Preparing for Disaster Using Scenarios: The Earthquake Experience

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Natural Hazards Center

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Boulder, Colorado

USGS *National Earthquake Information Center, Golden, Colorado*

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Scenario Questions Posed:

Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

1. What tools are you using to portray disaster impacts in a meaningful way?

2. Can the same scenarios be used for mitigation & response planning? What specific elements do you need for one as opposed to the other?

3. Some scenarios are highly technical & depend on cutting edge scientific & engineering input. Are more comprehensive scenarios more effective in bringing about the desired behavior of members of the technical & emergency management communities, educate the general public, and policy makers? How are scenarios modified for different audiences & what techniques help to get buy in & ownership of a scenario.

4. Are you aware of any post scenario evaluations that have determined effectiveness in changing behavior/attitudes, etc? Have you attempted to evaluate the materials you have created?

5. What technical, financial, or information resources exist for communities, agencies, or organizations wishing to develop their own scenarios?

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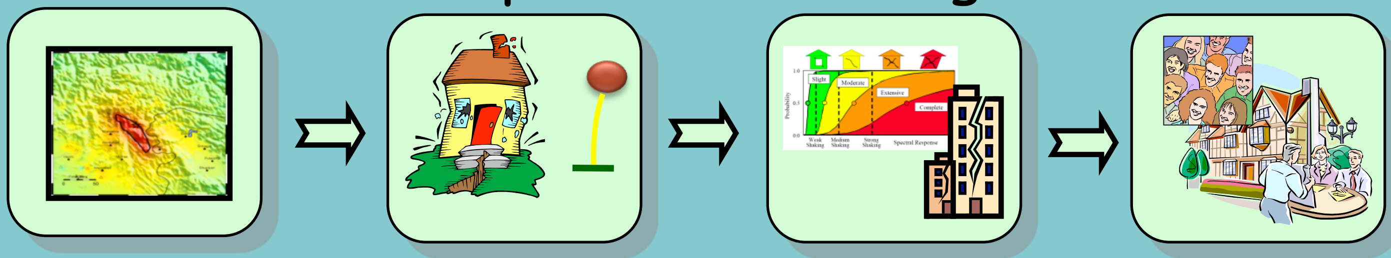
Earthquake Scenarios

Hazard | Response | Damage | Loss

PGA
SA
PGV
MMI



Deaths
Damage
Dollars
Downtime

— USGS ShakeCast —

ShakeMap — FEMA's HAZUS —

— USGS's PAGER —

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USGS ShakeCast

Automating, Simplifying, and Improving the Use of ShakeMap for Post-Earthquake Decisionmaking and Response

ShakeCast is a freely available, post-earthquake situational awareness application that automatically retrieves earthquake shaking data from ShakeMap, compares intensity measures against users' facilities, and generates potential damage assessment notifications, facility damage maps, and other Web-based products for emergency managers and responders.

What is ShakeCast?

ShakeCast, short for *ShakeMap Broadcast*, is a fully automated system for delivering specific ShakeMap products to critical users and for triggering established post-earthquake response protocols. ShakeMap is a well-established tool used to portray the extent of potentially damaging shaking following an earthquake. ShakeMap is automatically generated for small and large earthquakes in areas where it is available and can be found on the Internet at *http://earthquake.usgs.gov/shakemap/*. It was

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RESPONDING TO GLOBAL EARTHQUAKE HAZARDS

PAGER—Rapid Assessment of an Earthquake's Impact

PAGER (**P**rompt **A**ssessment of **G**lobal **E**arthquakes for **R**esponse) is an automated system to rapidly assess the number of people and regions exposed to severe shaking by an earthquake, and inform emergency responders, government agencies, and the media to the scope of the potential disaster. PAGER monitors the U.S. Geological Survey's near real-time U.S. and global earthquake detections and automatically identifies events that are of societal importance, well in advance of ground-truth or news accounts.

The U.S. Geological Survey's National Earthquake Information Center (NEIC), located in Golden, Colorado, reports over 30,000 earthquakes a year. Tragically about 25 of these cause significant damage, injuries, or fatalities. The U.S. Geological Survey (USGS) often detects earthquakes well before eyewitness reports are available. It must then decide rapidly whether Federal and international agencies should be alerted to a potentially damaging event. In the past, the USGS primarily relied on the experience and intuition of its on-duty seismologists to estimate the impact of an event. To improve the accuracy of the assessment, the USGS has developed PAGER, an automated system to rapidly estimate the number of people and settlements exposed to severe shaking during earthquakes occurring anywhere in the world.

PAGER provides important information to help emergency relief organizations, government agencies, and the media plan their responses to earthquake disasters. Content includes instrumentally-determined earthquake parameters of location, magnitude, and depth and an estimate of the number of people exposed to different severities of shaking—a useful indicator of potential impact. For most events, the system generates a comment describing infrastructure vulnerability in the region, and damage and fatality reports from previous nearby earthquakes. A table summarizes the predicted shaking intensity at nearby population centers, and maps provide quick visual overviews of shaking levels and population densities.

This information is available on the USGS earthquake website http://earthquake.usgs.gov/ and as a printable, one-page report with accompanying description such as that shown in the following pages. Fundamental to such a system, the USGS operates a robust computational and communication infrastructure necessary for earthquake response.

PAGER results are generally available within 30 minutes of a significant earthquake, shortly after the determination of its location and magnitude. However, information on the extent of shaking will be uncertain in the minutes and hours following an earthquake and typically improves as additional sensor data and reported intensities are acquired and incorporated into models of the earthquake's source. Users of PAGER exposure estimates should account for uncertainty and always seek the most current PAGER release for any earthquake.

Collapsed adobe church in Pisco, Peru, following the August 15, 2007, magnitude 8.0 earthquake. For events such as this, PAGER provides emergency relief organizations with information that helps them determine which areas likely require the most attention. Photograph by Emily So, EEFIT, United Kingdom.

U.S. Department of the Interior
U.S. Geological Survey

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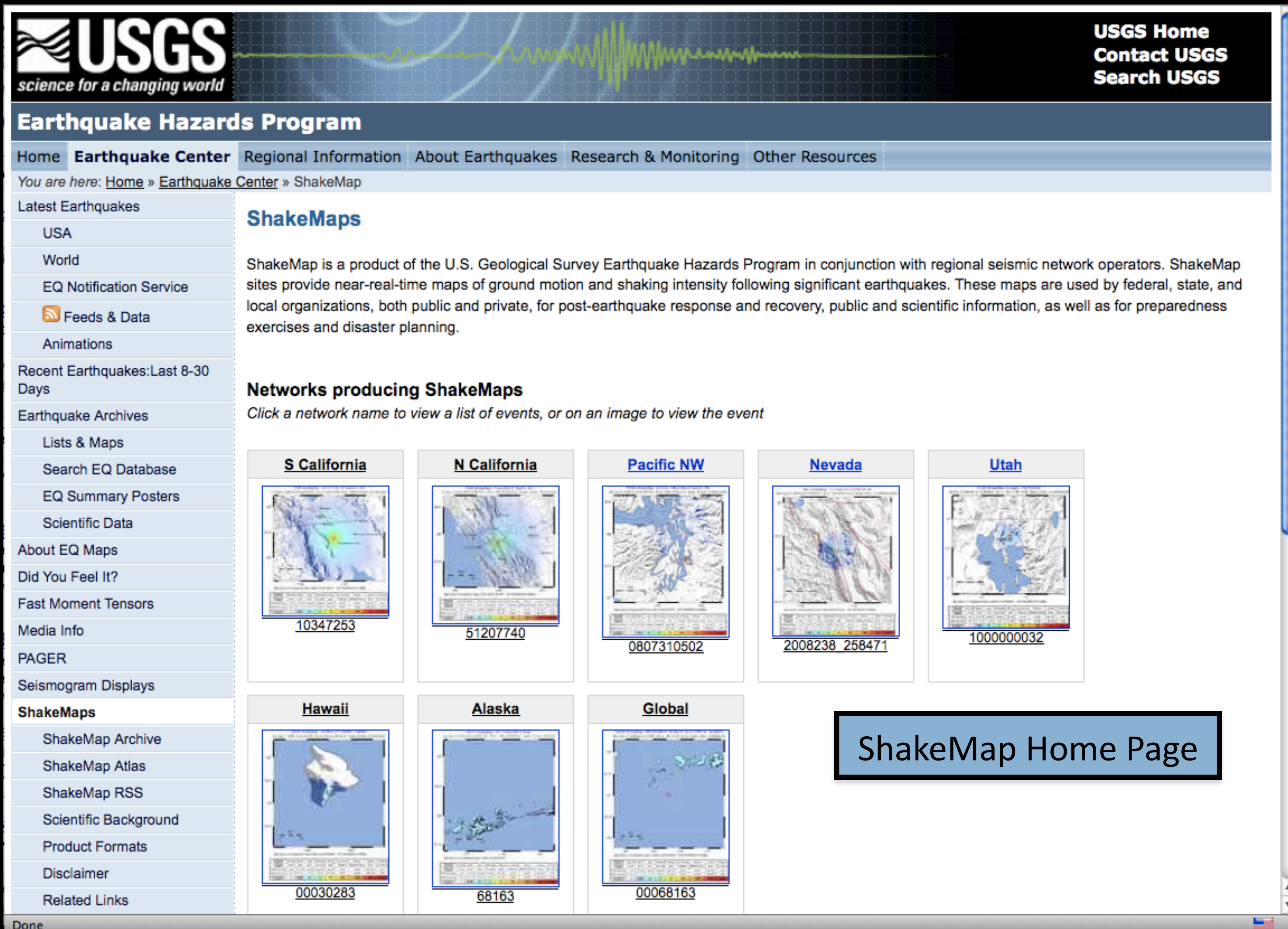
Fact Sheet 2007–3101
December 2007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ShakeMaps
ShakeMap is a product of the U.S. Geological Survey Earthquake Hazards Program in conjunction with regional seismic network operators. ShakeMap sites provide near-real-time maps of ground motion and shaking intensity following significant earthquakes. These maps are used by federal, state, and local organizations, both public and private, for post-earthquake response and recovery, public and scientific information, as well as for preparedness exercises and disaster planning.
Networks producing ShakeMaps
Click a network name to view a list of events, or on an image to view the event
S California
10347253
N California
51207740
Pacific NW
0807310502
Nevada
2008238_258471
Utah
1000000032
Hawaii
00030283
Alaska
68163
Global
00068163
ShakeMap Home Page
Done

http://earthquake.usgs.gov - ShakeMap Archive

ShakeMap Archive | ShakeMaps | Did You Feel It?

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  - ShakeMap RSS
  - Scientific Background

ShakeMap Archive

Networks: All | S. California | N. California | Pacific NW | Nevada | Utah | **Alaska** | Hawaii | Global
Years: **All** | 2005 | 1964
Type: Regular | **Scenarios**

ShakeMap Scenarios in Alaska

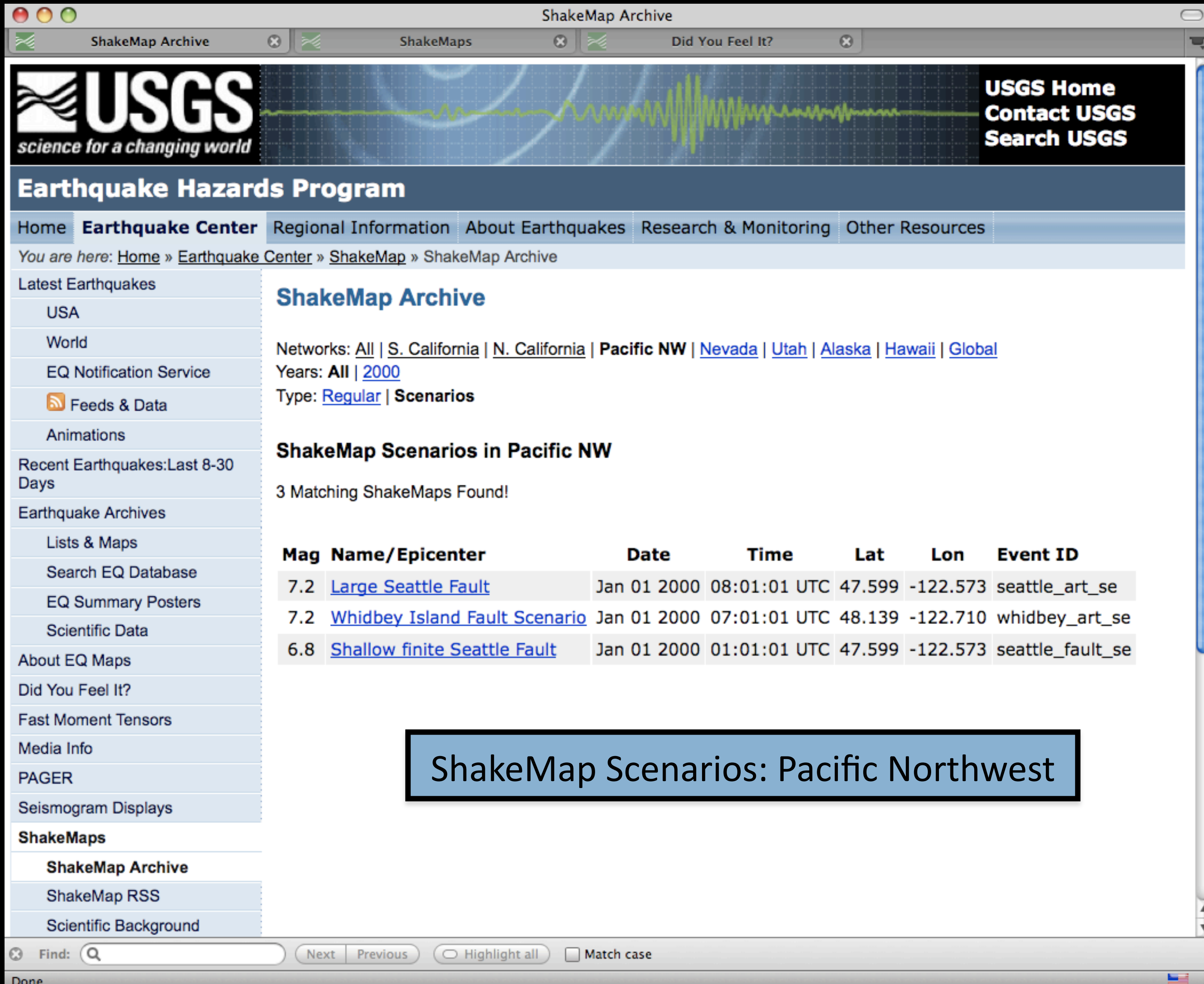
5 Matching ShakeMaps Found!

Mag	Name/Epicenter	Date	Time	Lat	Lon	Event ID
6.7	Juneau Scenario	Aug 10 2005	06:26:00 AKDT	58.228	-134.976	Juneau_se
7.5	Castle Mountain Fault Scenario	Aug 08 2005	15:00:00 AKDT	61.353	-151.040	Castle_Mountain_se
7.5	Castle Mountain Fault Scenario	Aug 08 2005	15:00:00 AKDT	61.353	-151.040	Castle_Mountain_zoomout_se
7.2	Intraslab Scenario	Apr 13 2005	17:36:14 AKDT	61.300	-149.700	Intraslab_se
9.2	1964 Scenario	Mar 27 1964	17:36:14 AKDT	61.000	-147.800	1964_se

ShakeMap Scenarios: Alaska

Find: | Next | Previous | Highlight all | Match case

Done



Mag	Name/Epicenter	Date	Time	Lat	Lon	Event ID
7.2	Large Seattle Fault	Jan 01 2000	08:01:01 UTC	47.599	-122.573	seattle_art_se
7.2	Whidbey Island Fault Scenario	Jan 01 2000	07:01:01 UTC	48.139	-122.710	whidbey_art_se
6.8	Shallow finite Seattle Fault	Jan 01 2000	01:01:01 UTC	47.599	-122.573	seattle_fault_se

ShakeMap Scenarios: Pacific Northwest

http://earthquake.usgs.gov - ShakeMap Archive

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ShakeMap Archive

Networks: All | **S. California** | N. California | Pacific NW | Nevada | Utah | Alaska | Hawaii | Global
Years: All | **2008** | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 1999 | 1994
Type: Regular | **Scenarios**

ShakeMap Scenarios in S. California during 2008

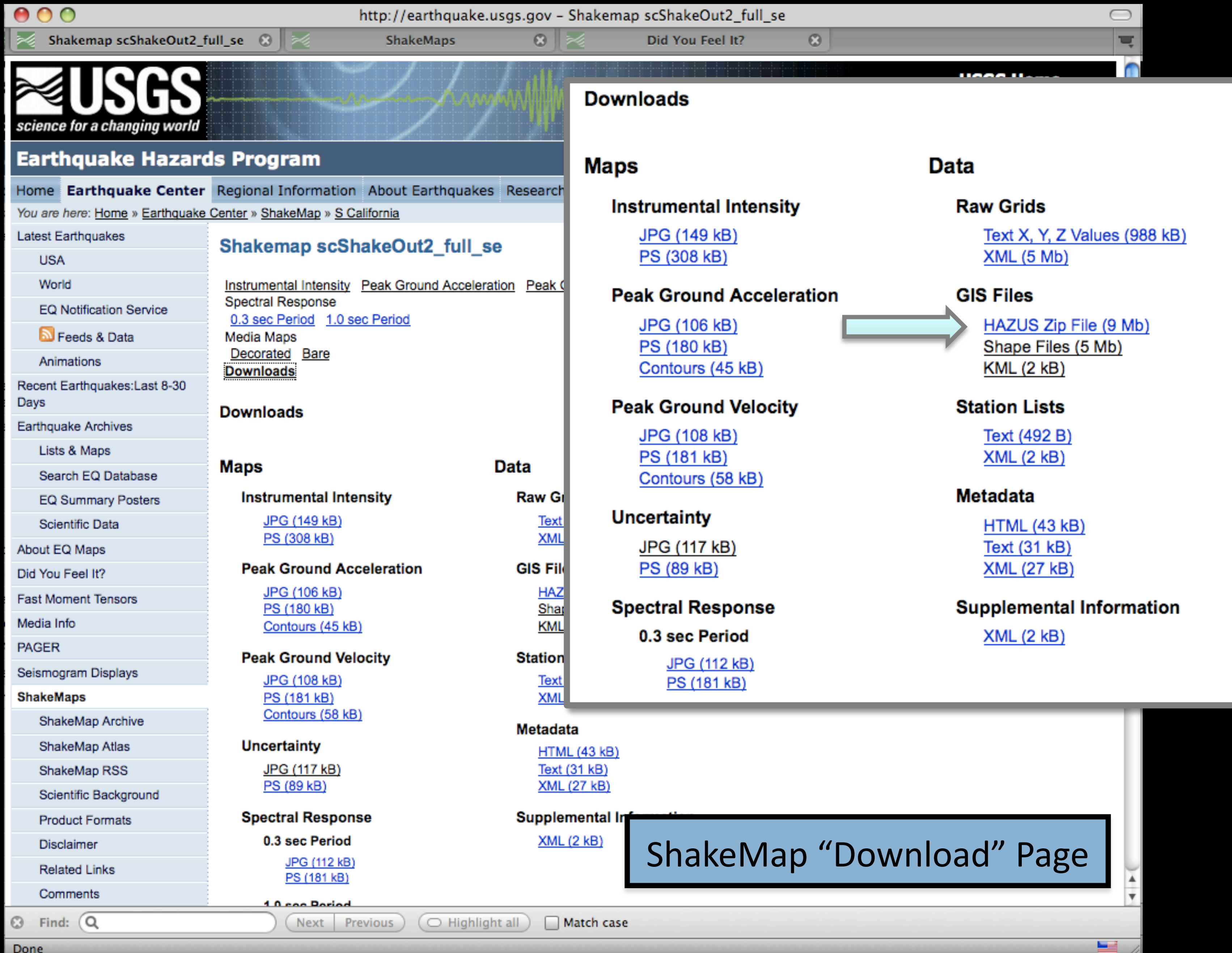
7 Matching ShakeMaps Found!

Mag	Name/Epicenter	Date	Time	Lat	Lon	Event ID
5.7	ShakeOut M5.7 Scenario V2 Aftershock	Nov 15 2008	23:32:30	34.159	-117.364	ShakeOut2_AS3_se
7.2	ShakeOut M7.2 Scenario V2 Aftershock	Nov 14 2008	03:16:16	34.180	-117.441	ShakeOut2_AS2_se
6.0	ShakeOut M6.0 Scenario V2 Aftershock	Nov 13 2008	17:00:00	34.271	-117.451	ShakeOut2_AS4_se
7.0	ShakeOut M7.0 Scenario V2 Aftershock	Nov 13 2008	12:00:33	33.548	-115.892	ShakeOut2_AS1_se
7.8	ShakeOut M7.8 Scenario V2	Nov 13 2008	10:00:00	33.350	-115.710	ShakeOut2_full_se

2008 ShakeMap Scenarios: Southern California

Find: Next Previous Highlight all Match case

Done



ShakeMap “Download” Page

The USGS Earthquake Scenario Development Project

Wald, D., Wald, L., Petersen, M., Frankel, A., Quitoriano, V., Lin, K., Bausch, D.

The USGS Earthquake Hazards program is producing a comprehensive suite of earthquake scenarios for planning, mitigation, loss estimation, and scientific purposes. For each event, fundamental input is i) the magnitude and specified fault dimensions, and ii) regional Vs30 shear velocity values for site amplification. A grid of standard ShakeMap ground motion parameters (PGA, PGV, and three response spectral values) is then produced using the well-defined, regionally-specific approach developed by the USGS National Seismic Hazard Mapping Project (NHSMP), including recent advances in empirical ground motion predictions (e.g., the NGA relations). The framework also allows for numerical (3D) ground motion computations for specific, detailed scenario analyses. Unlike NSHMP ground motions, for these scenarios, local rock and soil site conditions and commensurate shaking amplifications will be applied based on detailed Vs30 maps where available or based on topographic slope as a default.

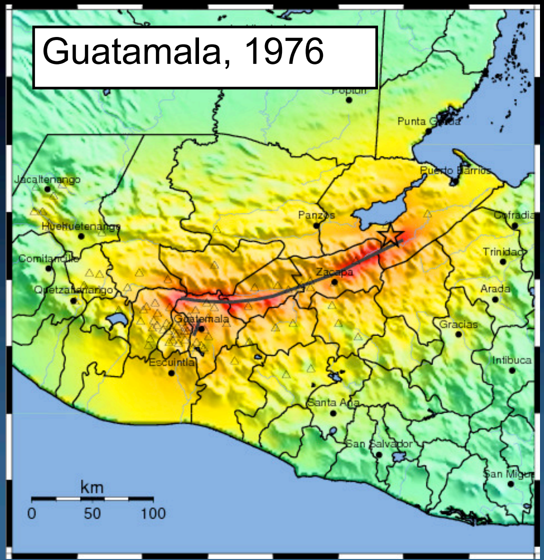
The scenario event set is comprised primarily by disaggregation of NSHMP events, though custom events are also chosen based on coordination of the scenario team and regional seismic hazard or seismic network coordinators. The event set will be harmonized with existing and future scenario earthquake events produced regionally or by other researchers. This includes ~200 events in CA, ~200 in NV, dozens in NM, UT, and smaller number in other regions. Systematic output will include all standard ShakeMap products, including HAZUS input, GIS, KML, and XML files used for visualization and loss estimation, ShakeCast, PAGER, and other systems. All products will be delivered via the ShakeMap web pages in a user-searchable archive. For each event, USGS PAGER runs will be produced, providing population exposure at current population levels. Hence, three types of ShakeMap events will be available: Scenario (specified fault and estimated ground motions); Historic (faulting, ground motion and intensity data where available); and, Modern events (e.g., recent events in regions with numerous ground motion recordings).

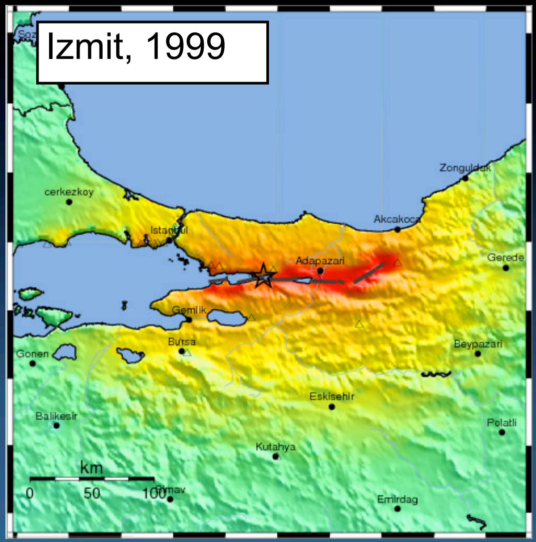
Anticipated users include the Federal Emergency Management Agency, the loss

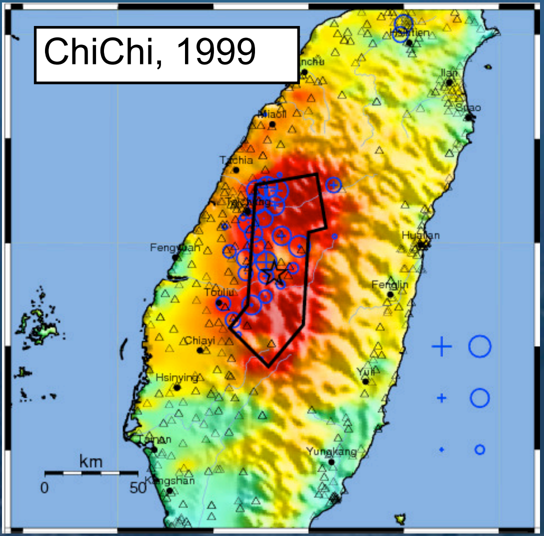
ShakeMap Atlas

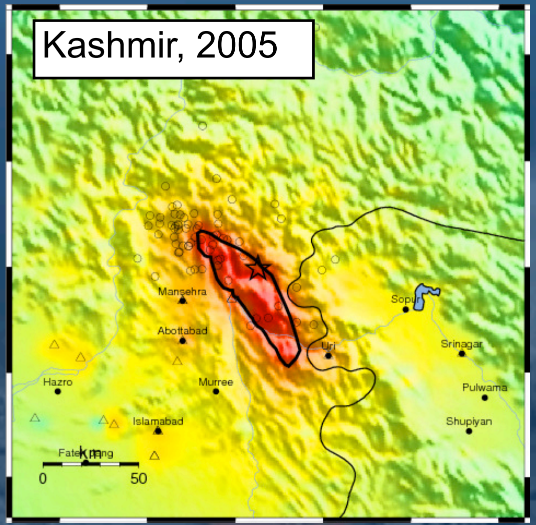
ShakeMaps for >5,600 Earthquakes globally (1973-2008)

- All available data (ground motion, intensity, fault plane)
- Site conditions from topo-graphy
- Standard ShakeMap approach to combine observed/estimated ground motions
- *Over 60 events in California alone!*)









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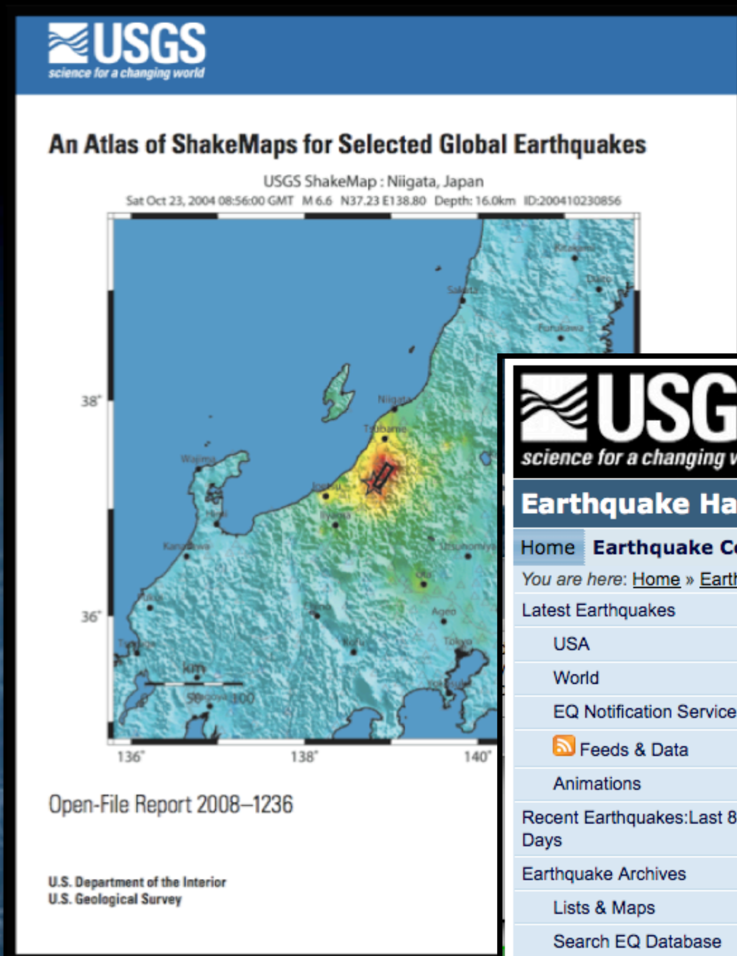
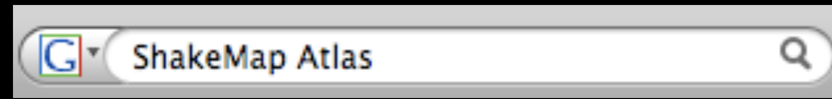
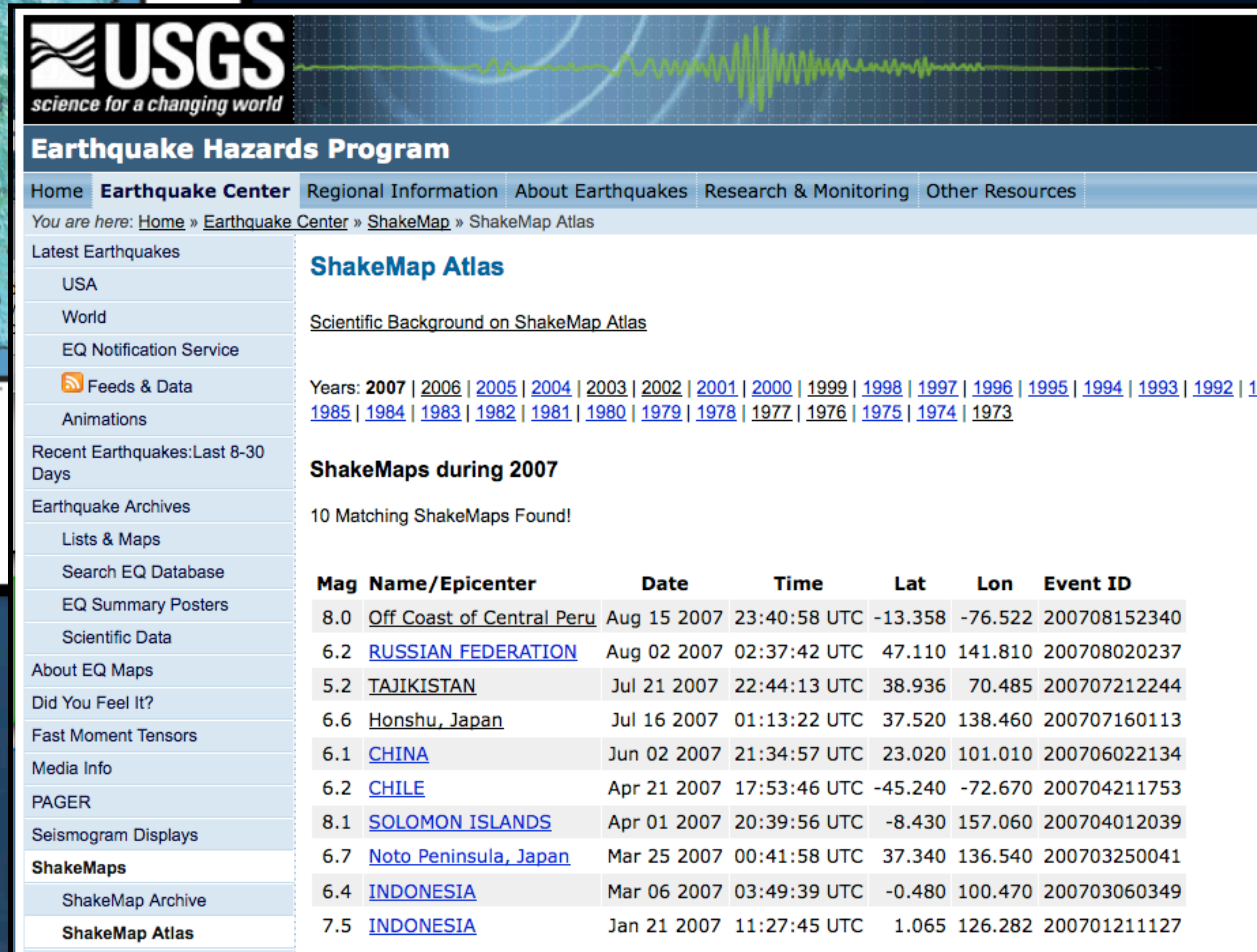




Other uses than Scenarios: PAGER, GEM, Loss Estimation, Insurance, Mitigation, Response Planning, UNEP, CUEDD, …



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ShakeMap Atlas

Scientific Background on ShakeMap Atlas

Years: **2007** | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 2000 | 1999 | 1998 | 1997 | 1996 | 1995 | 1994 | 1993 | 1992 | 19
1985 | 1984 | 1983 | 1982 | 1981 | 1980 | 1979 | 1978 | 1977 | 1976 | 1975 | 1974 | 1973

ShakeMaps during 2007

10 Matching ShakeMaps Found!

Mag	Name/Epicenter	Date	Time	Lat	Lon	Event ID
8.0	Off Coast of Central Peru	Aug 15 2007	23:40:58 UTC	-13.358	-76.522	200708152340
6.2	RUSSIAN FEDERATION	Aug 02 2007	02:37:42 UTC	47.110	141.810	200708020237
5.2	TAJIKISTAN	Jul 21 2007	22:44:13 UTC	38.936	70.485	200707212244
6.6	Honshu, Japan	Jul 16 2007	01:13:22 UTC	37.520	138.460	200707160113
6.1	CHINA	Jun 02 2007	21:34:57 UTC	23.020	101.010	200706022134
6.2	CHILE	Apr 21 2007	17:53:46 UTC	-45.240	-72.670	200704211753
8.1	SOLOMON ISLANDS	Apr 01 2007	20:39:56 UTC	-8.430	157.060	200704012039
6.7	Noto Peninsula, Japan	Mar 25 2007	00:41:58 UTC	37.340	136.540	200703250041
6.4	INDONESIA	Mar 06 2007	03:49:39 UTC	-0.480	100.470	200703060349
7.5	INDONESIA	Jan 21 2007	11:27:45 UTC	1.065	126.282	200701211127

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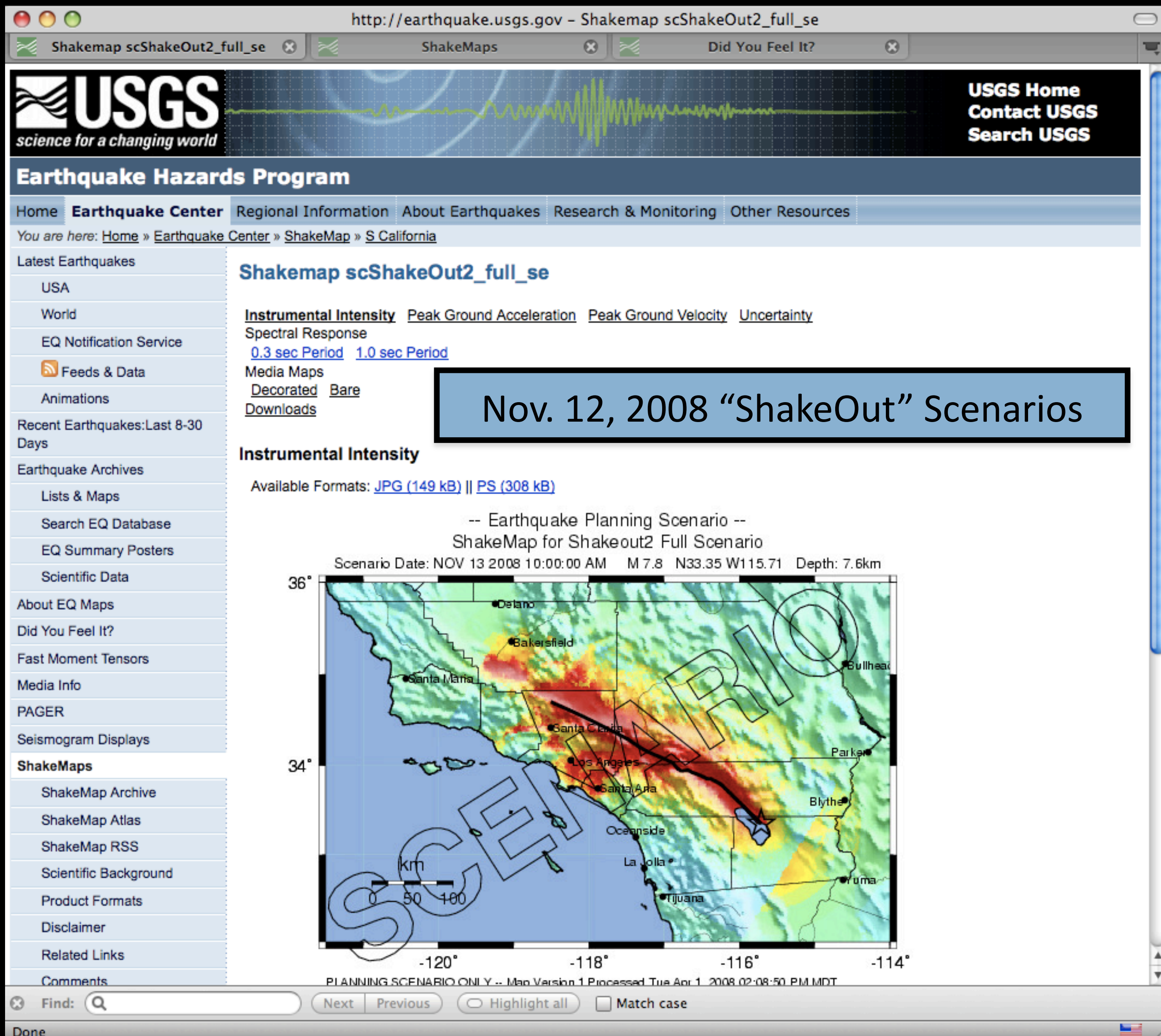
Nov. 12, 2008 “ShakeOut” Scenarios
http://earthquake.usgs.gov - Shakemap scShakeOut2_full_se
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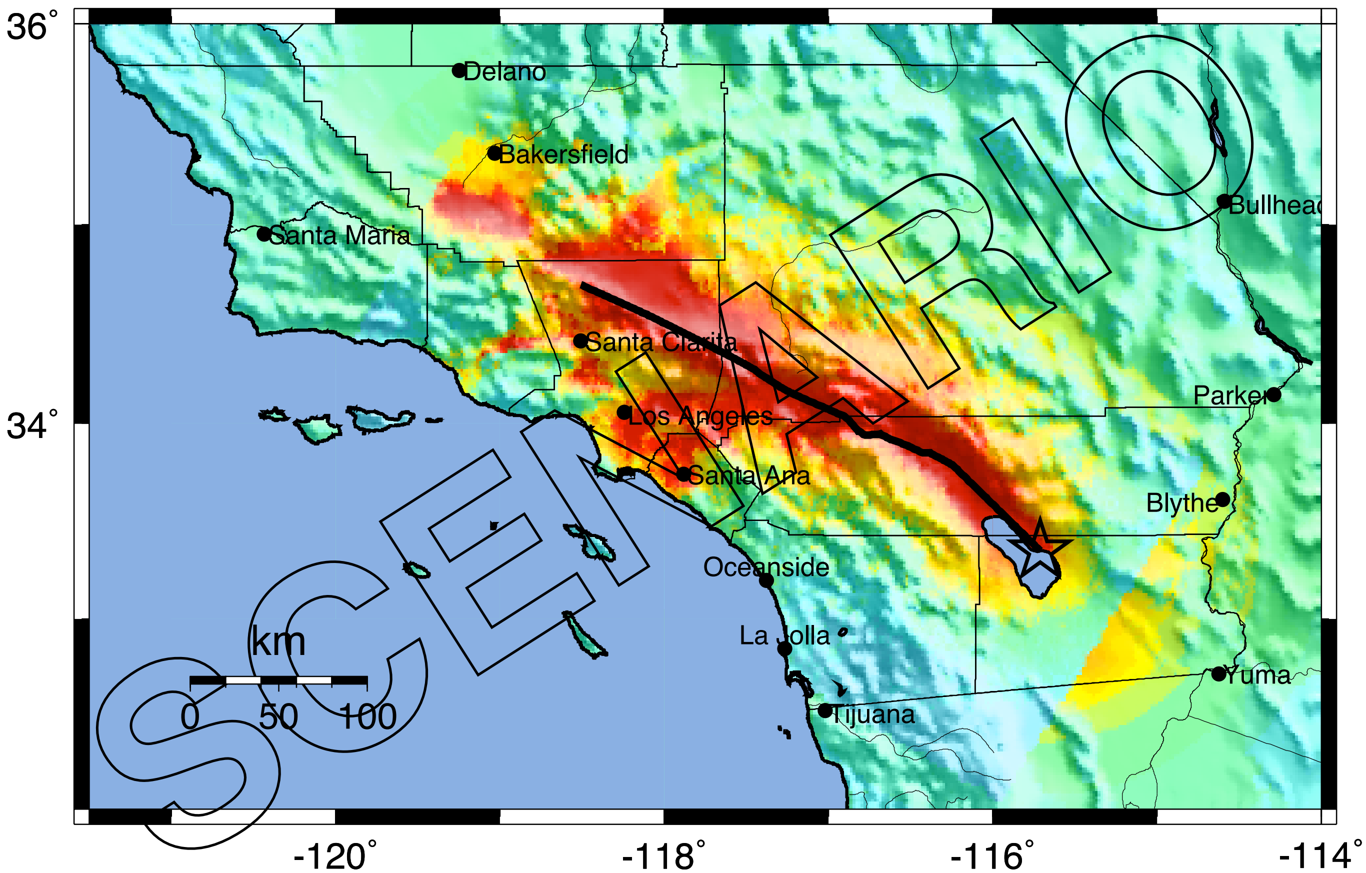
Instrumental Intensity
Peak Ground Acceleration
Peak Ground Velocity
Uncertainty
Spectral Response
0.3 sec Period
1.0 sec Period
Media Maps
Decorated
Bare
Downloads
Instrumental Intensity
Available Formats: JPG (149 kB) || PS (308 kB)
-- Earthquake Planning Scenario --
ShakeMap for Shakeout2 Full Scenario
Scenario Date: NOV 13 2008 10:00:00 AM M 7.8 N33.35 W115.71 Depth: 7.6km
36˚
34˚
Delano
Bakersfield
Santa Maria
Santa Clarita
Los Angeles
Santa Ana
Oceanside
La Jolla
Tijuana
Parker
Blythe
Yuma
SCENARIO
km
0
50
100
-120˚
-118˚
-116˚
-114˚
PLANNING SCENARIO ONLY -- Map Version 1 Processed Tue Apr 1, 2008 02:08:50 PM MDT
Find:
Next
Previous
Highlight all
Match case
Done

-- Earthquake Planning Scenario --

ShakeMap for Shakeout2 Full Scenario

Scenario Date: NOV 13 2008 10:00:00 AM M 7.8 N33.35 W115.71 Depth: 7.6km

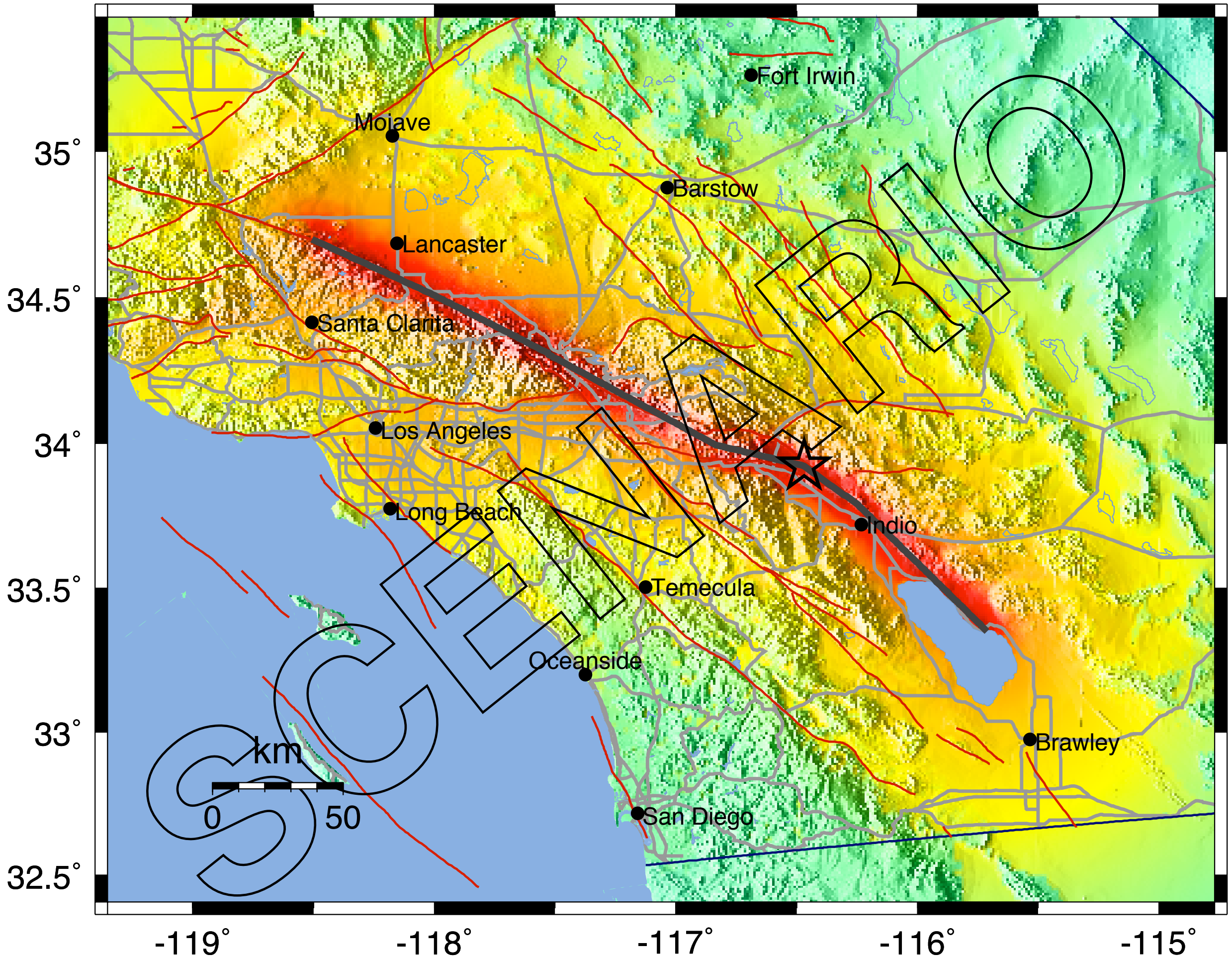


PLANNING SCENARIO ONLY -- Map Version 1 Processed Tue Apr 1, 2008 02:08:50 PM MDT

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

-- Earthquake Planning Scenario --
ShakeMap for Saf South7.8 Scenario

Scenario Date: Thu Aug 3, 2006 05:00:00 AM PDT M 7.8 N33.92 W116.47 Depth: 10.0km



PLANNING SCENARIO ONLY -- Map Version 1 Processed Thu Feb 8, 2007 11:47:37 AM PST

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
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-- Earthquake Planning Scenario --

ShakeMap for Shakeout2 Full Scenario

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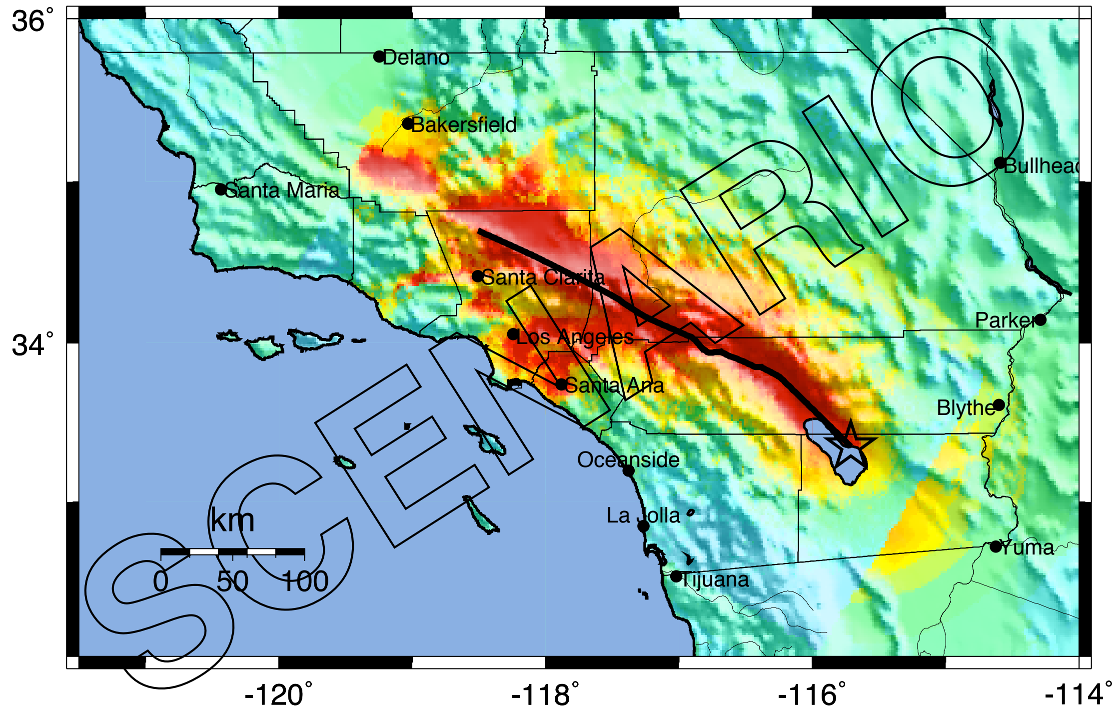

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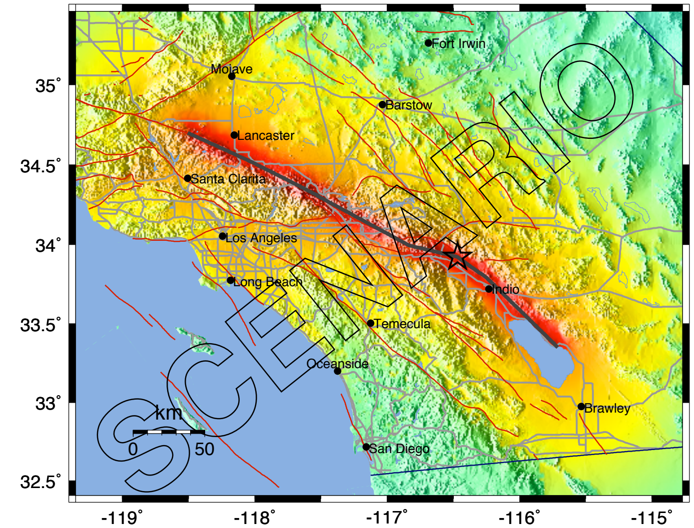

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PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Building Inventory Data in HAZUS

- Exposure data: total building square footage & dollars, by occupancy (33), and census tract for entire US. (→ proxy data)

- Mapping scheme data: for each occupancy, provides a % distribution across structural or "model building" types.
  → ~Based on ATC-13 profiles.

Courtesy of H. Seligson, MMI Engineering

San Luis Obispo County - Comparison to HAZUS default

Difference Between Assessor's Data And HAZUS MR-2 Default Data (Relative To Assessor's Data)

General Occupancy	Number of Buildings (MR-2)	Square Footage (MR-2)
Residential	29%	28%
Commercial	-76%	240%
Industrial	18%	1725%

→ Lesson Learned: HAZUS default data may overestimate exposure (sq ft) in smaller, less urban counties.

EERI

Courtesy of H. Seligson, MMI Engineering

nehrp

Los Angeles County - Comparison to HAZUS default

Difference Between Assessor's Data And HAZUS Default Data (Relative To Assessor's Data)

General Occupancy	# Bldgs (MR-2)	Sq. Ft. (MR-2)	Sq. Ft. (MR-3)
Residential	18%	6%	6%
Commercial	-68%	-46%	-41%
Industrial	-81%	-55%	-40%

→ Lesson Learned: HAZUS default data may underestimate non-residential exposure (sq ft) in large, urban counties.

EERI

Courtesy of H. Seligson, MMI Engineering

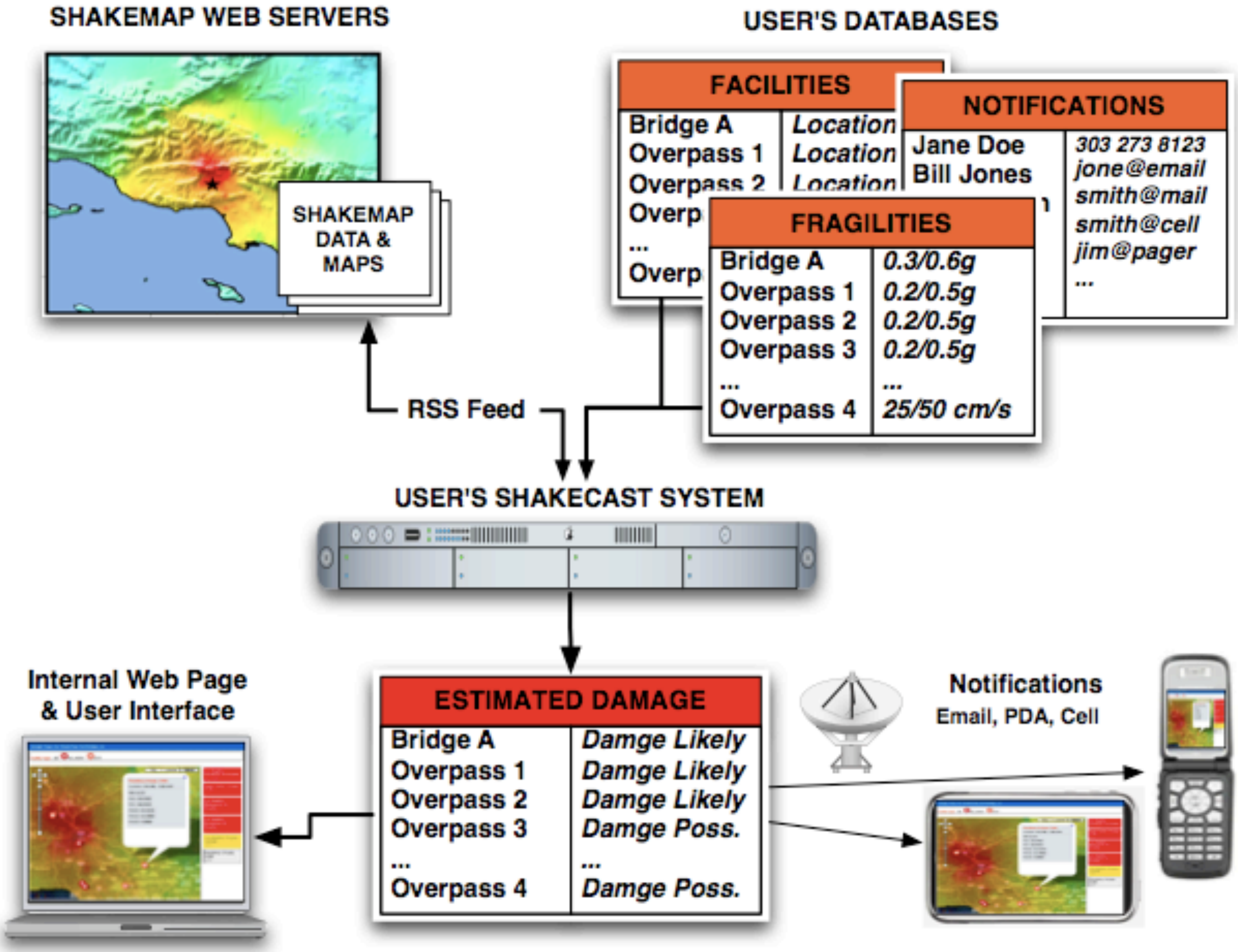
nehrp

ShakeCast

ShakeMap BroadCast — Moving beyond "looking at" ShakeMap

Automatic Damage Assessment for Critical Facilities

GeoResearch Group
Caltrans
Research & Innovation

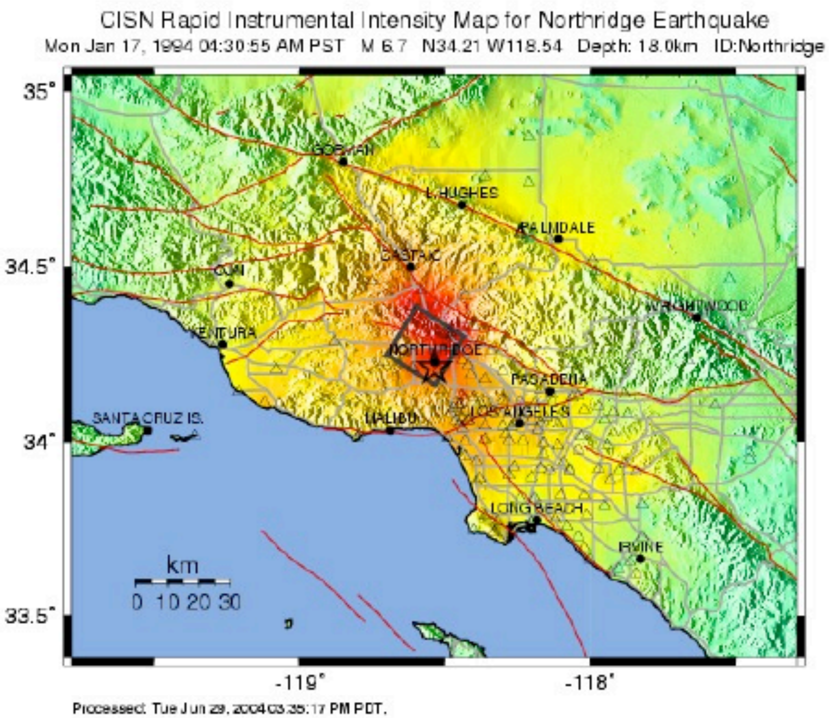

SHAKEMAP WEB SERVERS
SHAKEMAP DATA & MAPS
USER'S DATABASES
FACILITIES
Bridge A
Overpass 1
Overpass 2
Location
Location
NOTIFICATIONS
Jane Doe
Bill Jones
303 273 8123
jone@email
smith@mail
smith@cell
jim@pager
...
FRAGILITIES
Bridge A 0.3/0.6g
Overpass 1 0.2/0.5g
Overpass 2 0.2/0.5g
Overpass 3 0.2/0.5g
... ...
Overpass 4 25/50 cm/s
RSS Feed
USER'S SHAKECAST SYSTEM
Internal Web Page & User Interface
ESTIMATED DAMAGE
Bridge A Damge Likely
Overpass 1 Damge Likely
Overpass 2 Damge Likely
Overpass 3 Damge Poss.
... ...
Overpass 4 Damge Poss.
Notifications
Email, PDA, Cell

Caltrans ShakeCast Server (C) <Loren.Turner@dot.ca.gov>
03/23/2009 02:53 PM

To Caltrans-ShakeCastAdmin@dot.ca.gov
cc
Subject BRIDGE ASSESSMENT: 6.7, Northridge (Northridge_scte Version 1)

Caltrans ShakeCast Preliminary Earthquake Bridge Impact Report

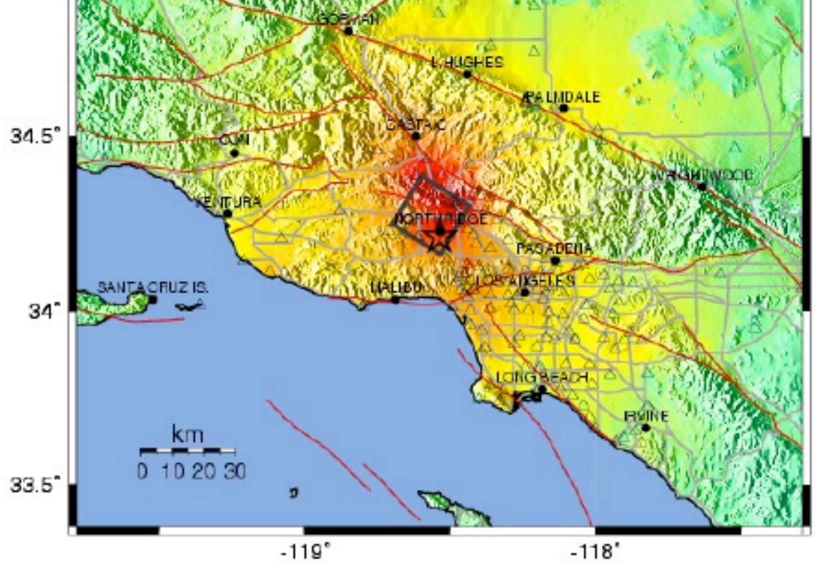
This report supersedes any earlier reports about this event. This is a computer-generated message and has not yet been reviewed by an Engineer or Seismologist. Information about the epicenter, magnitude, location, date, and time are provided by the California Integrated Seismic Network. The analysis of bridge inspection priorities in this report is based upon an initial unverified ShakeMap and estimated fragilities for Caltrans bridges using FEMA's 2003 HAZUS-MH MR3 Multi-hazard Loss Estimation Methodology. This report is intended to be used as a first response tool to assist in identifying Caltrans bridges most likely impacted by the event. The collection, compilation and engineering assessment of bridge condition is the responsibility of Caltrans Structures Maintenance & Investigations. More information on bridge assessment protocols can be found in the 2006 SM&I Emergency Response Plan. Questions about ShakeCast or this email report can be directed to Loren Turner at (916) 227-7174 or by email.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Event Summary

Name: (Unnamed Event) Version 1



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Event Summary

Name: (Unnamed Event) , Version 1
Magnitude: 6.7
ID: Northridge_scte-1
Location: Northridge
Latitude: 34.213
Longitude: -118.5357
Time: 1994-01-17 12:30:55 GMT

Downloads & Resources

- View an interactive version of this report on the Caltrans ShakeCast Website. (Login with username: *guest* , password: *guest* .)
- Download ArcGIS shapefiles, GoogleEarth KML files, and other products from the Caltrans ShakeCast Products directory.
- Download the Statewide Bridge Inventory as a GoogleEarth KML file.
- Download the bridge priority list as an Excel Spreadsheet.

Bridge Assessment Summary

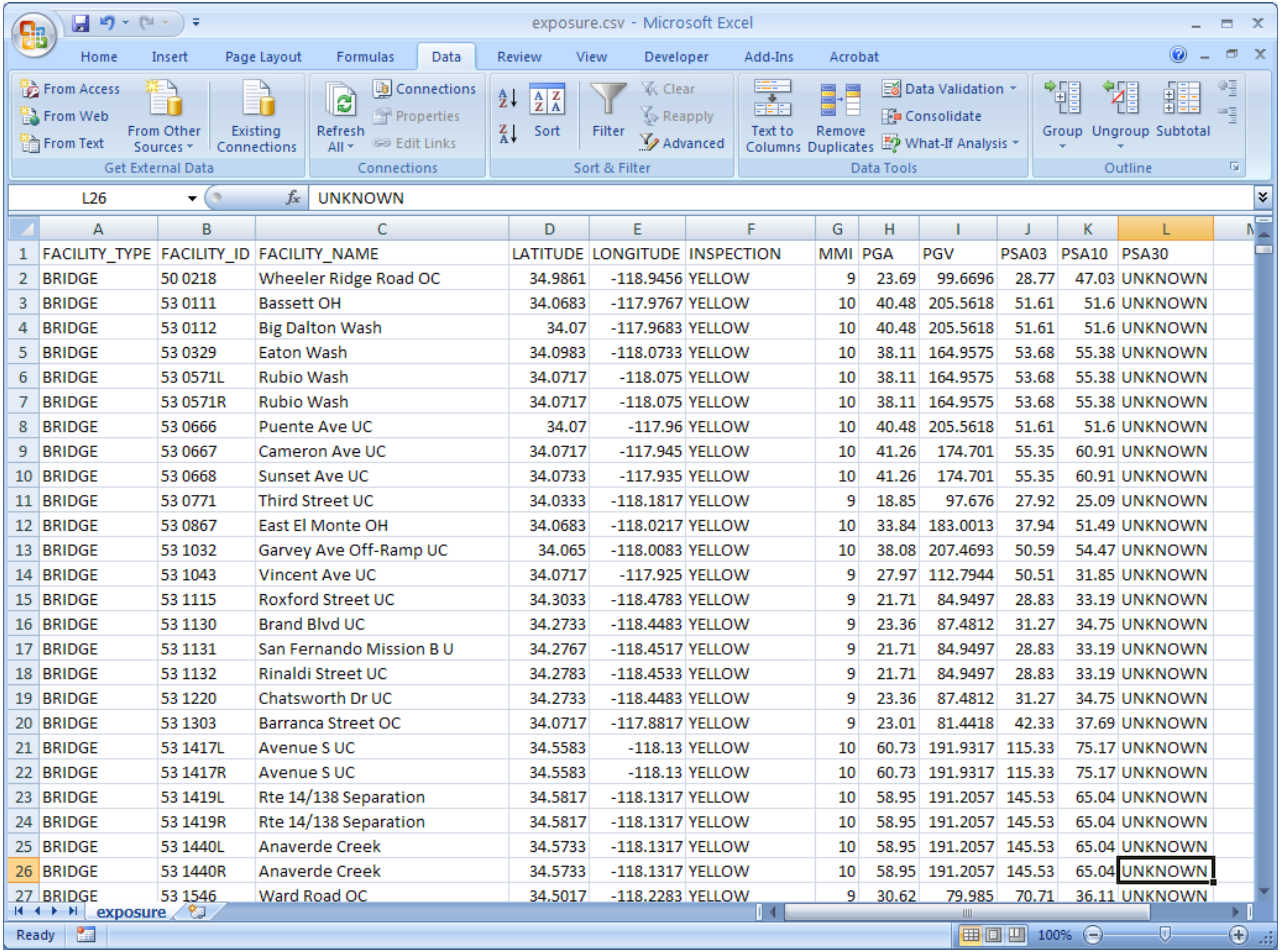
Maximum Peak 1.0 sec Spectral Acceleration: 198.7484%g
Maximum Acceleration: (not measured)
Total number of bridges assessed: **2448**
Summary by inspection priority:

High	16	High Priority for full engineering assessment
Medium-High	35	Medium-High Priority for full engineering assessment
Medium	53	Medium Priority for full engineering assessment
Low	2344	Low Priority for full engineering assessment; quick visual inspection likely sufficient.

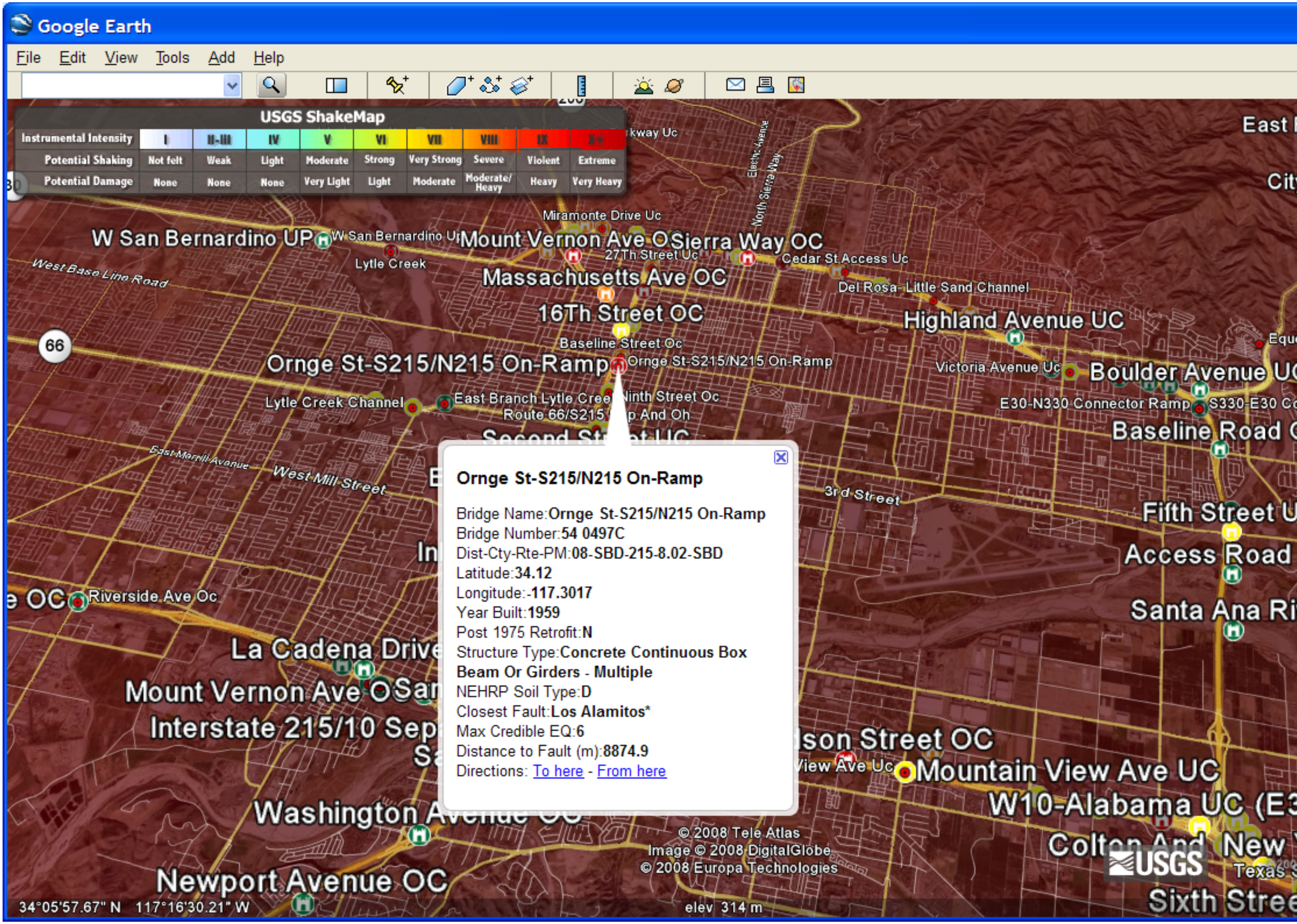
Bridge Assessment Details

Bridges presented in the table below are sorted in order of severity of impact(exceedance ratio). The list includes all state bridges in the area of shaking where the 1sec Peak Spectral Acceleration exceeds 10% g.

Bridge Name	Bridge Number	Dist-Cty-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%g)	Exceedance Ratio
53 1548 - ROUTE 5T/405 SEPARATION	53 1548	07-LA-005-41.55-LA	High	127.2633	1.686
53 2217H - E118-S405 CONNECTOR UC	53 2217H	07-LA-118-R9.74-LA	High	140.0625	1.569
53 2204 - HAYVENHURST AVENUE UC	53 2204	07-LA-118-R8.34-LA	High	198.7484	1.378
53 1133 - ROUTE 5/405 SEPARATION	53 1133	07-LA-005-41.57-LA	High	127.2633	1.347
53 1013 - SIERRA HIGHWAY OC	53 1013	07-LA-014-24.3	High	115.578	1.257
53 2793R - MISSION-GOTHIC UC	53 2793R	07-LA-118-R8.63-LA	High	198.7484	1.202
53 2793L - MISSION-GOTHIC UC	53 2793L	07-LA-118-R8.63-LA	High	198.7484	1.184
53 1991F - NORTH CONNECTOR OC	53 1991F	07-LA-210-R.02-LA	High	129.9639	1.144
53 2207 - WOODLEY AVENUE UC	53 2207	07-LA-118-R9.04-LA	High	171.7947	1.138
53 1011 - LOS ANGELES AQUEDUCT CHANNEL	53 1011	07-LA-005-R44.4-LA	High	131.0299	1.031
53 2794L - BULL CREEK CANYON CHANNEL	53 2794L	07-LA-118-R8.84-LA	High	171.7947	1.025
53 2794R - BULL CREEK CANYON CHANNEL	53 2794R	07-LA-118-R8.84-LA	High	171.7947	1.025
53 2016L - FOOTHILL BLVD UC	53 2016L	07-LA-210-R.43-LA	High	129.9639	1.018
53 2016R - FOOTHILL BLVD UC	53 2016R	07-LA-210-R.43-LA	High	129.9639	1.018
53 2208 - GAYNOR AVENUE UC	53 2208	07-LA-118-R9.33-LA	High	171.7947	1.017
53 1012 - LOS ANGELES AQUEDUCT PENSTOCK	53 1012	07-LA-005-R44.41-LA	High	131.0299	1.005
53 1984L - WEST SYLMAR OH	53 1984L	07-LA-005-R44.87-LA	Medium-High	115.578	0.923
53 1983 - S5TRUCK-S5 UC	53 1983	07-LA-005-R44.81	Medium-High	115.578	0.869
53 2925 - SANTA CLARA RIVER BRIDGE	53 2925	07-LA-005-R53.7-SCTA	Medium-High	144.1786	0.811
53 0996L - WELDON CANYON ROAD UC	53 0996L	07-LA-005-C45.86	Medium-High	115.578	0.691
53 1519M - EAST CANYON CHANNEL	53 1519M	07-LA-005-40.53-LA	Medium-High	122.517	0.514
53 1988F - W210-S5 CONNECTOR SEPARATION	53 1988F	07-LA-210-R.12-LA	Medium-High	129.9639	0.436
53 0688 - SANTA CLARA OVERHEAD	53 0688	07-LA-005-R53.94-SCTA	Medium-High	144.1786	0.430
53 2209 - HASKELL AVENUE UC	53 2209	07-LA-118-R9.57-LA	Medium-High	140.0625	0.401
53 2210G - E118-S405 CONNECTOR UC	53 2210G	07-LA-118-R9.7-LA	Medium-High	140.0625	0.401
53 1986 - BALBOA BLVD OC	53 1986	07-LA-005-R44.43	Medium-High	131.0299	0.355
53 1989F - W210-S5 CONNECTOR OC	53 1989F	07-LA-210-R.06-LA	Medium-High	129.9639	0.353
53 1506 - RINALDI STREET UC	53 1506	07-LA-405-47.75-LA	Medium-High	134.893	0.339
53 2214 - CHATSWORTH DRIVE UC	53 2214	07-LA-118-R10.51-LA	Medium-High	111.3769	0.323
53 2215 - FOX STREET UC	53 2215	07-LA-118-R10.83-LA	Medium-High	111.3769	0.323
53 1961G - N5 TRK-N14 CONNECTOR	53 1961G	07-LA-005-C45.63-LA	Medium-High	115.578	0.312
53 1507 - SAN FERNANDO MISSION BLVD	53 1507	07-LA-405-47.24-LA	Medium-High	134.893	0.303
53 1688 - RYE CANYON ROAD UNDERCROSSING	53 1688	07-LA-005-R54.17-SCTA	Medium-High	144.1786	0.303
53 0849 - WELDON CANYON OH	53 0849	07-LA-005-C45.75	Medium-High	115.578	0.270
53 1501 - CHATSWORTH STREET UC	53 1501	07-LA-405-46.74-LA	Medium-High	140.0625	0.242
53 2396 - RUFFNER AVENUE OC	53 2396	07-LA-118-R8.05-LA	Medium-High	175.6548	0.239
53 0730 - SAN FERNANDO ROAD OH	53 0730	07-LA-005-R43.84-LA	Medium-High	129.9639	0.230
53 2139M - WILEY CANYON CHANNEL	53 2139M	07-LA-005-R49.2	Medium-High	91.7766	0.196
53 2216G - N405-E&W118 CONNECTOR OC	53 2216G	07-LA-405-46.8-LA	Medium-High	140.0625	0.151
53 1131 - SAN FERNANDO MISSION BOULEVARD UC	53 1131	07-LA-005-40.24-LA	Medium-High	122.517	0.079
53 2343G - E118-S5 CONNECTOR OC	53 2343G	07-LA-118-R11.32-LA	Medium-High	111.3769	0.077
53 2357 - ARLETA AVENUE UC	53 2357	07-LA-118-R11.05-LA	Medium-High	111.3769	0.077
53 2395 - BALBOA BLVD OC	53 2395	07-LA-118-R7.8-LA	Medium-High	175.6548	0.069
53 2788 - NEWHALL CREEK	53 2788	07-LA-126-10.57-SCTA	Medium-High	114.867	0.069



	A	B	C	D	E	F	G	H	I	J	K	L
1	FACILITY_TYPE	FACILITY_ID	FACILITY_NAME	LATITUDE	LONGITUDE	INSPECTION	MMI	PGA	PGV	PSA03	PSA10	PSA30
2	BRIDGE	50 0218	Wheeler Ridge Road OC	34.9861	-118.9456	YELLOW	9	23.69	99.6696	28.77	47.03	UNKNOWN
3	BRIDGE	53 0111	Bassett OH	34.0683	-117.9767	YELLOW	10	40.48	205.5618	51.61	51.6	UNKNOWN
4	BRIDGE	53 0112	Big Dalton Wash	34.07	-117.9683	YELLOW	10	40.48	205.5618	51.61	51.6	UNKNOWN
5	BRIDGE	53 0329	Eaton Wash	34.0983	-118.0733	YELLOW	10	38.11	164.9575	53.68	55.38	UNKNOWN
6	BRIDGE	53 0571L	Rubio Wash	34.0717	-118.075	YELLOW	10	38.11	164.9575	53.68	55.38	UNKNOWN
7	BRIDGE	53 0571R	Rubio Wash	34.0717	-118.075	YELLOW	10	38.11	164.9575	53.68	55.38	UNKNOWN
8	BRIDGE	53 0666	Puente Ave UC	34.07	-117.96	YELLOW	10	40.48	205.5618	51.61	51.6	UNKNOWN
9	BRIDGE	53 0667	Cameron Ave UC	34.0717	-117.945	YELLOW	10	41.26	174.701	55.35	60.91	UNKNOWN
10	BRIDGE	53 0668	Sunset Ave UC	34.0733	-117.935	YELLOW	10	41.26	174.701	55.35	60.91	UNKNOWN
11	BRIDGE	53 0771	Third Street UC	34.0333	-118.1817	YELLOW	9	18.85	97.676	27.92	25.09	UNKNOWN
12	BRIDGE	53 0867	East El Monte OH	34.0683	-118.0217	YELLOW	10	33.84	183.0013	37.94	51.49	UNKNOWN
13	BRIDGE	53 1032	Garvey Ave Off-Ramp UC	34.065	-118.0083	YELLOW	10	38.08	207.4693	50.59	54.47	UNKNOWN
14	BRIDGE	53 1043	Vincent Ave UC	34.0717	-117.925	YELLOW	9	27.97	112.7944	50.51	31.85	UNKNOWN
15	BRIDGE	53 1115	Roxford Street UC	34.3033	-118.4783	YELLOW	9	21.71	84.9497	28.83	33.19	UNKNOWN
16	BRIDGE	53 1130	Brand Blvd UC	34.2733	-118.4483	YELLOW	9	23.36	87.4812	31.27	34.75	UNKNOWN
17	BRIDGE	53 1131	San Fernando Mission B U	34.2767	-118.4517	YELLOW	9	21.71	84.9497	28.83	33.19	UNKNOWN
18	BRIDGE	53 1132	Rinaldi Street UC	34.2783	-118.4533	YELLOW	9	21.71	84.9497	28.83	33.19	UNKNOWN
19	BRIDGE	53 1220	Chatsworth Dr UC	34.2733	-118.4483	YELLOW	9	23.36	87.4812	31.27	34.75	UNKNOWN
20	BRIDGE	53 1303	Barranca Street OC	34.0717	-117.8817	YELLOW	9	23.01	81.4418	42.33	37.69	UNKNOWN
21	BRIDGE	53 1417L	Avenue S UC	34.5583	-118.13	YELLOW	10	60.73	191.9317	115.33	75.17	UNKNOWN
22	BRIDGE	53 1417R	Avenue S UC	34.5583	-118.13	YELLOW	10	60.73	191.9317	115.33	75.17	UNKNOWN
23	BRIDGE	53 1419L	Rte 14/138 Separation	34.5817	-118.1317	YELLOW	10	58.95	191.2057	145.53	65.04	UNKNOWN
24	BRIDGE	53 1419R	Rte 14/138 Separation	34.5817	-118.1317	YELLOW	10	58.95	191.2057	145.53	65.04	UNKNOWN
25	BRIDGE	53 1440L	Anaverde Creek	34.5733	-118.1317	YELLOW	10	58.95	191.2057	145.53	65.04	UNKNOWN
26	BRIDGE	53 1440R	Anaverde Creek	34.5733	-118.1317	YELLOW	10	58.95	191.2057	145.53	65.04	UNKNOWN
27	BRIDGE	53 1546	Ward Road OC	34.5017	-118.2283	YELLOW	9	30.62	79.985	70.71	36.11	UNKNOWN


Google Earth
File Edit View Tools Add Help
USGS ShakeMap
Instrumental Intensity | I | II-III | IV | V | VI | VII | VIII | IX | X+
Potential Shaking | Not felt | Weak | Light | Moderate | Strong | Very Strong | Severe | Violent | Extreme
Potential Damage | None | None | None | Very Light | Light | Moderate | Moderate/Heavy | Heavy | Very Heavy
W San Bernardino UP
Mount Vernon Ave O
Sierra Way OC
Massachusetts Ave OC
16Th Street OC
Highland Avenue UC
Ornge St-S215/N215 On-Ramp
Boulder Avenue UC
Baseline Road
Fifth Street U
Access Road
Santa Ana Ri
La Cadena Drive
Mount Vernon Ave O
Interstate 215/10 Sep
Mountain View Ave UC
W10-Alabama UC
Washington Avenue OC
Newport Avenue OC
Riverside Ave Oc
Lytle Creek Channel
East Branch Lytle Cree
Ninth Street Oc
Miramonte Drive Uc
27Th Street Uc
Cedar St Access Uc
Del Rosa-Little Sand Channel
Baseline Street Oc
Victoria Avenue Uc
E30-N330 Connector Ramp
West Base Line Road
West Mill Street
East Merrill Avenue
3rd Street
Lytle Creek
66
Ornge St-S215/N215 On-Ramp
Bridge Name:Ornge St-S215/N215 On-Ramp
Bridge Number:54 0497C
Dist-Cty-Rte-PM:08-SBD-215-8.02-SBD
Latitude:34.12
Longitude:-117.3017
Year Built:1959
Post 1975 Retrofit:N
Structure Type:Concrete Continuous Box Beam Or Girders - Multiple
NEHRP Soil Type:D
Closest Fault:Los Alamitos*
Max Credible EQ:6
Distance to Fault (m):8874.9
Directions: To here - From here
© 2008 Tele Atlas
Image © 2008 DigitalGlobe
© 2008 Europa Technologies
USGS
34°05'57.67" N 117°16'30.21" W
elev 314 m

Scenario Questions Posed:

Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

1. What tools are you using to portray disaster impacts in a meaningful way?

2. Can the same scenarios be used for mitigation & response planning? What specific elements do you need for one as opposed to the other?

3. Some scenarios are highly technical & depend on cutting edge scientific & engineering input. Are more comprehensive scenarios more effective in bringing about the desired behavior of members of the technical & emergency management communities, educate the general public, and policy makers? How are scenarios modified for different audiences & what techniques help to get buy in & ownership of a scenario.

4. Are you aware of any post scenario evaluations that have determined effectiveness in changing behavior/attitudes, etc? Have you attempted to evaluate the materials you have created?

5. What technical, financial, or information resources exist for communities, agencies, or organizations wishing to develop their own scenarios?

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Scenario Questions Posed:

Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

1. What tools are you using to portray disaster impacts in a meaningful way?
   ShakeMap + HAZUS, ShakeCast, or PAGER, etc.

2. Can the same scenarios be used for mitigation & response planning? What specific elements do you need for one as opposed to the other?
   Yes & No: Depends on scale of analyses, users, uses.

3. Some scenarios are highly technical & depend on cutting edge scientific & engineering input. Are more comprehensive scenarios more effective in bringing about the desired behavior of members of the technical & emergency management communities, educate the general public, and policy makers? How are scenarios modified for different audiences & what techniques help to get buy in & ownership of a scenario.
   Input must be realistic but not overdone; that said, benefits come from efforts to inlist users.

4. Aware of or attempted to evaluate the materials you have created? No formal analyses; plenty of annectdotal feedback leads to new approaches.

5. What technical, financial, or information resources exist for communities, agencies, or organizations wishing to develop their own scenarios? Comprehensive ShakeMap/HAZUS/ShakeCast collection will be available based on input from regional users/local experts. Responders need to practice/plan with same tools that will be available after an earthquake!

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Closing thoughts:

Quote from President and military leader, Dwight D. Eisenhower:

> “In preparing for battle I have always found that plans are useless, but planning is indispensable.”

Quote from Professor Hiroo Kanamori:

> “If the next big earthquake [in California] was expected, that would be unexpected.”

Thank You

http://earthquake.usgs.gov

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