as follows:

**6.7.6.2 Seismic Subsidence before Tsunami Arrival.** Where the seismic source is a local subduction 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.

**Commented [jcs13]:** Modification sets the WA models as the baseline for 80% scaling, instead of ASCE 7.

Option could be to delete Item 4 altogether, if we don't want anyone to go below DNR models.

**Commented [DA(14R13]:** I would consider to delete item 4 altogether If we are saying DNR maps are a baseline. Is this 80% scaling a standard in other applications?

**Commented [ED(15]:** Nowhere in WA do distant sources exceed the local CSZ or SF inundation potential. Can this entire section be struck for simplicity, or note made to the effect that Distant Sources constitute less overall hazard than Local sources and only local sources should be considered for 2% in 50 years' design parameter (may apply for lesser thresholds)?

**Commented [jcs16]:** Moved to a user note, since the 1st sentence already allows for computed subsidence.

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.

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:

   If there is an economic impact, use the tool below to estimate the costs and savings of the proposal on construction practices, users and/or the public, the enforcement community, and operation and maintenance. If preferred, you may submit an alternate cost benefit analysis.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost **Analysis tool** and **Instructions;** use these **Inputs**. **Webinars on the tool can be found Here and Here**)

$Click here to enter text./square foot (For residential projects, also provide $Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

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

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.