

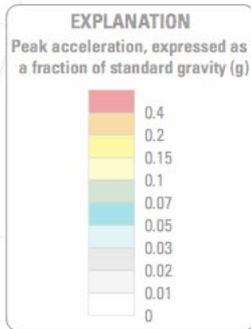
# Caltrans Reliance on USGS National Seismic Hazard Mapping Program

## ATC/USGS Seismic Hazard Users-Needs Workshop

September 20-21, 2015 Menlo Park

**Tom Shantz, P.E., G.E.**

Caltrans Division of Research, Innovation, and System Information  
tom.shantz@dot.ca.gov



□ Areas where suspected nontectonic earthquakes have been deleted

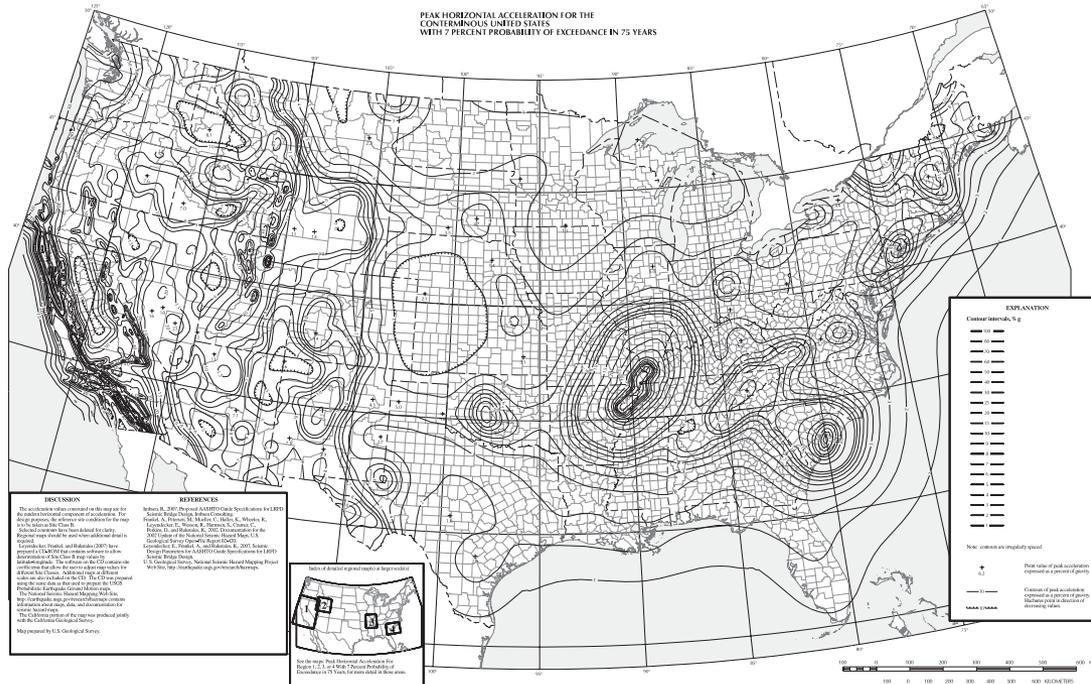
# All state DOT's, except Caltrans, obtain seismic loads from AASHTO

Seismic hazard maps were created for AASHTO by USGS in 2009

7% in 75 year hazard level

Three spectral periods: PGA, 0.2s, 1.0 s

Reference site condition: NEHRP Site Class B



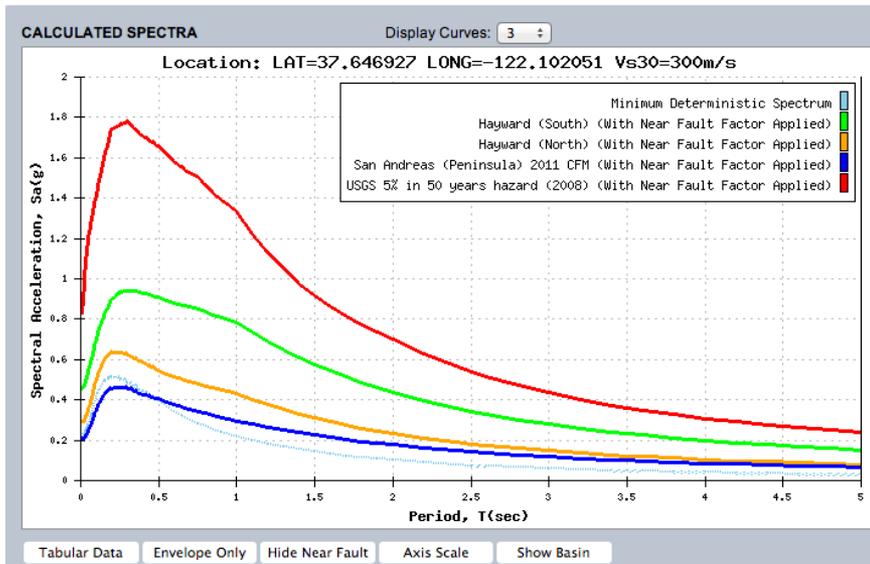
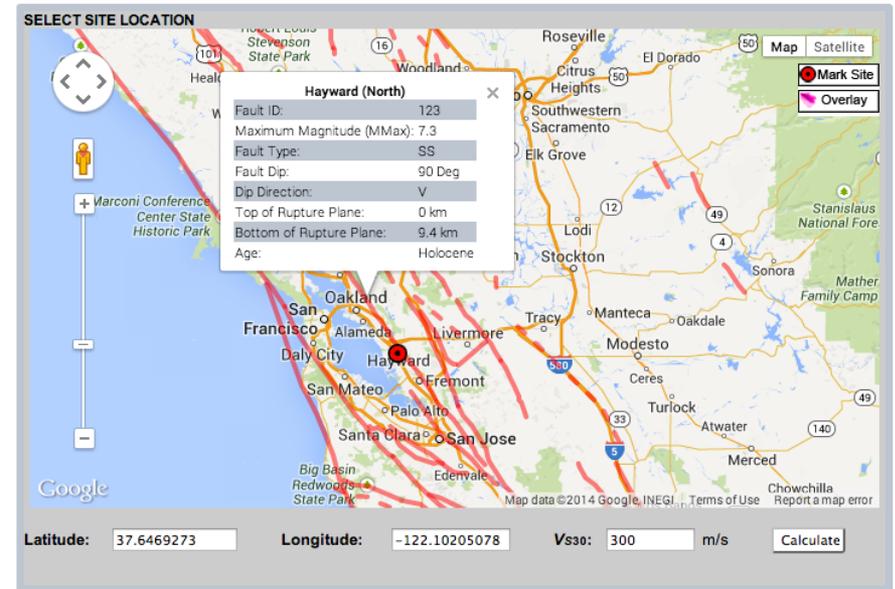
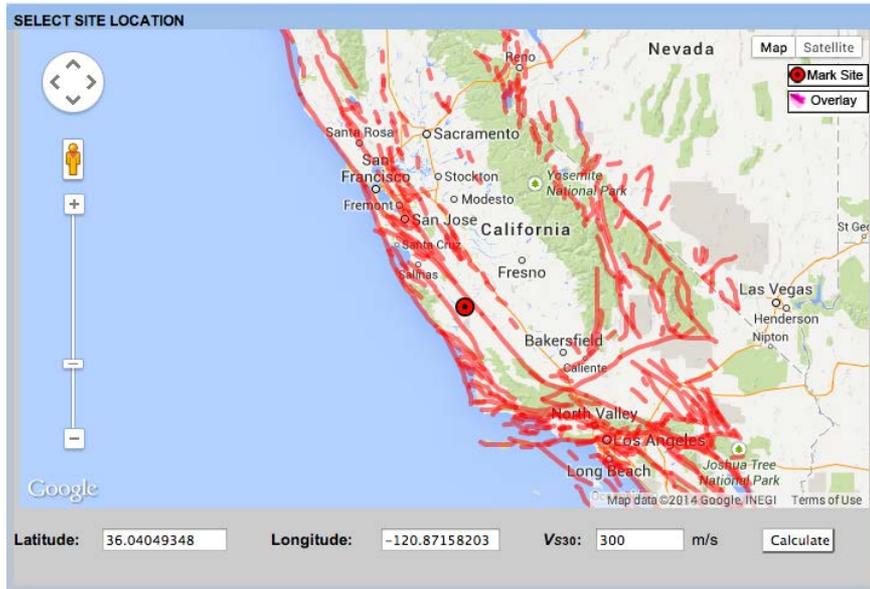
# Caltrans seismic loading procedure incorporates both deterministic and probabilistic methods.

Design spectrum = Envelope of the *deterministic* spectrum and the *probabilistic* spectrum

Deterministic spectrum based on average of Campbell and Bozorgnia, 2008 and Chiou and Youngs, 2008 median estimates

Probabilistic spectrum based on 5% in 50 year hazard (per USGS)

- Instead of a map, USGS provided data files for 0.05 degree grid covering California.
- Hazard data was provided for 11 periods and 4 NEHRP site classes (BC, C, D, DE)
- Hazard data was incorporated into our web-based design tool *ARS Online*



**SITE DATA** DETERMINISTIC PROBABILISTIC MINIMUM ENVELOPE

FID 137 FID 123 FID 134

**Hayward (South)**

Fault ID: 137

Maximum Magnitude (MMax): 7.3

Fault Type: SS

Fault Dip: 90 Deg

Dip Direction: V

Bottom of Rupture Plane: 9.40 km

Top of Rupture Plane(Ztor): 0.00 km

Rrup: 3.038 km

Rjb: 3.037 km

Rx: 3.038 km

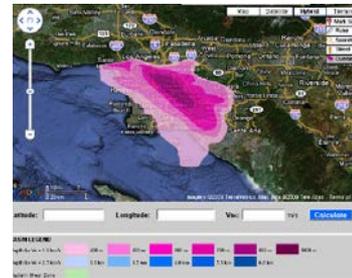
Fnorm: 0

Frev: 0

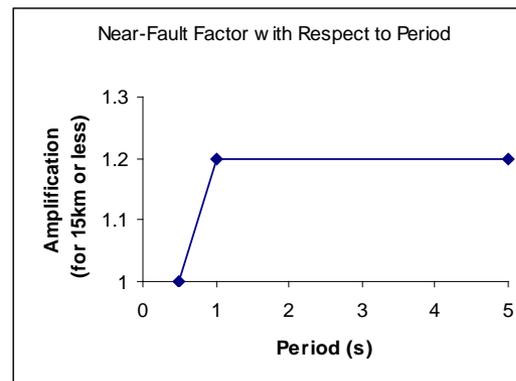
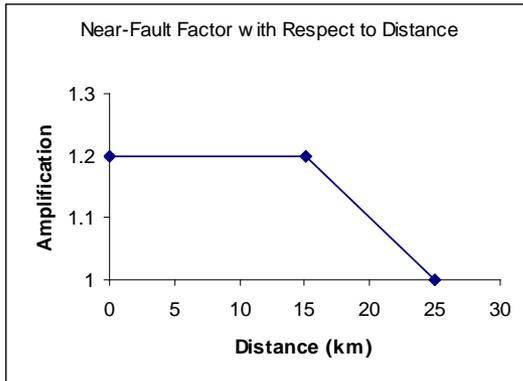
Period	SA(Base Spectrum)	Basin Factor	Near Fault Factor(Applied)	SA(Final Spectrum)
0.01	0.457	1.000	1.000	0.457
0.05	0.546	1.000	1.000	0.546
0.1	0.700	1.000	1.000	0.700
0.15	0.817	1.000	1.000	0.817
0.2	0.897	1.000	1.000	0.897
0.25	0.931	1.000	1.000	0.931
0.3	0.941	1.000	1.000	0.941
0.4	0.931	1.000	1.000	0.931
0.5	0.907	1.000	1.000	0.907
0.6	0.847	1.000	1.040	0.881
0.7	0.796	1.000	1.080	0.860
0.85	0.721	1.000	1.140	0.822
1	0.654	1.000	1.200	0.785
1.2	0.574	1.000	1.200	0.689
1.5	0.481	1.000	1.200	0.577
2	0.365	1.000	1.200	0.438
3	0.233	1.000	1.200	0.279
4	0.165	1.000	1.200	0.199
5	0.127	1.000	1.200	0.153

# Modifications to USGS hazard data by *ARS Online*

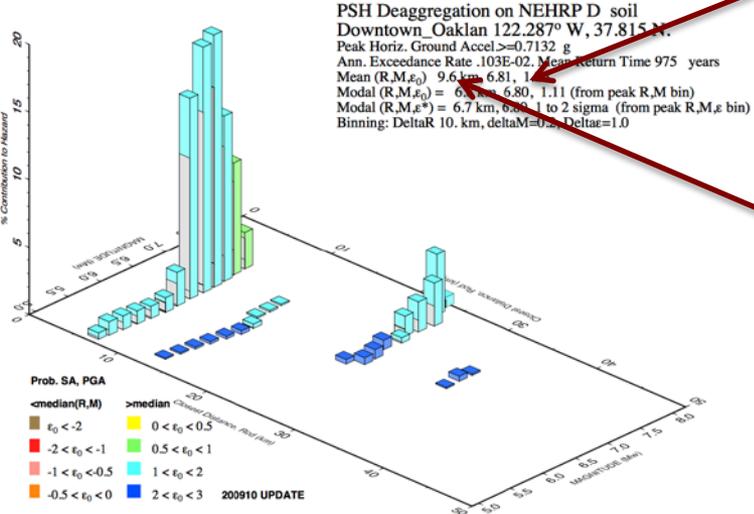
- Interpolates between grid points
- Interpolates between  $V_{s30}$
- Applies basin amplification



- Applies near-fault amplification factor



Caltrans is also a big user of the USGS 2008 Interactive Deaggregations web site.



Magnitude used for liquefaction assessment, time-series selection, and fault rupture studies.

Distance used for near-fault adjustment factor

## Caltrans hazard data “wish list”:

- Update 2008 hazard files with 2014 data (11 periods, 4 site classes, 0.05 deg)
- Update the *2008 Interactive Deaggregations* website to 2014 hazard
- Develop a forecasted CA earthquake catalog for the next 300,000 years