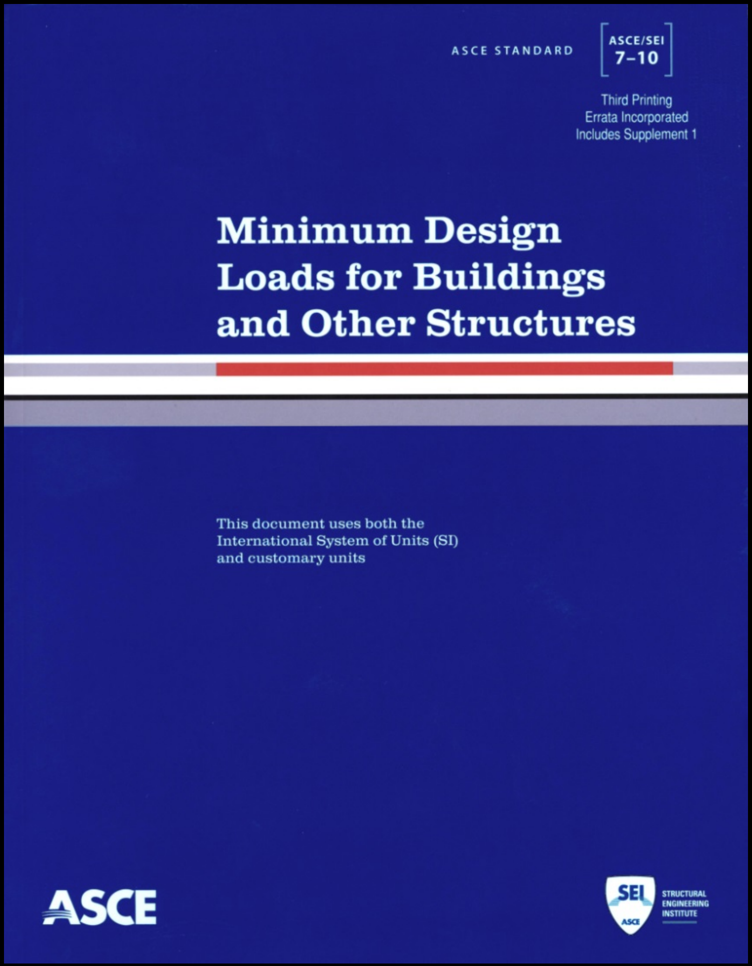
Use of USGS Seismic Hazard Tools at Individual Sites—New Building Design Perspective

John D. Hooper, P.E., S.E.
Senior Principal & Director of Earthquake Engineering
Magnusson Klemencic Associates

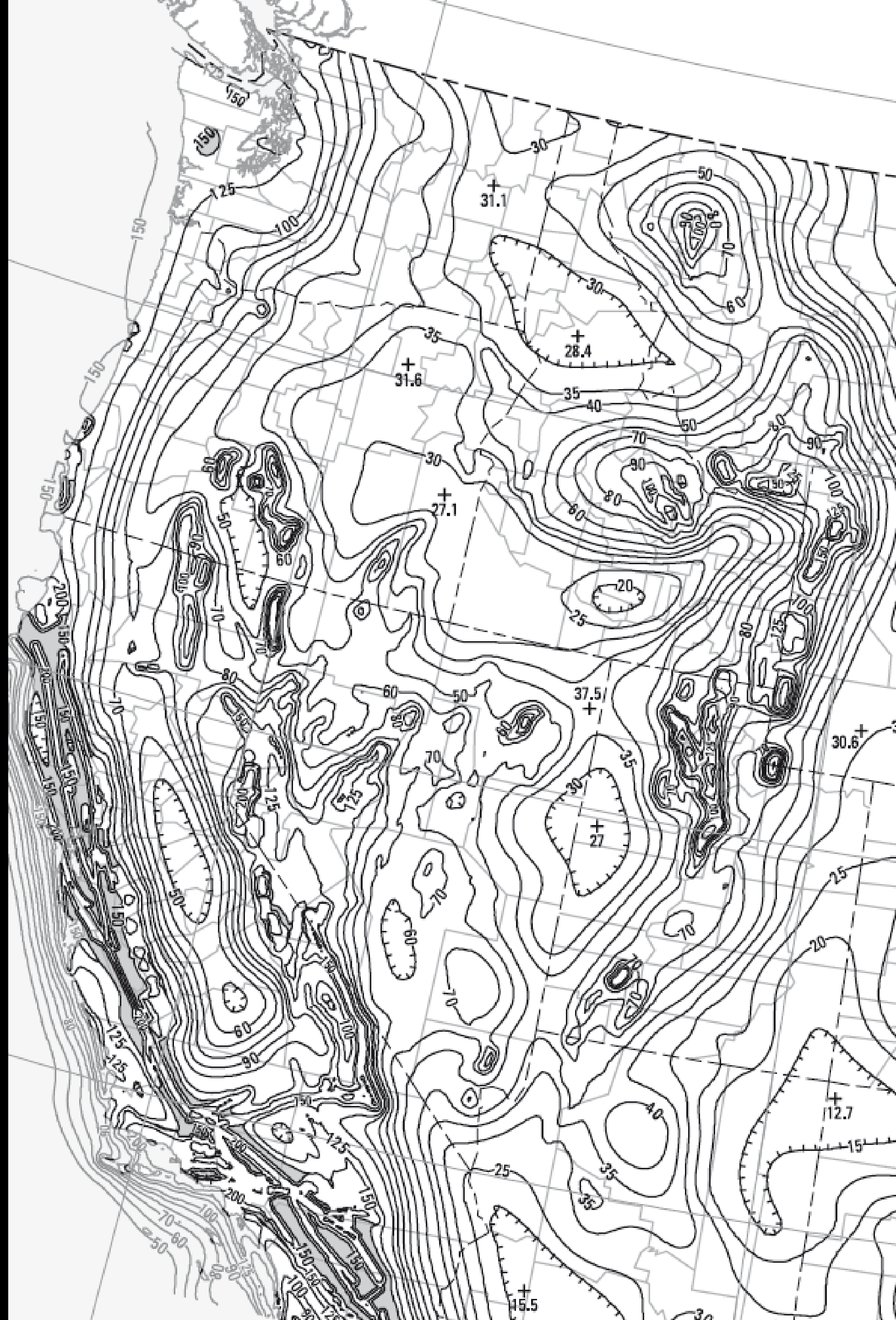
Governing Codes & Standards



11.4.3 Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters. The MCE_R spectral response acceleration parameter for short periods (S_{MS}) and at 1 s (S_{M1}), adjusted for site class effects, shall be determined by Eqs. 11.4-1 and 11.4-2, respectively.

$$S_{MS} = F_a S_S \tag{11.4-1}$$

$$S_{M1} = F_v S_1 \tag{11.4-2}$$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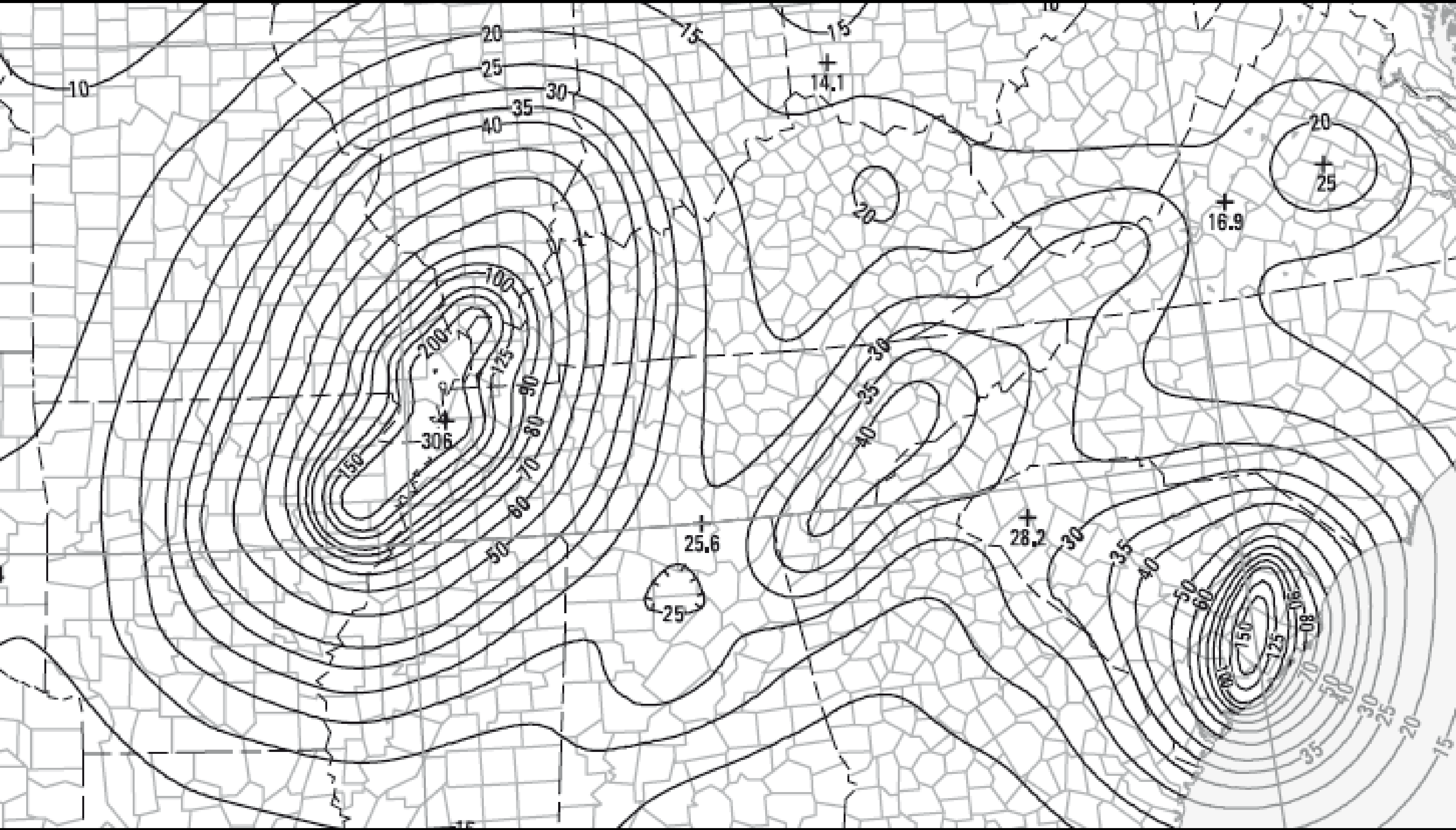

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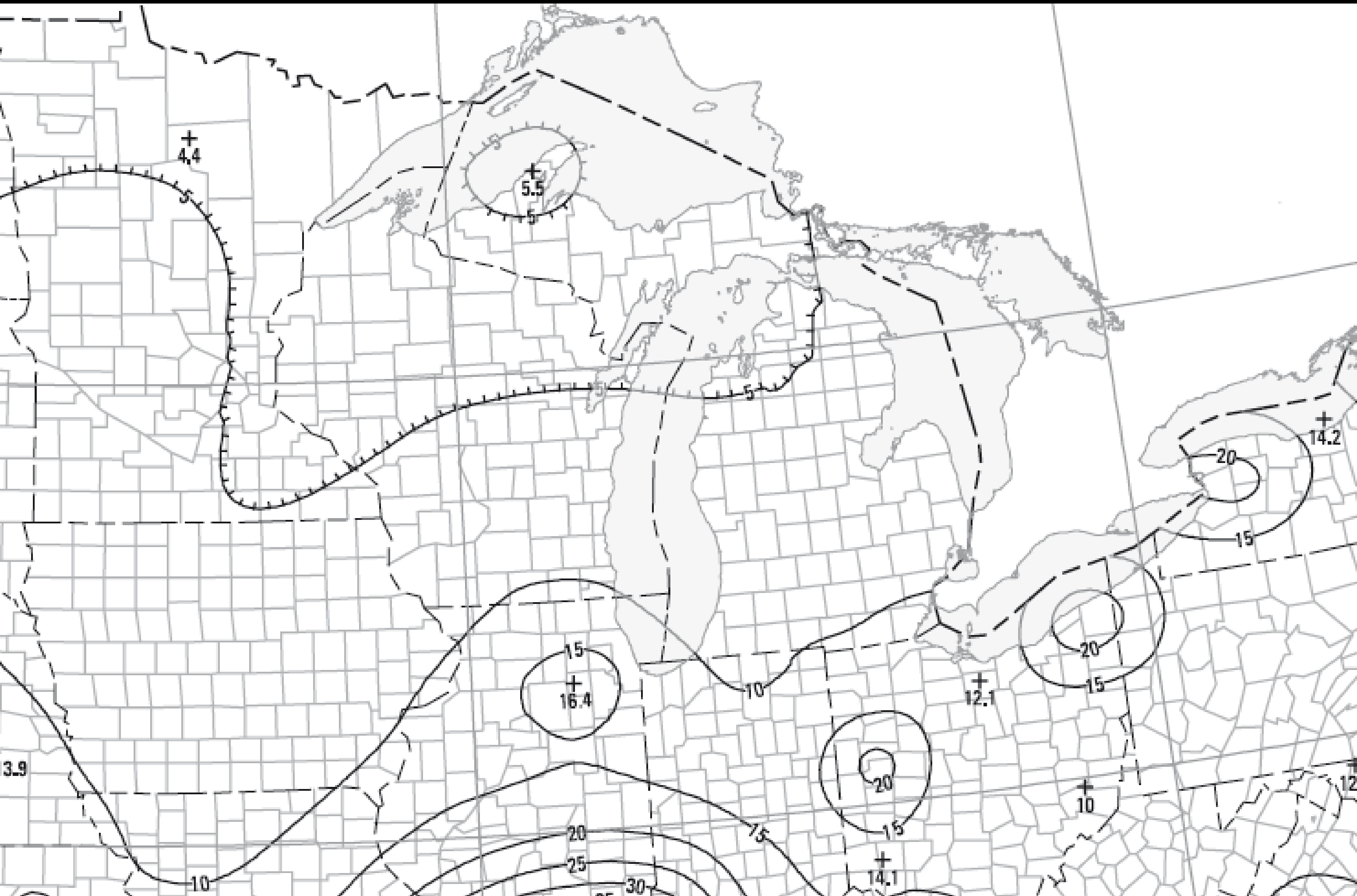

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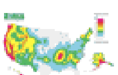
User Note: Electronic values of mapped acceleration parameters and other seismic design parameters are provided at the USGS website at http://earthquake.usgs.gov/designmaps, or through the SEI website at http://content.seinstitute.org.

Hazards

The USGS has recently released updated 2014 seismic hazard maps for the conterminous U.S. The maps, documentation, and data will be posted here as they become available.

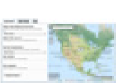
Seismic Hazard Maps and Data



Probabilistic and scenario ground-motion hazard maps, input and output data, and documentation. More...

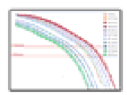
- Lower 48
- Alaska
- Hawaii
- Puerto Rico & U.S. Virgin Islands
- Guam & Marianas
- Samoa & Pacific Islands
- Urban & Regional
- Scenarios
- Time-Dependent EQ Probability Maps
- Foreign

Seismic Design Maps, Data, and Tools for Engineers



Ground motion parameter values for building and bridge design. More...

Seismic Hazard Analysis Tools



Create customized hazard and probability maps with additional options to assess individual source-contributions to overall hazard.

More...

- Custom Hazard Maps
- Custom Earthquake Probability Maps
- Hazard Curves
- Vs30
- Interactive Deaggregations
- Banded Deaggregations

Faults

Where are the faults in my area, and when did they last have a large earthquake? Find maps and comprehensive geologically based information on known or suspected active faults and folds in the United States. More...

Seismic Hazards Primers

- Earthquake Hazards 101-The Basics
- Earthquake Hazards 201-Technical Q&A
- Fact Sheet-what are hazard maps?
- FAQ

About the NSHM Project

- Publications
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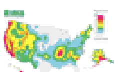

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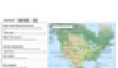
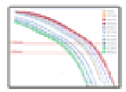


Ground motion parameter values for building and bridge design. More...

Seismic Hazard Analysis Tools



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Seismic Design Maps & Tools
US Seismic Design Maps
Use the Tool
Recent Changes
Documentation & Help
Risk Targeted Ground Motion Calculator
Use the Tool
Documentation & Help
Worldwide Seismic Design Tool
Use the Tool
Documentation & Help

Seismic Design Maps & Tools

Engineers should use these maps and tools for seismic design, not the hazard maps available elsewhere on the USGS website.

Sites in the U.S. and its Territories

U.S. Seismic Design Maps

The USGS collaborates with organizations (such as the Building Seismic Safety Council) that develop model building and bridge design codes to make seismic design parameter values available to engineers. The design code developers first decide how USGS earthquake hazard information should be applied in design practice. Then the USGS calculates gridded values of seismic design parameters based on USGS hazard values in accordance with design code procedures. The *U.S. Seismic Design Maps* application provides seismic design parameter values from the following design code editions:

- *2013 ASCE/SEI 41*
- *2012/09/06 International Building Code*
- *2010/05 ASCE/SEI 7 Standard*
- *2009/03 NEHRP Recommended Seismic Provisions*
- *2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design*

The USGS also provides data files and maps of these gridded design values.

Risk Targeted Ground Motion Calculator

This tool is used to calculate risk-targeted ground motion values from probabilistic seismic hazard curves in accordance with the site-specific ground motion procedures defined in "Method 2" of *2010 ASCE 7 Standard* Section 21.2.1.2.

The vast majority of engineering projects in the U.S. will require the use of the *U.S. Seismic Design Maps* application (see above) rather than the *Risk Targeted Ground Motion Calculator*.

Sites outside the U.S. and its Territories

Worldwide Seismic Design Values (Beta)

This tool provides design values (specifically, S_S and S_1) worldwide for use with the *International Building Code*.

Looking for seismic zones?

Seismic Design Maps & Tools

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U.S. Seismic Design Maps

Use the Application

Purpose:	Retrieve seismic design parameter values for the design of buildings and bridges at sites in the U.S. and its Territories
Input:	Building code reference document: • 2012/09/06 International Building Code • 2010/05 ASCE/SEI 7 Standard • 2009/03 NEHRP Recommended Provisions • 2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design Site address, or latitude and longitude Soil classification (for example, Site Class C for "very dense soil and soft rock"; not available from the USGS) Note, the application can batch-process multiple sites.
Output:	Summary Report: mapped location; and design values and response spectra from the building code reference document Detailed Report: the calculations underlying the design values, including any associated maps, tables, and equations
Similar Tools:	• Regional Minimum and Maximum Design Values (Minimum and maximum S_S, S_1, and PGA values for: 50 U.S. States; Washington, D.C.; 3,222 counties; and most ZIP codes) • Data files of gridded values • Mapped design values • Seismic design maps and tools (Older U.S. or worldwide design)

Seismic Design Maps & Tools
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U.S. Seismic Design Maps

For occasional announcements about this web tool, please visit our U.S. Seismic Design Maps wiki.

Application | **Batch Mode** | **Help**

Design Code Reference Document
Consult your local design official if you need help selecting this.
Please Select...

Report Title (Optional)
This will appear at the top of the generated report.

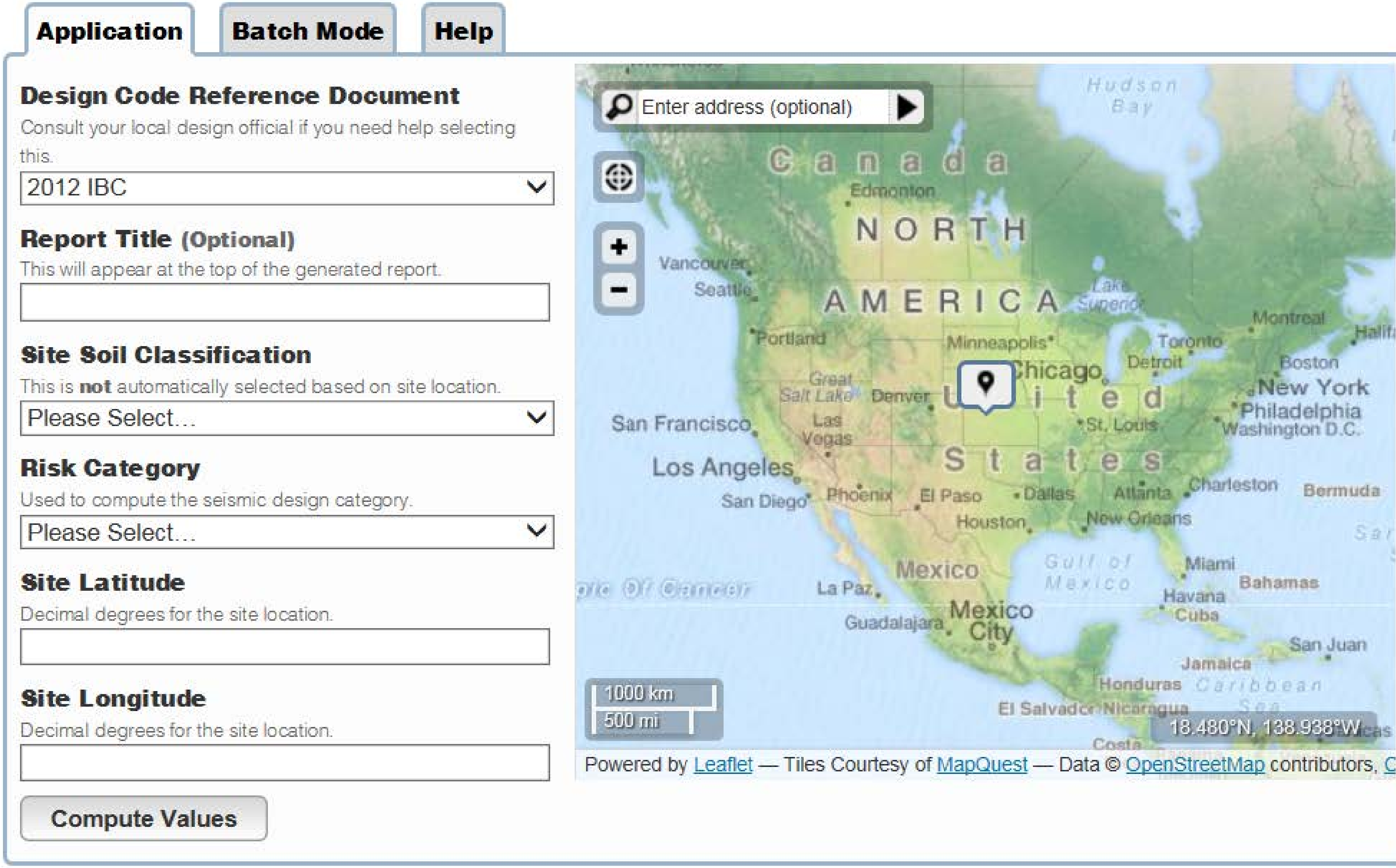
Site Soil Classification
This is **not** automatically selected based on site location.
Please Select...

Site Latitude
Decimal degrees for the site location.

Site Longitude
Decimal degrees for the site location.

Compute Values

Powered by Leaflet — Tiles Courtesy of MapQuest — Data © OpenStreetMap contributors, C


Application
Batch Mode
Help
Design Code Reference Document
Consult your local design official if you need help selecting this.
2012 IBC
Report Title (Optional)
This will appear at the top of the generated report.
Site Soil Classification
This is not automatically selected based on site location.
Please Select…
Risk Category
Used to compute the seismic design category.
Please Select…
Site Latitude
Decimal degrees for the site location.
Site Longitude
Decimal degrees for the site location.
Compute Values
Enter address (optional)
Hudson Bay
Canada
Edmonton
NORTH
AMERICA
Vancouver
Seattle
Lake Superior
Montreal
Portland
Minneapolis
Toronto
Chicago
Detroit
Boston
Great Salt Lake
Denver
United States
New York
Philadelphia
Washington D.C.
San Francisco
Las Vegas
St. Louis
Los Angeles
San Diego
Phoenix
El Paso
Dallas
Atlanta
Charleston
Bermuda
Houston
New Orleans
Gulf of Mexico
Miami
Mexico
La Paz
Bahamas
Havana
Cuba
Guadalajara
Mexico City
San Juan
Jamaica
Honduras
Caribbean Sea
El Salvador
Nicaragua
1000 km
500 mi
18.480°N, 138.938°W
Powered by Leaflet — Tiles Courtesy of MapQuest — Data © OpenStreetMap contributors, C

Application | **Batch Mode** | **Help**

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

Rainier Tower Seattle Washington

Site Soil Classification

This is **not** automatically selected based on site location.

Please Select...

Risk Category

Used to compute the seismic design category.

Please Select...

Site Latitude

Decimal degrees for the site location.

Site Longitude

Decimal degrees for the site location.

Compute Values

Powered by Leaflet — Tiles Courtesy of MapQuest — Data © OpenStreetMap contributors, C

Application | **Batch Mode** | **Help**

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

Rainier Tower Seattle Washington

Site Soil Classification

This is **not** automatically selected based on site location.

Site Class C – "Very Dense Soil and Soft Rock

Risk Category

Used to compute the seismic design category.

Please Select…

Site Latitude

Decimal degrees for the site location.

Site Longitude

Decimal degrees for the site location.

Compute Values

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Application | **Batch Mode** | **Help**

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

Rainier Tower Seattle Washington

Site Soil Classification

This is **not** automatically selected based on site location.

Site Class C – “Very Dense Soil and Soft Rock

Risk Category

Used to compute the seismic design category.

I or II or III

Site Latitude

Decimal degrees for the site location.

Site Longitude

Decimal degrees for the site location.

Compute Values

Powered by Leaflet — Tiles Courtesy of MapQuest — Data © OpenStreetMap contributors, C

Application | Batch Mode | Help

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

Rainier Tower Seattle Washington

Site Soil Classification

This is **not** automatically selected based on site location.

Site Class C – "Very Dense Soil and Soft Rock

Risk Category

Used to compute the seismic design category.

I or II or III

Site Latitude

Decimal degrees for the site location.

47.6088258

Site Longitude

Decimal degrees for the site location.

-122.33437365707

Compute Values

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Application | **Batch Mode** | **Help**

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

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Site Soil Classification

This is **not** automatically selected based on site location.

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Risk Category

Used to compute the seismic design category.

I or II or III

Site Latitude

Decimal degrees for the site location.

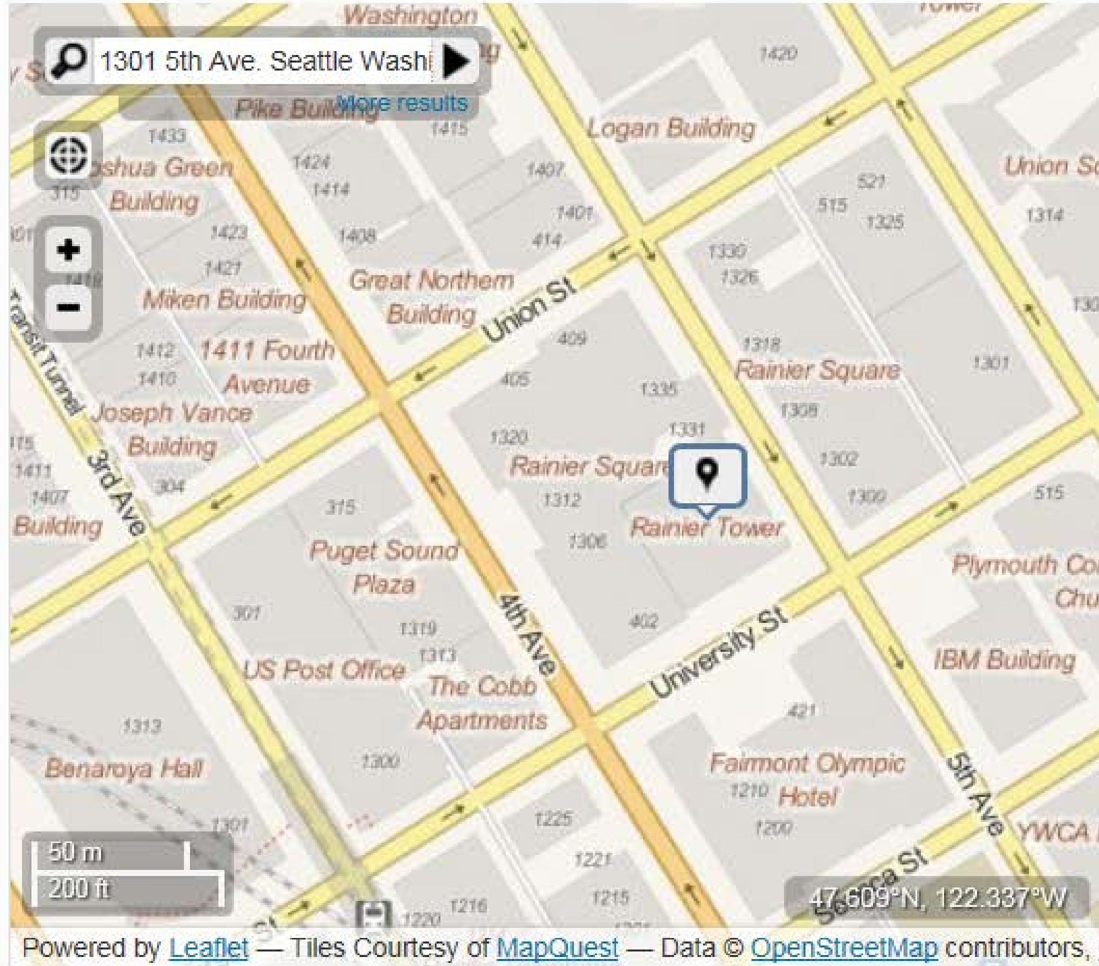
47.6088258

Site Longitude

Decimal degrees for the site location.

-122.334373655707

Compute Values



Design Maps Summary Report - Internet Explorer

http://ehp2-earthquake.wr.usgs.gov/designmaps/us/summary.php?template=minimal&latitude=47.6

USGS Design Maps Summary Report

View Detailed Report Print

User–Specified Input

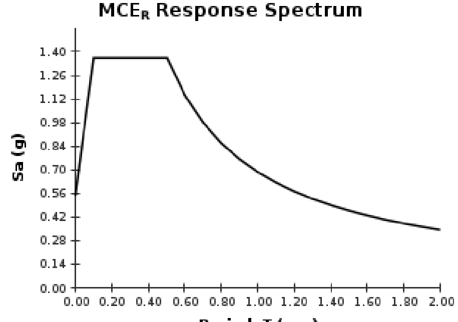
Report Title	Rainier Tower Seattle Washington Fri September 18, 2015 15:47:42 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.60883°N, 122.33437°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

USGS–Provided Output

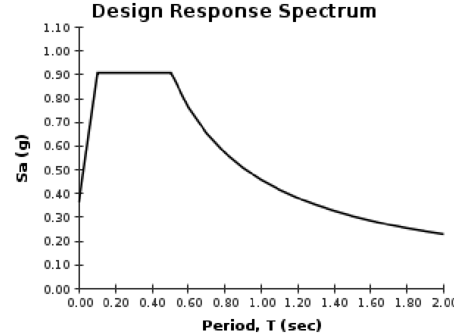
S_S =	1.362 g	S_{MS} =	1.362 g	S_{DS} =	0.908 g
S_1 =	0.527 g	S_{M1} =	0.686 g	S_{D1} =	0.457 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



http://www.usgs.gov/

Design Maps Detailed Report - Internet Explorer

http://ehp2-earthquake.wr.usgs.gov/designmaps/us/report.php?template=minimal&latitude=47.608

USGS Design Maps Detailed Report

View Summary Report Print

2012 International Building Code (47.60883°N, 122.33437°W)

Site Class C – "Very Dense Soil and Soft Rock", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_s) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) $S_s = 1.362$ g

From Figure 1613.3.1(2) $S_1 = 0.527$ g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class C, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Design Maps Detailed Report - Internet Explorer

http://ehp2-earthquake.wr.usgs.gov/designmaps/us/report.php?template=minimal&latitude=47.608

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_s

For Site Class = C and S_s = 1.362 g, F_a = 1.000

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1–s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = C and S_1 = 0.527 g, F_v = 1.300

Equation (16-37): $S_{MS} = F_aS_s = 1.000 \times 1.362 = 1.362$ g

Equation (16-38): $S_{M1} = F_vS_1 = 1.300 \times 0.527 = 0.686$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Design Maps Detailed Report - Internet Explorer

http://ehp2-earthquake.wr.usgs.gov/designmaps/us/report.php?template=minimal&latitude=47.608

Equation (16-37): $S_{MS} = F_aS_s = 1.000 \times 1.362 = 1.362$ g

Equation (16-38): $S_{M1} = F_vS_1 = 1.300 \times 0.527 = 0.686$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = ⅔ S_{MS} = ⅔ \times 1.362 = 0.908$ g

Equation (16-40): $S_{D1} = ⅔ S_{M1} = ⅔ \times 0.686 = 0.457$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167$g	A	A	A
$0.167\text{g} \leq S_{DS} < 0.33$g	B	B	C
$0.33\text{g} \leq S_{DS} < 0.50$g	C	C	D
$0.50\text{g} \leq S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.908 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067$g	A	A	A
$0.067\text{g} \leq S_{D1} < 0.133$g	B	B	C
$0.133\text{g} \leq S_{D1} < 0.20$g	C	C	D
$0.20\text{g} \leq S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.457 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

12.8 EQUIVALENT LATERAL FORCE PROCEDURE

12.8.1 Seismic Base Shear. The seismic base shear, V, in a given direction shall be determined in accordance with the following equation:

$$V = C_s W \tag{12.8-1}$$

where

C_s = the seismic response coefficient determined in accordance with Section 12.8.1.1
W = the effective seismic weight per Section 12.7.2

12.8.1.1 Calculation of Seismic Response Coefficient. The seismic response coefficient, C_s, shall be determined in accordance with Eq. 12.8-2.

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)} \tag{12.8-2}$$

where

S_{DS} = the design spectral response acceleration parameter in the short period range as determined from Section 11.4.4 or 11.4.5
R = the response modification factor in Table 12.2-1
I_e = the importance factor determined in accordance with Section 11.5.1

The value of C_s computed in accordance with Eq. 12.8-2 need not exceed the following:

$$C_s = \frac{S_{D1}}{T\left(\frac{R}{I_e}\right)} \quad \text{for} \quad T \le T_L \tag{12.8-3}$$

$$C_s = \frac{S_{D1}T_L}{T^2\left(\frac{R}{I_e}\right)} \quad \text{for} \quad T > T_L \tag{12.8-4}$$

C_s shall not be less than

$$C_s = 0.044 S_{DS} I_e \ge 0.01 \tag{12.8-5}$$

In addition, for structures located where S_1 is equal to or greater than 0.6g, C_s shall not be less than

$$C_s = 0.5 S_1/(R/I_e) \tag{12.8-6}$$

where I_e and R are as defined in Section 12.8.1.1 and

S_{D1} = the design spectral response acceleration parameter at a period of 1.0 s, as determined from Section 11.4.4 or 11.4.5
T = the fundamental period of the structure(s) determined in Section 12.8.2
T_L = long-period transition period(s) determined in Section 11.4.5
S_1 = the mapped maximum considered earthquake spectral response acceleration parameter determined in accordance with Section 11.4.1 or 11.4.3

Rainier Square

(Using ASCE 7-10)

(MKA Project #: 99991.00)

Base Shear

Basic Sheet

By: BK Date: 9.18.2015 Time: 9.30a

File: C:\Users\jdh\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\PMNXWHN4\[Rainier Squa

Show Diaphragm Forces | **Show** Accidental Torsion

Hide Diaphragm Forces | **Hide** Accidental Torsion

Note:
Enter maximum spectral period for charts here (value is

Ground Motion/Site

mapped S_S:	**1.362**	F_a =	1.00	
mapped S_1:	**0.527**	F_v =	1.30	
Site Class:	**C**			
S_{DS} =	0.908	E_v =	0.182D	(for reference only)
S_{D1} =	0.457			
T_L =	**6**			

Building Information

Risk Category	**III**	
SDC =	D	
I =	1.25	
C_u =	1.40	
Bldg Code =	**IBC 2012**	
Min V_{DYN} =	0.85	V_{ELF}
No. stories =	**59**	

Note:
Use LOCKED button below to prevent accidental changes

LOCKED

Add 1 | **Remove 1**

Add 10 | **Remove 10**

		X-direction			**Y-direction**	
	Type:	**All others**		Type:	**All others**	
	C_t =	0.020		C_t =	0.020	
	x =	0.75		x =	0.75	
	Approximate period, T_a =	3.13	sec	T_a =	3.13	sec
	Upper limit period, $C_u T_a$ =	4.39	sec	$C_u T_a$ =	4.39	sec
	$R_{x\text{-}dir}$:	**6.5**		$R_{y\text{-}dir}$:	**6.5**	
	$T_{analysis,x}$:	**6.00**	sec	$T_{analysis,y}$:	**6.00**	sec
	$T_{design,x}$ =	4.39	sec	$T_{design,y}$ =	4.39	sec
	k_x =	2.00		k_y =	2.00	
(Eq. 12.8-2)	$C_{s,x}$ =	0.175		$C_{s,y}$ =	0.175	
(Eq. 12.8-3)		0.020			0.020	
(Eq. 12.8-4)		n/a			n/a	
(Eq. 12.8-5)		**0.050**	- controls		**0.050**	- controls
(Eq. 12.8-6)		n/a			n/a	
For ELF:	$V_{ELF,x}$ =	10621	kips	$V_{ELF,y}$ =	10621	kips
(V_t computed with R = 1 and I = 1)	$V_{t,x}$:	**24736**	kips	$V_{t,y}$:	**30612**	kips
Scale to:	$V_{DYN,x}$ =	9028	kips	$V_{DYN,y}$ =	9028	kips
		[controlled by 0.85 * Velf]			[controlled by 0.85 * Velf]	
(ETABS/SAP)	Scale Factor:	141.027		Scale Factor:	113.959	

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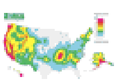
Hazards

“Pop-ups” can create problems depending on browser

The USGS has recently releas ... ation, and data will be posted here as they become available.

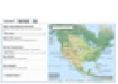
Seismic Hazard Maps and Data



Probabilistic and scenario ground-motion hazard maps, input and output data, and documentation. More...

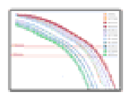
- Lower 48
- Alaska
- Hawaii
- Puerto Rico & U.S. Virgin Islands
- Guam & Marianas
- Samoa & Pacific Islands
- Urban & Regional
- Scenarios
- Time-Dependent EQ Probability Maps
- Foreign

Seismic Design Maps, Data, and Tools for Engineers



Ground motion parameter values for building and bridge design. More...

Seismic Hazard Analysis Tools



Create customized hazard and probability maps with additional options to assess individual source-contributions to overall hazard. More...

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- Hazard Curves
- Vs30
- Interactive Deaggregations
- Banded Deaggregations

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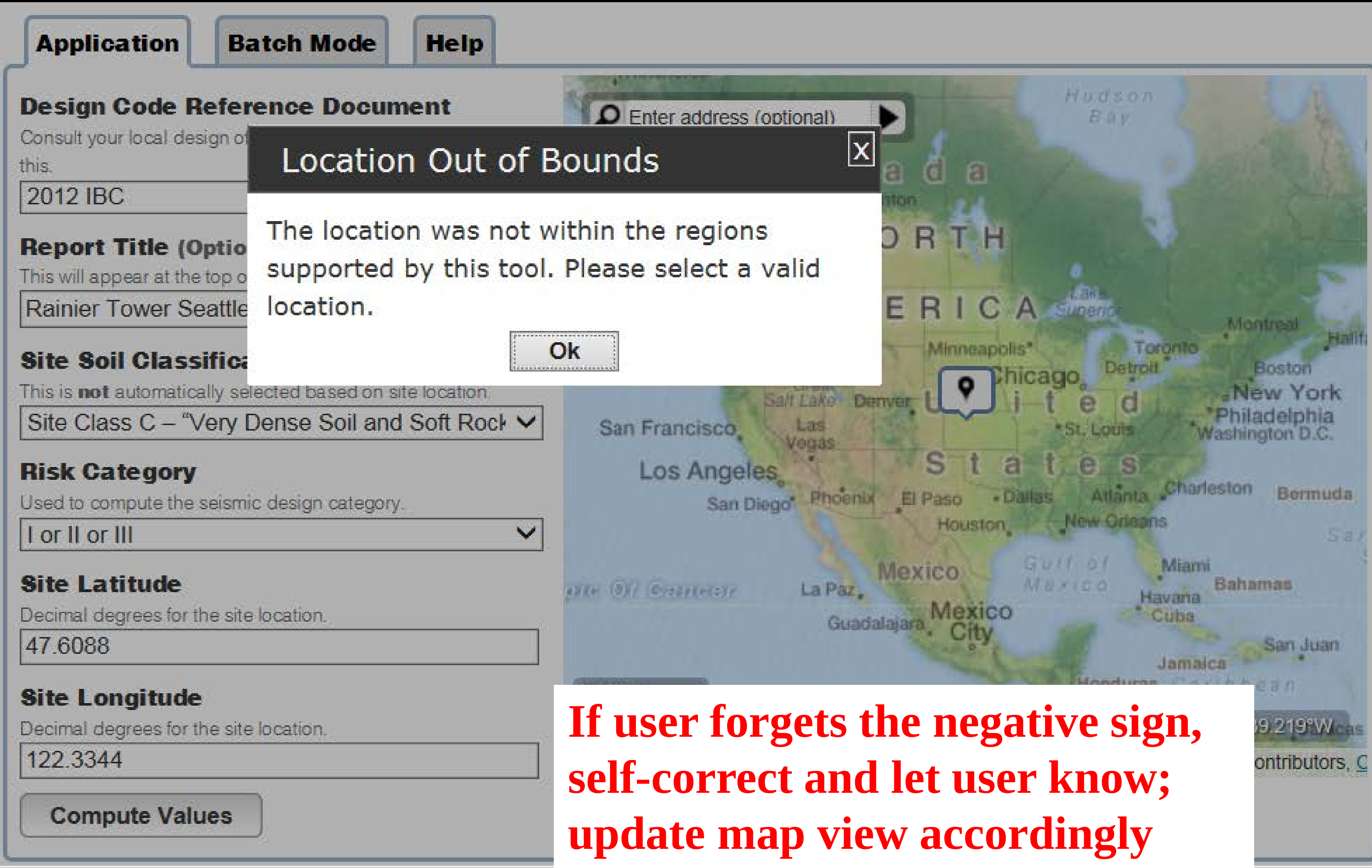


If user forgets the negative sign, self-correct and let user know; update map view accordingly

Application | **Batch Mode** | **Help**

Design Code Reference Document

Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)

This will appear at the top of the generated report.

Rainier Tower Seattle Washington

Site Soil Classification

This is **not** automatically selected based on site location.

Site Class C – "Very Dense Soil and Soft Rock

Risk Category

Used to compute the seismic design category.

I or II or III

Site Latitude

Decimal degrees for the site location.

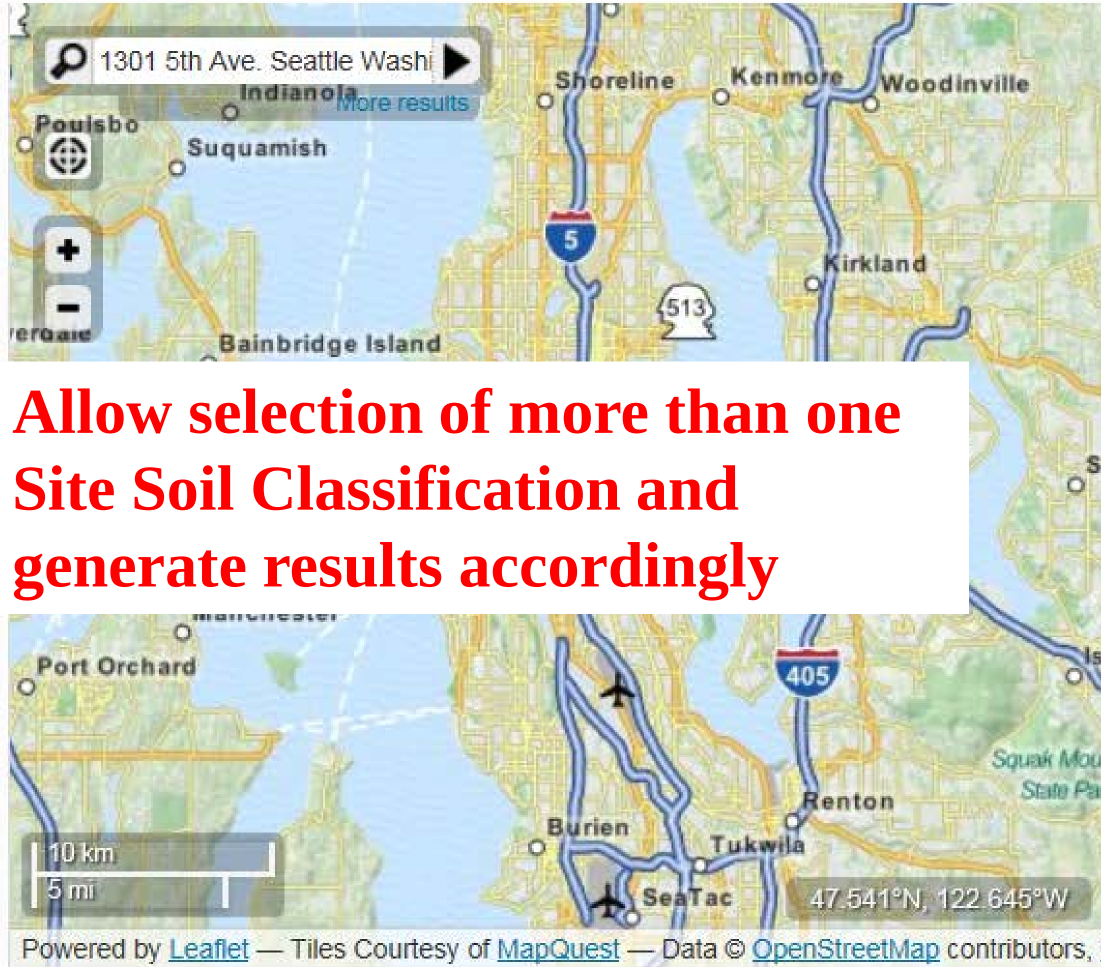
47.6088258

Site Longitude

Decimal degrees for the site location.

-122.33437365707

Compute Values



Allow selection of more than one Site Soil Classification and generate results accordingly

Application | **Batch Mode** | **Help**

Design Code Reference Document
Consult your local design official if you need help selecting this.

2012 IBC

Report Title (Optional)
This will appear at the top of the generated report.

Rainier Tower Seattle Washington

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I or II or III

Site Latitude
Decimal degrees for the site location.

47.6088258

Site Longitude
Decimal degrees for the site location.

-122.33437365707

Compute Values

Allow user-defined values of Fa and Fv

Design Maps Summary Report - Internet Explorer

http://ehp2-earthquake.wr.usgs.gov/designmaps/us/summary.php?template=minimal&latitude=47.6

USGS **Design Maps Summary Report**

View Detailed Report   Print

User–Specified Input

Report Title	Rainier Tower Seattle Washington Fri September 18, 2015 15:47:42 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.60883°N, 122.33437°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

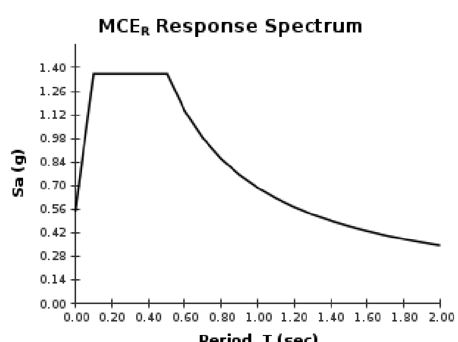
USGS–Provided Output

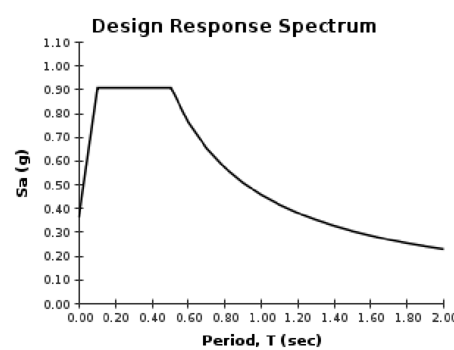
S_S = 1.362 g

S_1 = 0.527 g

Provide tabular values for Sa vs. T

For information on how th ... sk-targeted) and deterministic ground mot ... the application and select the "2009 NEHRP" ...





http://www.usgs.gov/


The Infinity
The Infinity

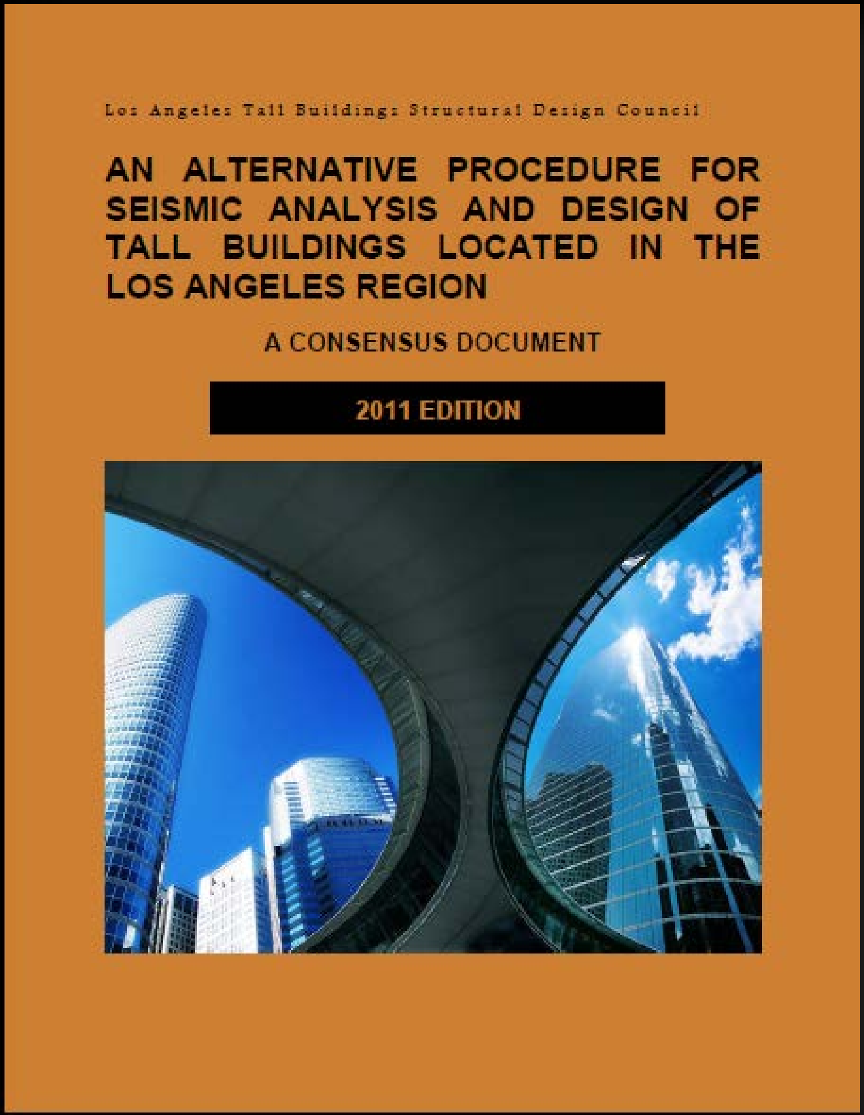
PBSD Guidelines


TBI
Tall Buildings Initiative
Guidelines for Performance-Based Seismic Design of Tall Buildings
Version 1.0
November 2010

Developed by
Pacific Earthquake Engineering Research Center
Report No. 2010/05

Sponsored by
Charles Pankow Foundation
California Seismic Safety Commission
California Emergency Management Agency
Los Angeles Department of Building and Safety

PEER


Los Angeles Tall Buildings Structural Design Council

AN ALTERNATIVE PROCEDURE FOR SEISMIC ANALYSIS AND DESIGN OF TALL BUILDINGS LOCATED IN THE LOS ANGELES REGION

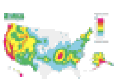
A CONSENSUS DOCUMENT

2011 EDITION

Hazards

The USGS has recently released updated 2014 seismic hazard maps for the conterminous U.S. The maps, documentation, and data will be posted here as they become available.

Seismic Hazard Maps and Data



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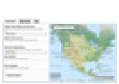
Seismic Design Maps, Data, and Tools for Engineers



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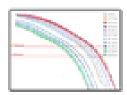
Seismic Hazard Analysis Tools



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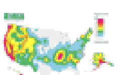

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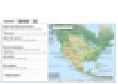

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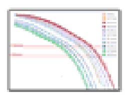

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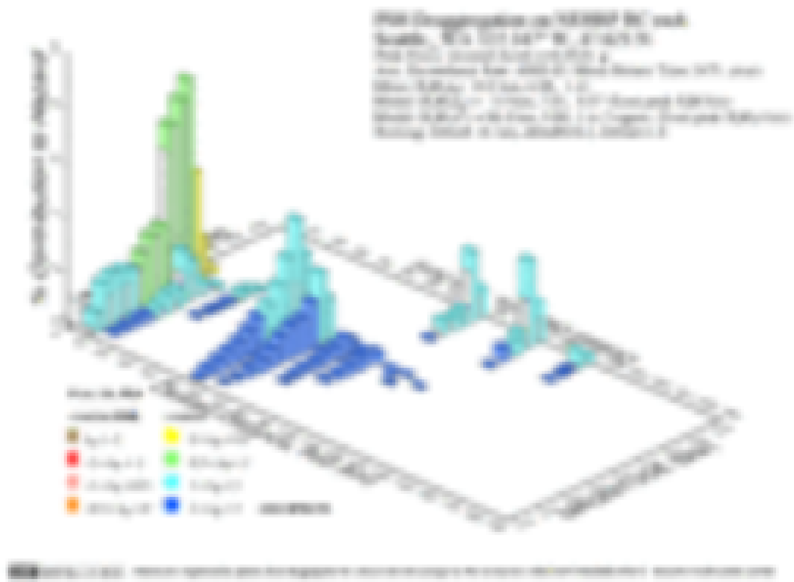
Interactive Deaggregations



2008 - US

2008 Samoa

2002 - US, Puerto Rico

1996 - US, Alaska, Hawaii

Seismic Hazard Analysis Tools
Custom Hazard Maps
Custom EQ Probability Maps
Hazard Curve Application
Vs30
Interactive Deaggregation
2008-US
2008-Samoa
2002-US,Puerto Rico
1996-US,AK,HI
Banded Deaggregation-2009

2008 Interactive Deaggregations

This is a preliminary version of the 2008 NSHMP PSHA Interactive Deaggregation web site. In this initial release, the 2008–update source and attenuation models of the NSHMP (Petersen and others, 2008) are used with just one exception. For the New Madrid Seismic Zone (NMSZ), the deaggregation source model is set up for the "unclustered" event branches only. These unclustered New Madrid sources are given full weight (90% weight to the 500 year mean recurrence models; 10% weight to the 1000–year mean recurrence models) whereas in the 2008 NSHMP PSHA they are only given 50% weight. Clustered–source models receive the other 50% weight in 2008 NSHMP PSHA. This is a temporary difference. The interactive deaggregation will include the NMSZ clustered –source models when a few software checkups are completed.

Seismic–hazard deaggregations are available for the following spectral periods anywhere in the conterminous U.S: 0.0 s (PGA), 0.1 s, 0.2 s, 0.3 s, 0.5 s, 1.0 s, and 2.0 s. This is the same set of periods that has been available at the USGS interactive deaggregation web sites since 1996 (for sites in the conterminous United States).

In the western US, long–period seismic–hazard deaggregations at 3.0 s, 4.0 s, and 5.0 s are also available at this web site. More...

FAQ Documentation 1996 Update 2002 Update Feedback

Site Name [ ]

Enter latitude/longitude instead

Address [ ]

Exceedance Probability 2% in 50 years

Spectral Period 0.0 seconds (Peak Ground Acceleration)

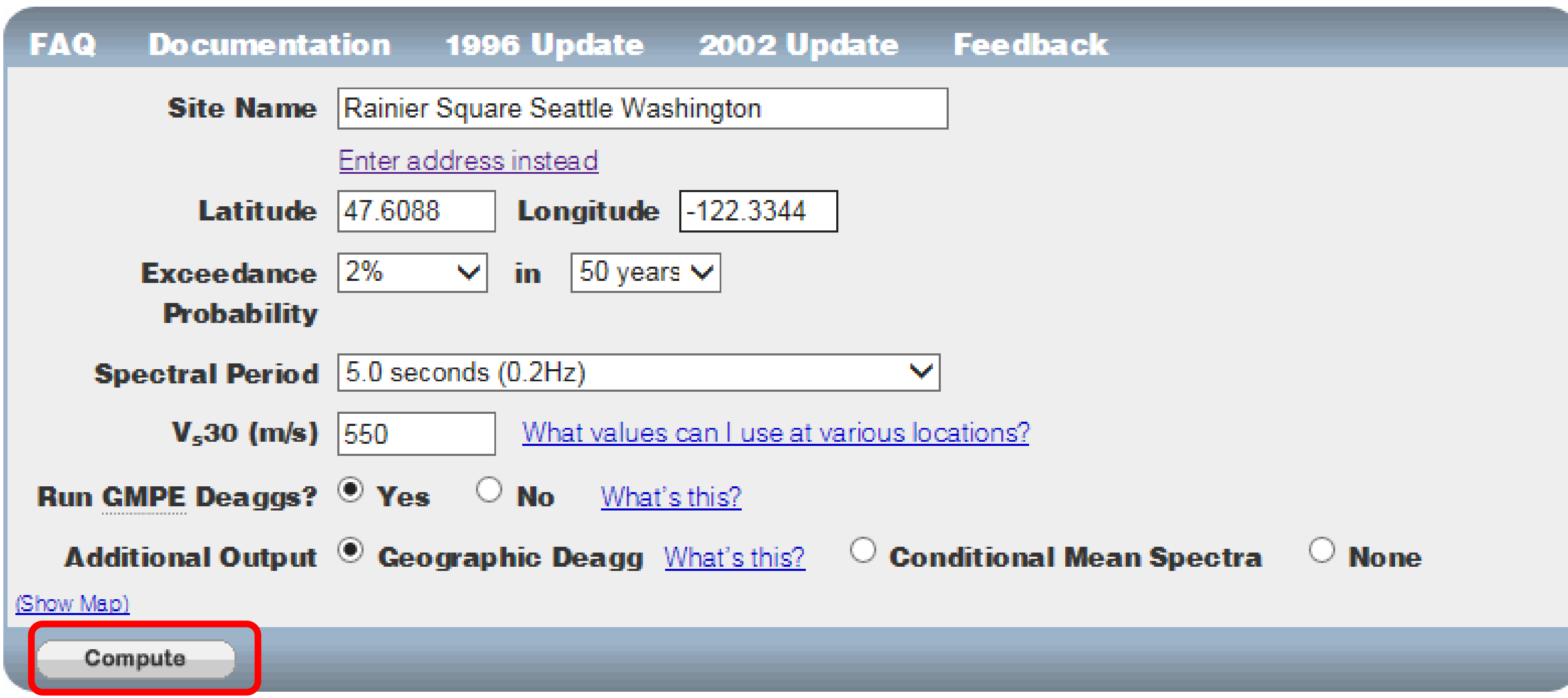
V_s30 (m/s) 760.0 What values can I use at various locations?

Run GMPE Deaggs? (•) Yes ( ) No What's this?

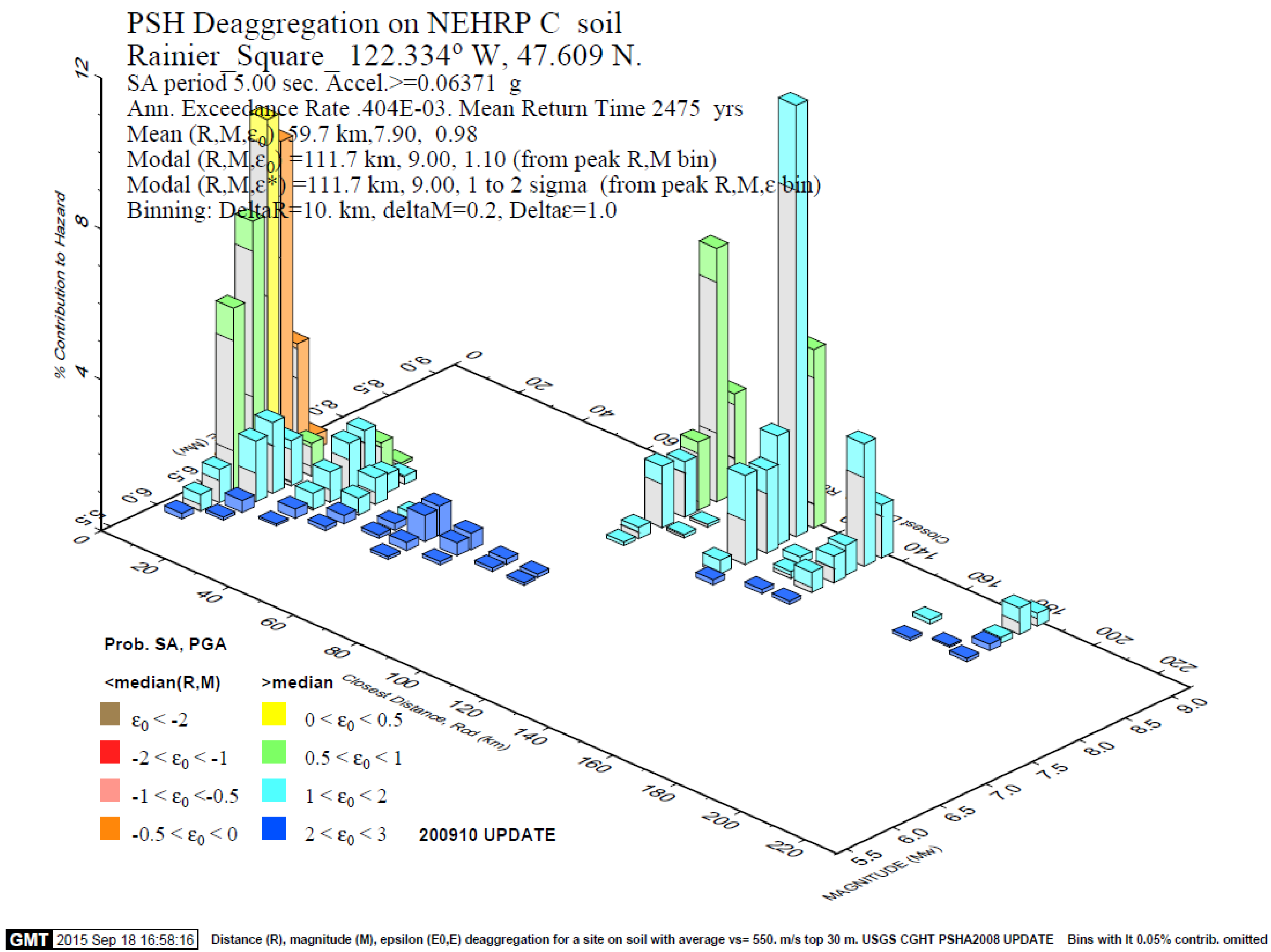
Additional Output (•) Geographic Deagg What's this? ( ) Conditional Mean Spectra ( ) None

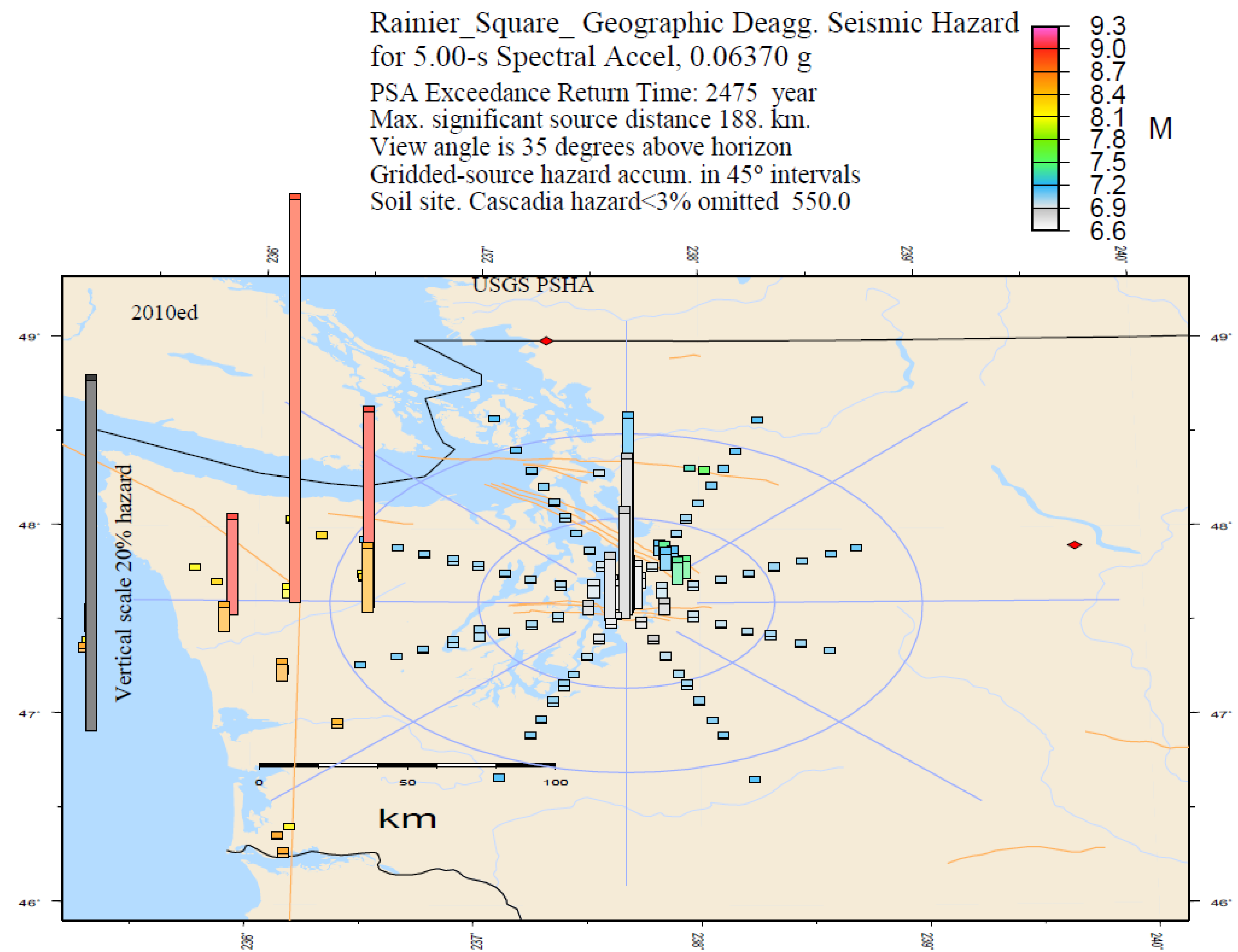
(Show Map)

Compute



FAQ
Documentation
1996 Update
2002 Update
Feedback
Site Name
Rainier Square Seattle Washington
Enter address instead
Latitude
47.6088
Longitude
-122.3344
Exceedance Probability
2%
in
50 years
Spectral Period
5.0 seconds (0.2Hz)
Vs30 (m/s)
550
What values can I use at various locations?
Run GMPE Deaggs?
Yes
No
What's this?
Additional Output
Geographic Deagg
What's this?
Conditional Mean Spectra
None
(Show Map)
Compute


PSH Deaggregation on NEHRP C soil
Rainier_Square_ 122.334° W, 47.609 N.
SA period 5.00 sec. Accel.>=0.06371 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 yrs
Mean (R,M,ε0) 59.7 km,7.90, 0.98
Modal (R,M,ε0) =111.7 km, 9.00, 1.10 (from peak R,M bin)
Modal (R,M,ε*) =111.7 km, 9.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
Closest Distance, Rcd (km)
MAGNITUDE (Mw)
Prob. SA, PGA
<median(R,M)
>median
ε0 < -2
-2 < ε0 < -1
-1 < ε0 <-0.5
-0.5 < ε0 < 0
0 < ε0 < 0.5
0.5 < ε0 < 1
1 < ε0 < 2
2 < ε0 < 3
200910 UPDATE
GMT 2015 Sep 18 16:58:16
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 550. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted



GMT 2015 Sep 18 16:58:16 Site Coords:-122.334 47.6088 (yellow disk) Vs30= 550.0. Max annual ExcdRate .9278E-04 (column height prop. to ExRate). Red diamonds: historical earthquakes, M>6

For These PBSD Projects…

- Information assists the geotechnical engineer develop site-specific ground motions
- It would be great if ground motion selection & scaling could be done automatically
- Not likely occur for a decade (or two), providing links from the UGSS Earthquake Tool to ground motion database websites would be a helpful first step.

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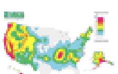

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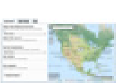
Seismic Design Maps, Data, and Tools for Engineers



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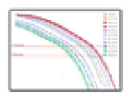

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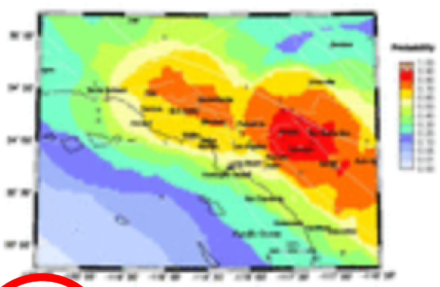
Custom EQ Probability Maps



2009

Map of probability of earthquake larger than given magnitude within selected distance. Earthquake probability maps use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project.

2009 Earthquake Probability Mapping

Please Note: This feature does not include potentially induced seismicity or any earthquake after the year 2006. A probability calculated for a location that is currently experiencing induced earthquakes will not be valid. This tool will underestimate the probability because it is based on the 2008 National Seismic Hazard Maps.

New Feature: This application now supports Alaska locations. Please see below for details.

This web site was designed to display earthquake probabilities that are computed from the source model of the 2008 USGS-National Seismic Hazard Mapping Project (NSHMP) update. The region of model validity is the conterminous (lower 48 states) USA and Alaska. Valid locations in the conterminous 48 states range from [24.6, 50.0] degrees latitude and [-125.0, -65.0] degrees longitude. Valid locations in Alaska range from [50.0, 72.0] degrees latitude and [-200.0, -125.0] degrees longitude.

The generated maps will show the probabilities of earthquakes within a radius of 50 km. A text report of the probabilities for a different, selected radius can also be generated.

Latitude: 47.6088
Decimal degrees. See above for valid range.

Longitude: -122.3344
Decimal degrees. See above for valid range.

Input location using zip code instead.

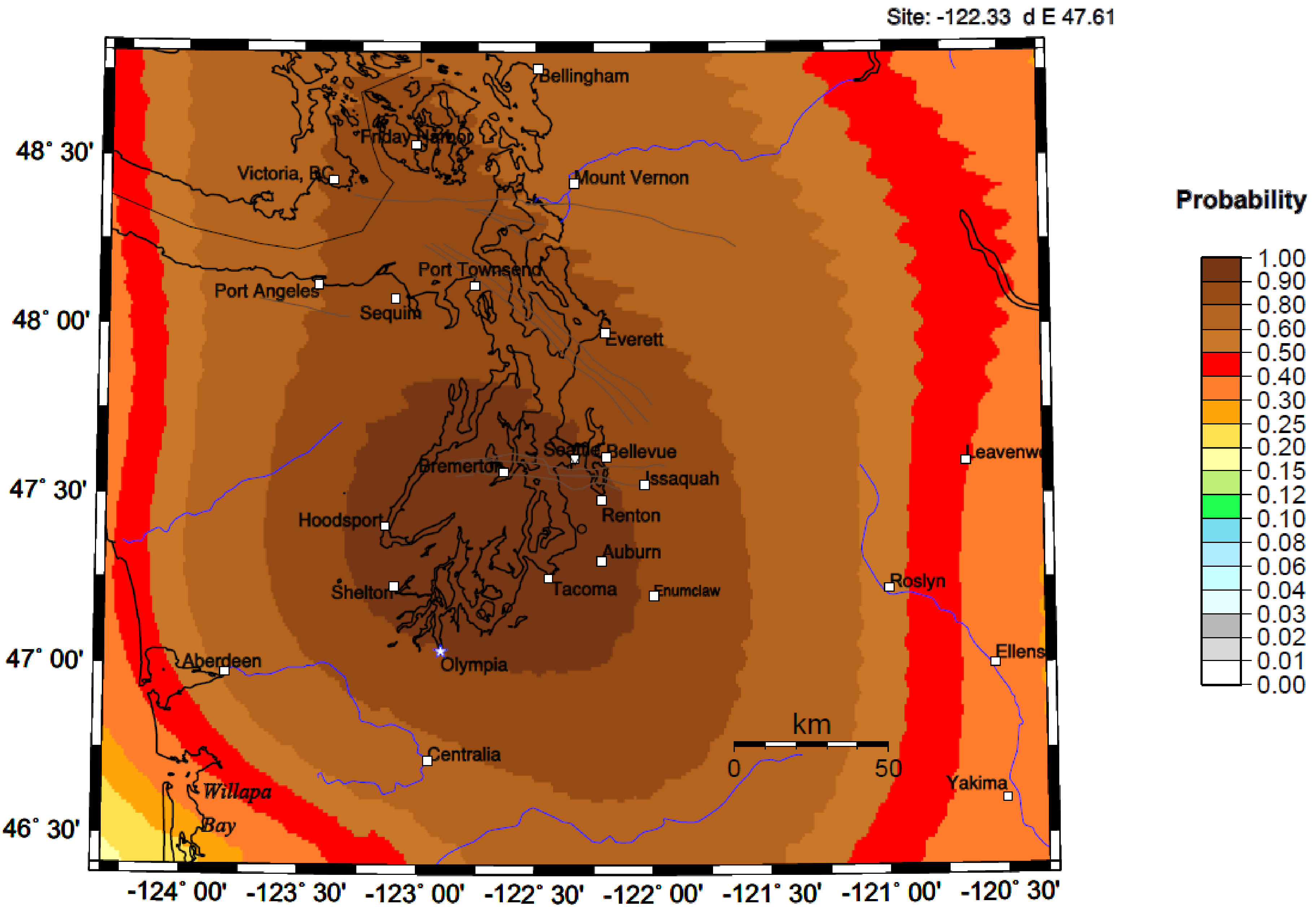
Time Span: 50
Number of years to consider (integer)

Magnitude: 5.0
Minimum magnitude to consider

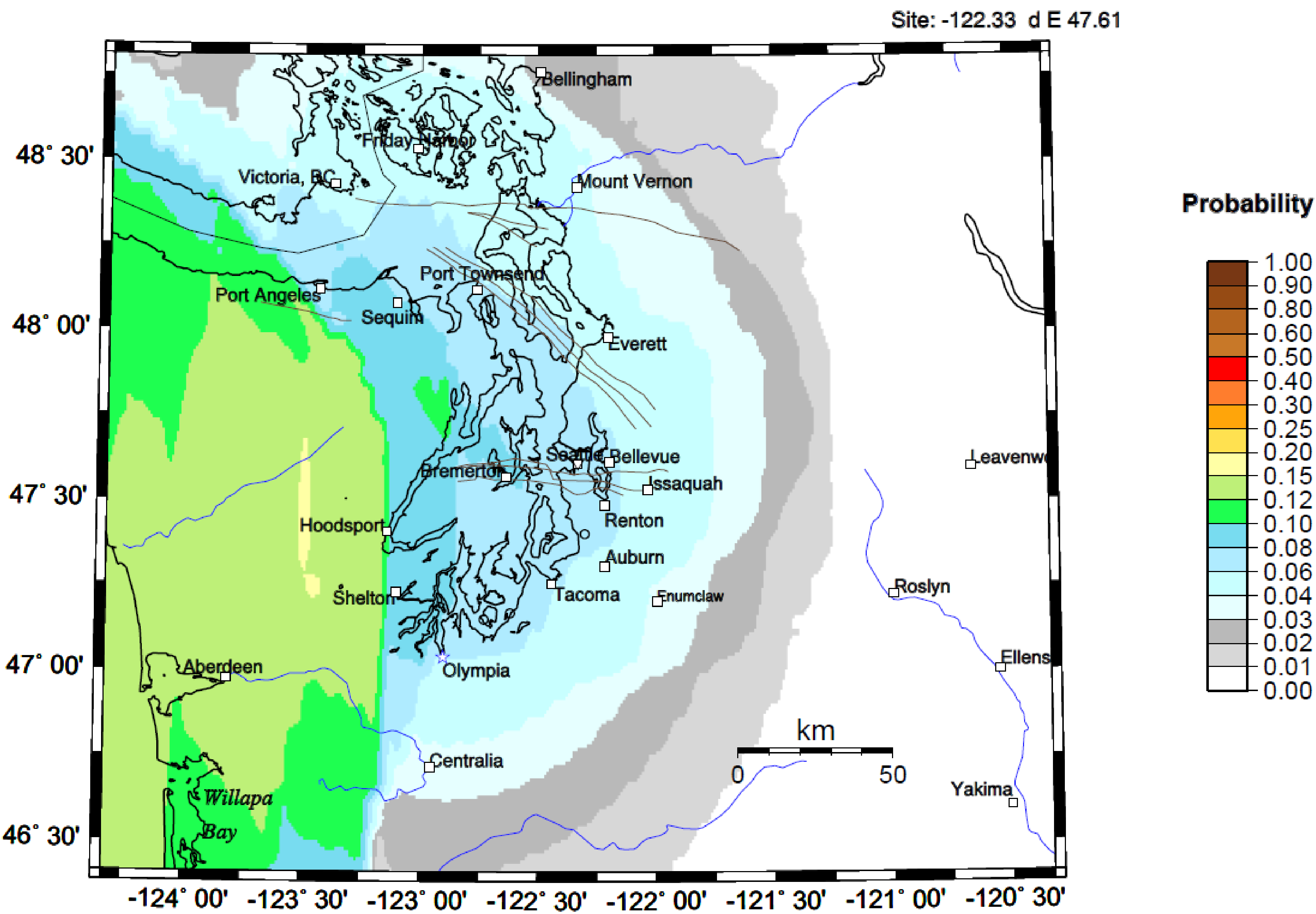
Text Report: ○ Yes ◉ No
Generate an ASCII text report of probabilities

Compute Probability

Probability of earthquake with M > 5.0 within 50 years & 50 km



Probability of earthquake with M > 7.0 within 50 years & 50 km



2009 Earthquake Probability Mapping

Please Note: This feature does not include potentially induced seismicity or any earthquake after the year 2006. A probability calculated for a location that is currently experiencing induced earthquakes will not be valid. This tool will underestimate the probability because it is based on the 2008 National Seismic Hazard Maps.

New Feature: This application now supports Alaska locations. Please see below for details.

This web site was designed to display earthquake probabilities that are computed from the source model of the 2008 USGS-National Seismic Hazard Mapping Project (NSHMP) update. The region of model validity is the conterminous (lower 48 states) USA and Alaska. Valid locations in the conterminous 48 states range from [24.6, 50.0] degrees latitude and [-125.0, -65.0] degrees longitude. Valid locations in Alaska range from [50.0, 72.0] degrees latitude and [-200.0, -125.0] degrees longitude.

The generated maps will show the probabilities of earthquakes within a radius of 50 km. A text report of the probabilities for a different, selected radius can also be generated.

It would be helpful if the radius was an input parameter

Latitude: 47.6088
Decimal degrees. See above for valid range.

Longitude: -122.3344
Decimal degrees. See above for valid range.

Input location using zip code instead.

Time Span: 50
Number of years to consider (integer)

Magnitude: 5.0
Minimum magnitude to consider

Text Report: ○ Yes ◉ No
Generate an ASCII text report of probabilities

Compute Probability

Questions?