

Pacific coast tsunami-risk maps

Building codes tweaked so we'll survive

Jake Ellison, San Francisco Chronicle, 9-29-16

Until now, the best plan for the survival of the millions of Americans at risk of a tsunami has been to run like hell for high ground, or just hope against hope that the building you're in can take the wave.

Well, recent tsunamis in Japan, Chile, Samoa and the Indian Ocean have shown this to be a bad Plan A. Consequently, civil engineers have gotten together to establish building codes for areas at risk of tsunamis so that we can all have a better shot at survival ... should we find ourselves facing a mountain of surging ocean.

Check out the gallery above to see where the American Society of Civil Engineers (ASCE) has determined those danger zones to be for the entire Pacific coast of the contiguous United States.

"Earlier efforts were in the hands of scientists and emergency management agencies, and their primary focus was evacuation," said Gary Chock, chair of ASCE's Tsunami Loads and Effect Subcommittee. "The idea was, you evacuate and everything else is toast."

He said a situation in which only some, if any, people could be expected to evacuate a tsunami zone in time, leaving the rest to perish, was "unacceptable" to him and other civil engineers.

And the number of Americans at risk is pretty staggering. The engineers determined that 3.5 million Americans are threatened by major tsunamis:

- **California:** 275,000 residents plus another 400,000 to 2,000,000 tourists at risk along 840 miles of coastline. Damage could cost more than \$200 billion with the loss of three major airports, a military port, five "very large" ports, one large port and five medium ports.
- **Oregon:** 25,000 residents plus another 55,000 tourists at risk along 300 miles of coastline. Damage could run to \$8.5 billion, plus the destruction of essential facilities, two medium ports and one fuel depot hub.
- **Washington:** 45,000 residents plus another 20,000 tourists at risk along 160 miles of coastline. Damages could hit \$4.5 billion plus the destruction of essential facilities, one military port, two very large ports, one large port and three medium ports.
- **Hawaii:** More than 200,000 residents plus another 175,000 or more tourists and approximately 1,000 buildings directly relating to the tourism industry at risk along 750 miles of coastline. Damages could run into the \$40 billion range with the devastation of three international airports and one military port, one medium port and four other container ports. The state could also lose one fuel refinery intake port, three regional power plants and 100 government buildings.
- **Alaska:** 105,000 residents, plus highly seasonal visitor count are at risk along 6,600 miles of coastline. Damages could hit \$10 billion plus the loss of an international airport fuel depot, three medium ports, plus nine other container ports, or 55 ports total.

The engineers first figured out which areas of the five states mostly likely to be hit with a tsunami — Alaska, Washington, Oregon, California and Hawaii — were most at risk and then created design requirements for those areas and the online tools builders can use for drilling down to their specific construction sites.

This "first-of-its-kind digital geodatabase tool" will give engineers "the specific tsunami conditions to be resisted by the structure at its site," the ASCE explained in a news release.

"Probabilistic hazard and inundation maps like these help to provide the necessary information when designing structures located in areas at risk for tsunamis," said Dr. Yong Wei, research scientist at the University of Washington and the National Oceanic and Atmospheric Administration. "These Tsunami Design Zone maps tell us the inundation distance and run-up elevations – key factors for calculating tsunami effects on specific structures under the ASCE standard."

The strength of tsunamis being considered for this planning are those which would be created by a mega-thrust earthquake resulting from movement in one of the Pacific Rim's subduction zones, where one of Earth's plates slides under another. Those major zones are the Alaska Aleutian zone, Cascadia subduction zone, the Kamchatka-Kuriles and Japan Trench, and Chile-Peru zone. (See subduction zone graphic in gallery above.)

What's next?

"ASCE will publish its new design standard in ASCE-7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, and a companion guide, Tsunami Loads and Effects: Guide to the Tsunami Design Provisions of ASCE 7-16, both due to be released in early 2017. ASCE 7 is the accredited, consensus-based engineering standard that is the primary reference of structural design requirements in all U.S. building codes," the news release said.