Uses of the USGS National Seismic Hazard Model (NSHM)

(ID SS086A)

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11th National Conference on Earthquake Engineering (11NCEE)
Mini-Workshop On Needs Of Users Of The USGS National Seismic Hazard Model
(Special Session SS025.S)
Los Angeles, CA
June 28, 2018
Various Users

- **Earthquake Scientists**
  Using various components of hazard model (e.g., earthquake rates, source models, ground motion models)

- **Engineers (Practicing & Research)**
  Using “hazard curves/maps” or their direct products “deaggregation” & “design motions”

- **Policymakers**
  Using models derived from hazard model (e.g., risk maps)
Various Users

Government:
- USDA
- FEMA
- GSA
- USNRC
- Caltrans
- CGS
- US Army Corps of Engineers
- United States Geological Survey

Building Codes & Other Structural Design Guidelines:
- ICC
- ASCE
- AREMA
- NSC

Insurance:
- CEA
- RMS
- CoreLogic
- EqCat
- Validus

Risk Modelers:
- AIR Worldwide

International Organizations:
- IAEA
- USAID
- GEM

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Adoption of NSHMs in U.S. Building Codes

USGS National Seismic Hazard Model

Site-Specific Ground Motion Procedures of...
(e.g., risk-targeted, site coeffs, max-dir)

Design Motions Values/Maps

FEMA Code Resource Support Committee

ASCE-7 Committee

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# USGS NSHM Updates & Building Code Applications

<table>
<thead>
<tr>
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</tr>
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<td>2016</td>
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</table>

## Hazard Maps → Design Maps

- **USGS National Seismic Hazard Model (NSHM)**
- **NEHRP Recommended Seismic Provisions**
- **Site-Specific Ground Motion Procedures**
- **ASCE-7 Committee**
- **FEMA Code Resource Support Committee**

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- **Most Recent**: 2018
- **Next**: 2018

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Adjusted our six year update schedule as a result of our interactions w/ BSSC

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### Uses of the USGS National Seismic Hazard Model (NSHM), S. Rezaeian, June 2018
A joint USGS-BSSC effort to develop consensus among practicing engineers and earth science communities engaged in formulating the rules by which the next-generation seismic design value maps will be developed. (2021 NEHRP, ASCE 7-22, 2024 IBC)

Initially identified 13 issues as important for consideration in the next-generation of design value maps (4 were selected as primary issues due to limited budget and resources):

1. Timing for Updated Map Publication
2. Design Value Conveyance
3. Balancing Precision and Uncertainty
4. Acceptable Collapse Risk Definition
5. Collapse Risk Definition
6. Maximum Direction Ground Motion Components
7. Multi-Period Spectral Values
8. Duration as a Mapped Parameter
9. Damping Levels
10. Vertical Motion Parameters
11. Use and Definition of Deterministic Parameters
12. Basin Effects
13. Use of 3-D Simulation to Develop Long Period Parameters

One of the primary issues that will effect 2018 and future USGS NSHMs

Long period issues that can be combined into issue 7
Multi-Period Response Spectrum (MPRS)

A Project ‘17 issue that will influence 2018+ USGS NSHMs

Realizing the shortcomings of the current simple design spectrum, building code has decided to take advantage of USGS additional “maps” to develop multi-period design spectrum (21 periods & 8 site classes)

Spectrum based on Ss & S1:

Multi-period (multi-V30) Spectrum:

Site class D & E can have a very different shape
Multi-Period Response Spectrum (MPRS)

Example: Los Angeles CA -118.25 34.05

Note: the ASCE7-16 and ASCE7-22 are the same because ASCE7-16 calls for a site-specific. (ASCE7-16 "exception" using conservative $F_a$ for Site Class C incorporated)

$F_v=0$ refers to sitespecific analysis requirement for site D

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### Other Structural Design Regulations

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#### AASHTO: American Association of State Highway and Transportation Officials
- Jan 2017 TRB Conference: presented potential updates
- Proposal submitted to update NSHMs and site coefficients
- Future proposal to include max-direction and uniform risk …

#### AREMA: American Railway Engineering and Maintenance-of-Way Association
- Started collaboration June 2017
- USGS presented potential updates in 2018 meetings
- Considering 2018 NSHMs for their next update …

#### UFC: Department of Defense Unified Facilities Criteria
- last updated in 2013

2018 and future NSHM updates will be developed with new software and disseminated with new web services

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Deaggregation of Hazard: controlling M, distance, fault, GMM, etc. (e.g., SCEC simulations)

Los Angeles:
- Elysian Park (EP)
- Others
- San Andreas fault system (SSA)
**Other Users**

**SC DOT:** Using components of the USGS NSHM
- e.g., GMMs that were used in 2002 model
- need to update their models based on the latest USGS GMMs

**Other Examples:**
- US NRC
- CGS
- Insurance Industry: Core Logic, AECOM
  ...

**Insurance:**

**Government:**

**Risk Modelers**
Thank you