



## **United States Geological Survey (USGS) Peak Ground Acceleration (PGA) Calculator Tutorial (Beta – Unified Hazard Tool)**

Fannie Mae requires the Lender to assess the seismic risk for each Property that secures a Mortgage Loan being purchased by Fannie Mae. The Property Condition Assessment (PCA) Report provides the Lender with the information needed to evaluate whether a Property is located in an area or region that may have a propensity to be impacted by a seismic event. To assess the seismic risk, the PCA Report must identify the Peak Ground Acceleration (“PGA”) for the Property. The PGA, which replaced the reporting of the Seismic Zone for the Property, is reported by the United States Geological Survey (“USGS”), and represents the shaking or ground motion from an earthquake, expressed as a percentage of  $g$ , with  $g$  being the acceleration of a falling object due to gravity. If the Property is located in a region with a high seismic risk (i.e., the Property is located in a region that has a 10% or greater probability of the maximum Peak Ground Acceleration equal to or greater than 0.15g at any point in a 50 year period), then the Lender must perform additional seismic risk analysis.

The Lender may wish to determine a Property’s seismic risk earlier in the underwriting process, before the PCA is ordered, to assess whether to proceed with full underwriting for a Property that may require additional seismic risk analysis. This tutorial will assist the Lender in using the USGS Earthquake Hazards website, with a focus on the Beta – Unified Hazard Tool website (see link below). There are other publicly available sources for determining a Property’s PGA, as well as numerous seismic hazardous determination tools made available by USGS.

By clicking on the following link, the user should be taken to the following screen:

<https://earthquake.usgs.gov/hazards/interactive/>.



## Beta - Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Earthquake Hazard and Probability Maps

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Spectral Period

Peak ground acceleration

Time Horizon

Before 1900 to 1999

Location

To determine a Property's PGA using the tool, the user will need to input the following information:

Item Description	Input	Input Type
<b>Edition</b>	Dynamic: Coterminous US 2014	Drop Down Menu
<b>Location</b>	Latitude & Longitude via Property Address	Text
<b>Site Class</b>	259 m/s (Site class D) – CA, OR, NV, WA 760 m/s (B/C Boundary) – all other states	Drop Down Menu
<b>Spectral Period</b>	Peak Ground Acceleration	Drop Down Menu
<b>Time Horizon</b>	475 years (10% in 50 years)	Drop Down Menu

1. Edition: From the drop-down menu, select “Dynamic: Coterminous US 2014”.
2. Location: The Latitude and Longitude may be obtained from the property address.
  - (a) Click “Choose location using a map.”



**Location**


Latitude  
Decimal degrees


Longitude  
Decimal degrees, negative values for western longitudes

[Choose location using a map](#)


(b) Next click “Search for a location using an address.”

**Specify a Location** ×

 Attempt to automatically locate my **current location**.

 **Search** for a location using an **address**.

**x,y** Enter **coordinates**, latitude and longitude.

 **Drop pin** on the map to specify a location.

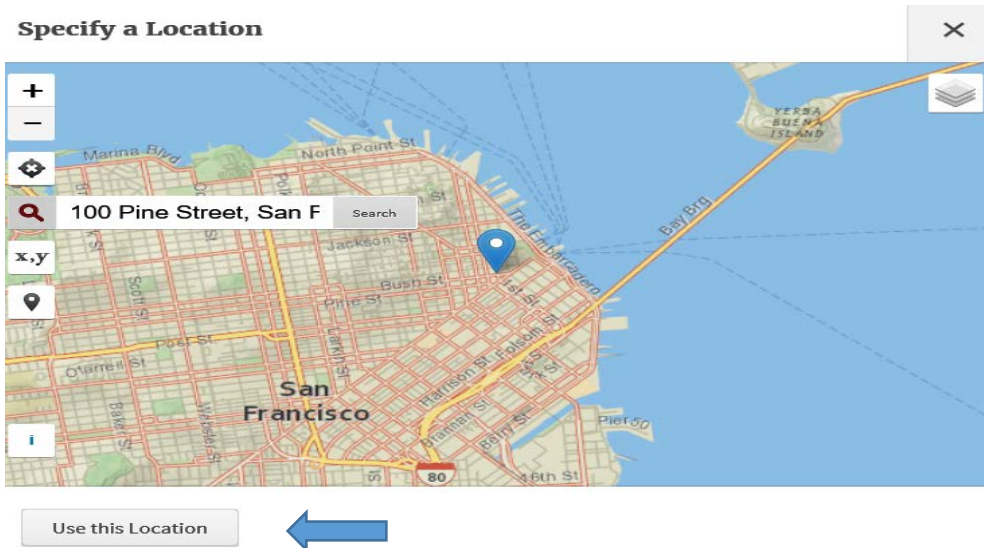
(c) Type in the Property address and click “Search.”



### Specify a Location



(d) Click “Use this location”.





3. Input the Site Class (259 m/s or 760 m/s), Spectral Period (Peak ground acceleration) and Time Horizon (475) per the chart above.

^ Input

Edition  
Dynamic: Conterminous U.S. 2014 (v4.1.0) ▼

Spectral Period  
Peak ground acceleration ▼

Location

Latitude  
Decimal degrees  
37.792

Longitude  
Decimal degrees, negative values for western longitudes  
-122.399  
[Choose location using a map](#)

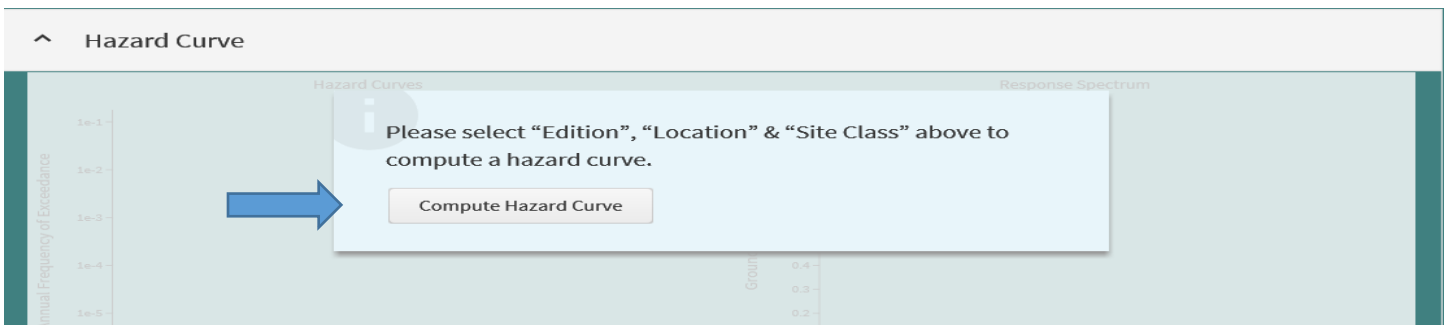
Time Horizon  
Return period in years  
475

2% in 50 years  
(2,475 years)

10% in 50 years  
(475 years)

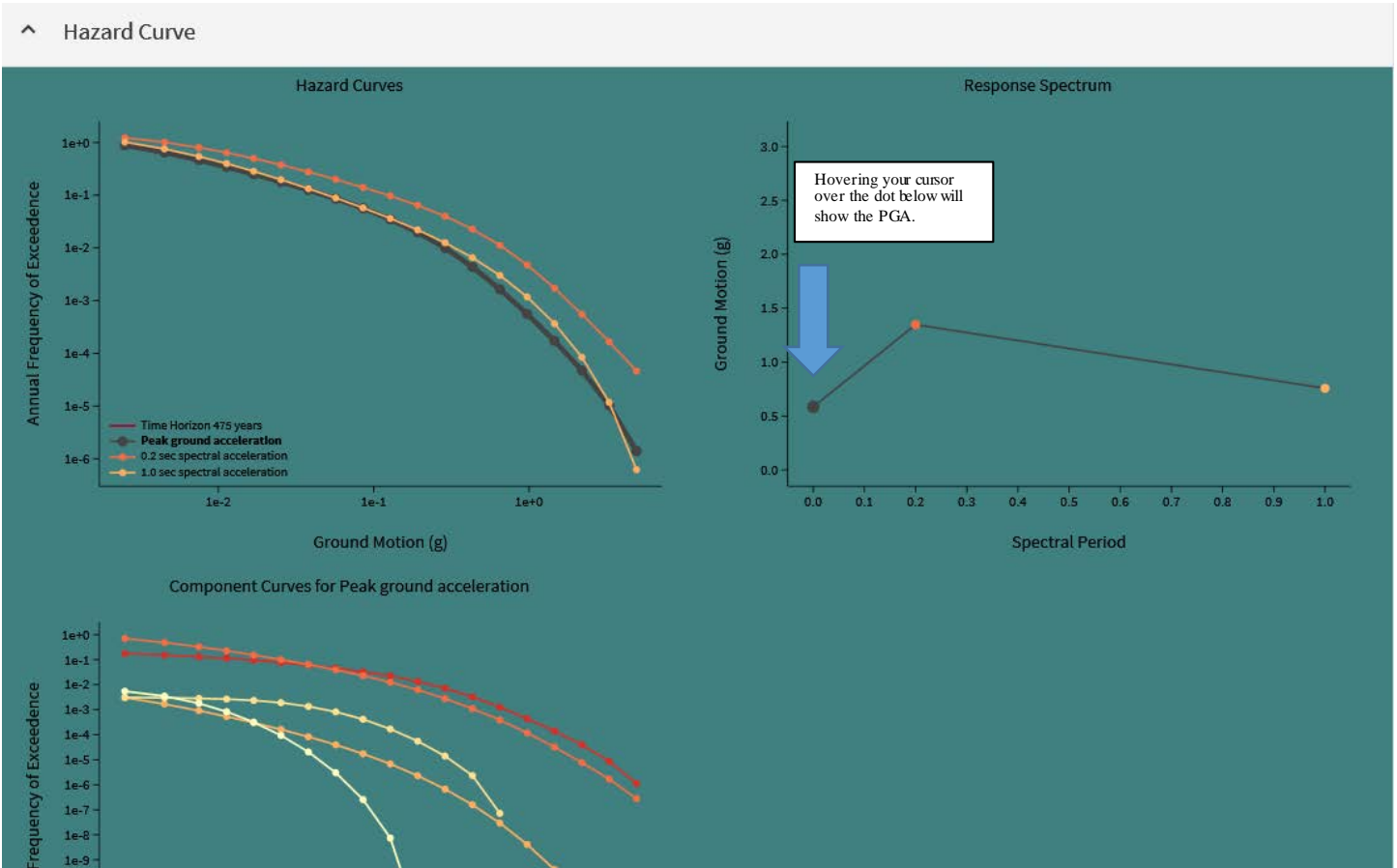
Site Class  
259 m/s (Site class D) ▼

4. Click "Compute Hazard Curve".





5. Click “Compute Deaggregation”.



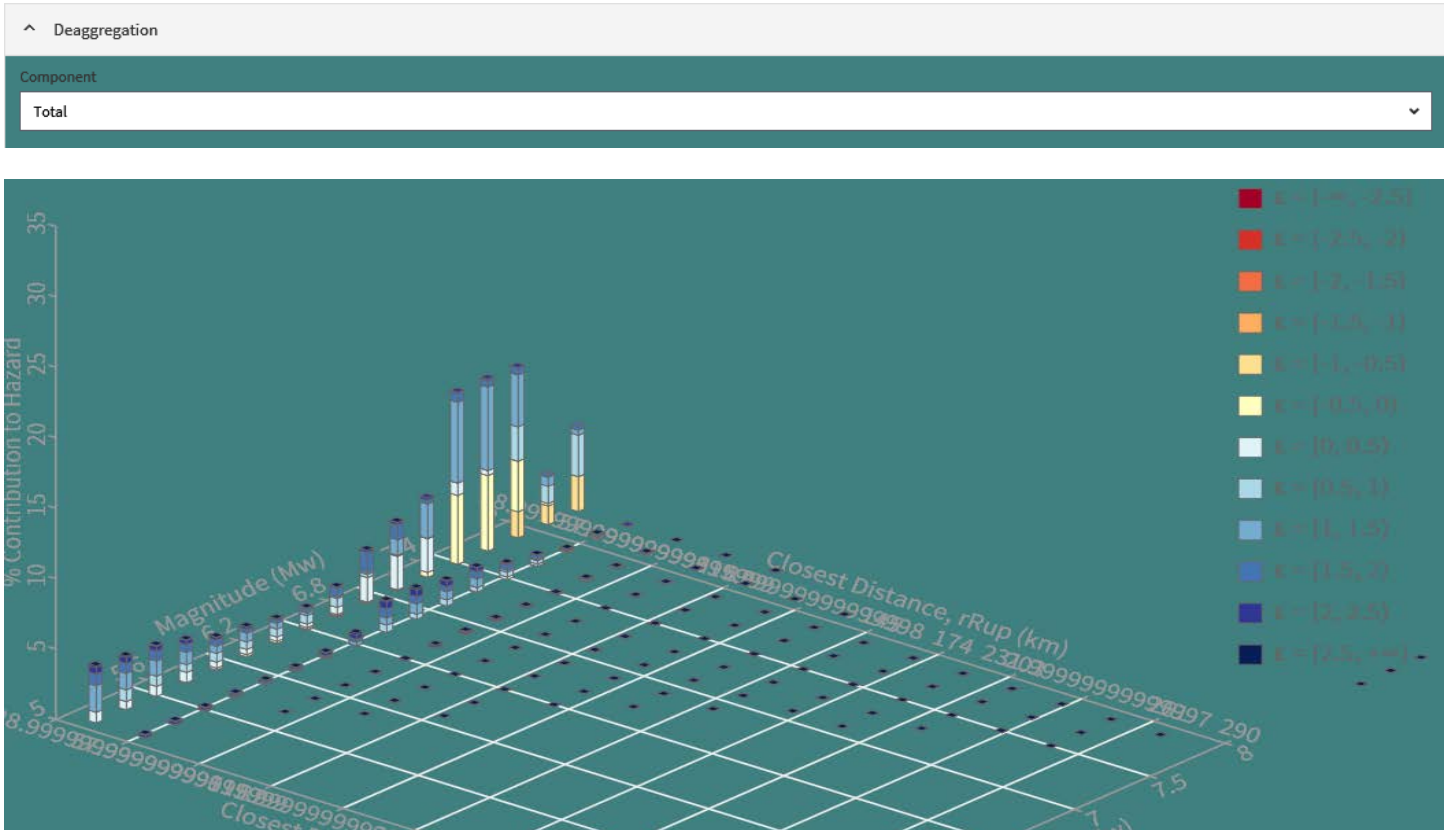
^ Deaggregation

The screenshot shows the Deaggregation section of the calculator. A message box with an information icon contains the text: "Please select 'Edition', 'Location', 'Site Class', 'Spectral Period' & 'Time Horizon' above to compute a deaggregation." Below the message box is a button labeled "Compute Deaggregation". A blue arrow points to the button.



## RESULTS

The calculated PGA is located by the arrow in the chart below under “Deaggregation targets”. The Exceedance IML is the calculated PGA. In this example, the PGA is 0.58555069 g or 0.59g rounded.





Standard Deviation: 0.0021052632 yr<sup>-1</sup>

Summary statistics for, Deaggregation: Total

Deaggregation targets	Recovered targets	Totals
Return period: 475 yrs	Return period: 519.29154 yrs	Binned: 100 %
Exceedance rate: 0.0021052632 yr <sup>-1</sup>	Exceedance rate: 0.0019257006 yr <sup>-1</sup>	Residual: 0 %
Exceedance IML: 0.58555069 g		Trace: 0.2 %
Mean (for all sources)	Mode (largest r-m bin)	Mode (largest $\epsilon_a$ bin)
r: 16.51 km	r: 16.12 km	r: 16.04 km
m: 7.07	m: 7.69	m: 7.7
$\epsilon_g$ : 0.85 $\sigma$	$\epsilon_g$ : 0.54 $\sigma$	$\epsilon_g$ : 1.18 $\sigma$
	Contribution: 12.2 %	Contribution: 5.92 %
Discretization	Epsilon keys	
r: min = 0.0, max = 1000.0, $\Delta$ = 20.0 km	$\epsilon 0$ : [- $\infty$ .. -2.5]	
m: min = 4.4, max = 9.4, $\Delta$ = 0.2	$\epsilon 1$ : [-2.5 .. -2.0]	
$\epsilon$ : min = -3.0, max = 3.0, $\Delta$ = 0.5 $\sigma$	$\epsilon 2$ : [-2.0 .. -1.5]	
	$\epsilon 3$ : [-1.5 .. -1.0]	
	$\epsilon 4$ : [-1.0 .. -0.5]	
	$\epsilon 5$ : [-0.5 .. 0.0]	
	$\epsilon 6$ : [0.0 .. 0.5]	
	$\epsilon 7$ : [0.5 .. 1.0]	
	$\epsilon 8$ : [1.0 .. 1.5]	
	$\epsilon 9$ : [1.5 .. 2.0]	
	$\epsilon 10$ : [2.0 .. 2.5]	
	$\epsilon 11$ : [2.5 .. + $\infty$ ]	



Because this Property has a PGA equal to or greater than 0.15g, additional seismic analysis would be required by the Lender.

Please refer to Part IIIA, Section 321 of the Fannie Mae Guide for further instructions regarding Property eligibility and underwriting requirements regarding a Property with high seismic risk.

For additional questions regarding the calculation of a Property's PGA using the USGS Earthquake Hazards website, please contact [drawer\\_insurance@fanniemae.com](mailto:drawer_insurance@fanniemae.com).