BASE*Line*

The quarterly newsletter of BASE

Spring 2017

RESILIENCY

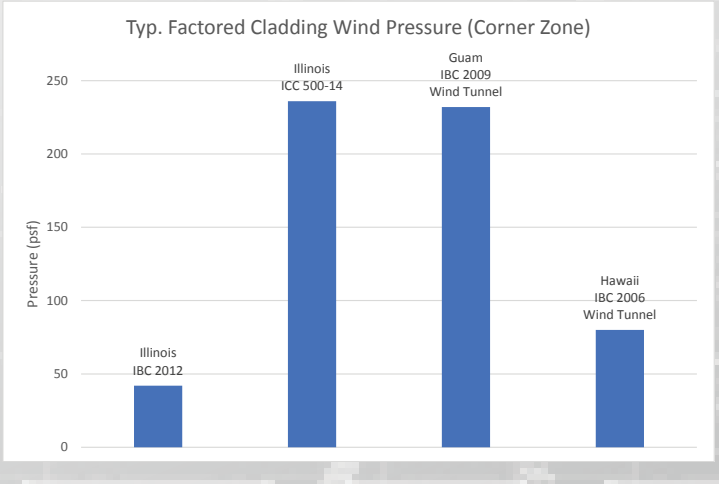
To Bend but Not Break

BASE has offices in diverse locations around the world, each in areas that are prone to different extreme forces of nature. In Chicago it is dealing with tornadoes, in Hawaii tsunamis, and in Guam severe earthquakes. Standards are continuously evolving and reflect a better understanding of these extreme events. This BASELine discusses some of the upcoming changes to building codes and standards that will impact building construction in these areas.

Tornado Shelter Design

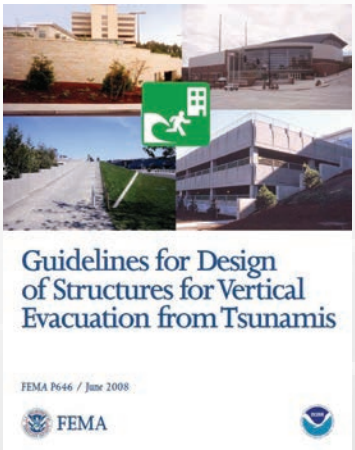
Starting in IBC 2015, all Group E occupancies with an occupant load of 50+ that are in regions with design tornado wind speeds of 250 mph will be required to have storm shelters or safe rooms that are designed in accordance with ICC 500-14: Standard for the Design and Construction of Storm Shelters. This includes several Midwest states, including the entire state of Illinois.

This requirement has caused some consternation among designers as the design wind pressures for tornadoes as determined by ICC 500-14 are generally over five times higher than the design wind pressures for typical buildings. However, BASE is uniquely positioned to attack this challenge due to our extensive design work in Guam, one of the harshest hurricane regions on earth. Due to Guam's unique topography and Guam's design wind speed being the highest in the United States, design wind pressures for standard buildings typically approach and occasionally exceed the ICC 500-14 design wind pressure for storm shelters in Illinois. Shown at left is a comparison of factored cladding wind pressures for typical building design in Illinois, storm shelter design in Illinois, and recent wind tunnel results for BASE projects in Guam and Honolulu, respectively. While extreme wind loads may be new to many designers in the Midwest, they are nothing new for BASE.



Tsunami Design

The 2018 IBC will incorporate ASCE 7-16 that includes a new Chapter 6, Tsunami Loads and Effects, which will require structures "be designed for the effects of the maximum considered tsunami, including hydrostatic and hydrodynamic forces, waterborne debris accumulation and impact loads, subsidence and scour effects." It will become the first national standard for tsunami resilience for use in Alaska, Washington, Oregon, California, and Hawaii and can be adopted into their local building codes. The new design provisions include tsunami design zone maps indicating inundation distance and run-up elevation factors for calculating tsunami effects on structures.



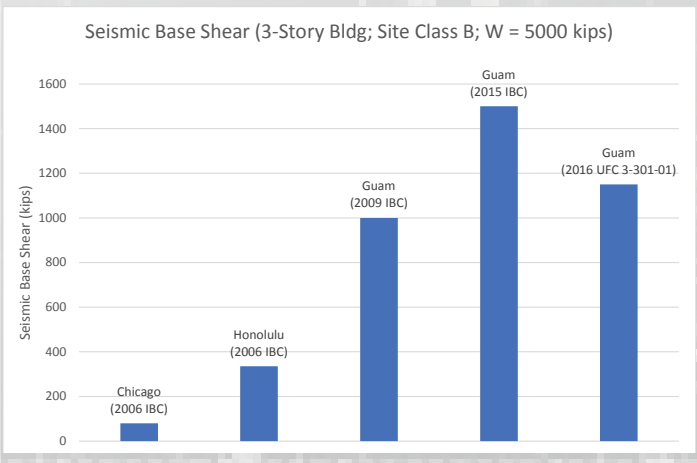
These new standards were developed from new research along with previous groundwork including FEMA P646: Guidelines for Design of Structures for Vertical Evacuation from Tsunamis. Published by the Federal Emergency Management Agency in 2008, P646 was prepared by the Applied Technology Council (ATC) that was headed by BASE's Steve Baldridge, its project technical director.

Revised Seismic Accelerations

Over the past several years, the seismic design accelerations for Guam have changed significantly. This is due to new research that better maps ground motion parameters in Guam and the region. As shown in the table on the right, Ss, the spectral response acceleration parameter at short periods, increased from the 2009 IBC to the 2015 IBC by almost a factor of two. Just recently, however, the Department of Defense released new criteria in UFC 3-301-01 that allows a 20% reduction on the seismic acceleration values mandated for military work. This reduction is based on a site specific ground motion study conducted by URS corporation. With this 20% reduction, the increase from the 2009 IBC is not nearly as large as with the 2015 IBC.

Code/Standard	S_S	S_1
2009 IBC	1.50	0.60
2015 IBC	2.86	0.72
UFC 3-301-01 (12 Sept. 2016)	2.79*	0.68*

* Values can be reduced by 20%.



To illustrate the difference between the various seismic accelerations, the figure on the left compares the seismic base shear for a fictitious, but typical, low-rise building designed with the 2009 IBC, 2015 IBC and UFC 3-301-01. We also include the base shear for an identical building located in both Chicago and Honolulu based on the seismic accelerations in the 2006 IBC.

BASE Projects in the News

The Westin Nanea Ocean Villas
Ka'anapali, HI

Developer: Vistana Signature Experiences
Architect: WCIT Architecture
Contractor: Hawaiian Dredging Construction Company

BASE was the structural engineer of record for this newest resort development on Maui that officially opened to the public on April 15. The 390-unit Westin Nanea Ocean Villas consists of eight six-story buildings of approximately 627,000 SF forming a W-shape that creates two landscaped courtyard areas. The resort also includes two stand-alone parking structures with a total square footage of about 240,000 SF. The hotel building's walls and floors were designed to be built with concrete tunnel forms. Additionally, post-tensioned transfer slabs and beams were utilized to transfer out concrete walls in areas where large, open spaces were desired for lobbies, sales space, open offices, and restaurants. BASE also worked closely with the general contractor throughout the project to modify the structure to simplify formwork, sequencing, and trade coordination. This collaboration helped the general contractor deliver a more economical project and accelerate the construction schedule without compromising the owner's and architect's visions. Read more about the project at The Maui News.

Hale Mahana Collegiate Apartments
Honolulu, HI

Developer: Laconia Development LLC
Architect: Lowney Architecture
Contractor: Albert C. Kobayashi, Inc.

Ground breaking was held on February 10 for Hale Mahana Collegiate Apartments, a new 14-story, 191-unit student housing project. BASE is proud to be the structural engineer of record for this development that will provide much-needed student housing options for nearby University of Hawaii students. Click here for KHON2's story about the project.