

A ShakeCast User's Observations on the Benefits of Situational Awareness for Seismic Risk Management

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Caltrans

Division of Research & Innovation

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U.S. Geological Survey



ShakeCast Overview

- ▶ Project History
 - ▶ What is it?
 - ▶ What does it provide to responders?
 - ▶ How does it work?
 - ▶ How has Caltrans benefitted?
- 

History

- ▶ 1996 – ShakeMap introduced
 - ▶ 1999 – NT&R proposes “simple” method for assessing bridge impacts using ShakeMap and ArcView
 - ▶ 2003 – ShakeCast Version 1 developed; Caltrans beta tester
 - ▶ 2005 – Caltrans contracts with USGS
 - ▶ 2008 – ShakeCast Version 2 released
- 

Project Details

- ▶ Contract with the United States Geological Survey (USGS) commenced in 2006.
- ▶ Scope of Work – develop ShakeCast system that provides:
 - Automated earthquake and bridge performance analysis
 - Produce maps and bridge inspection priority lists.
 - Web-based interface to administer system and provide suite of products to users.



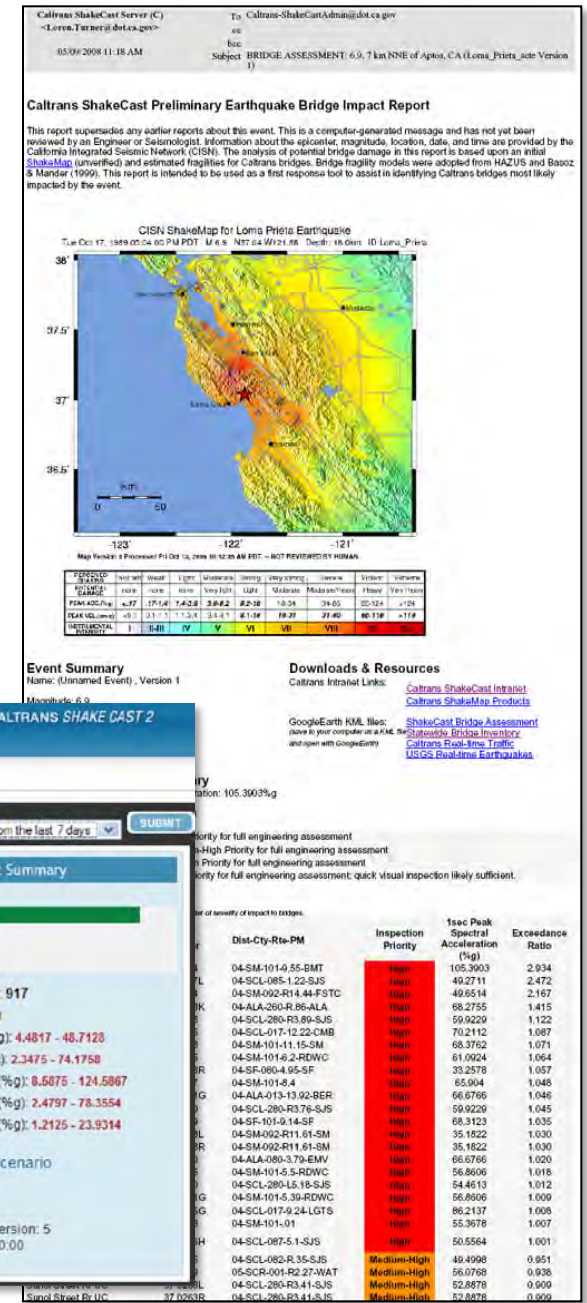
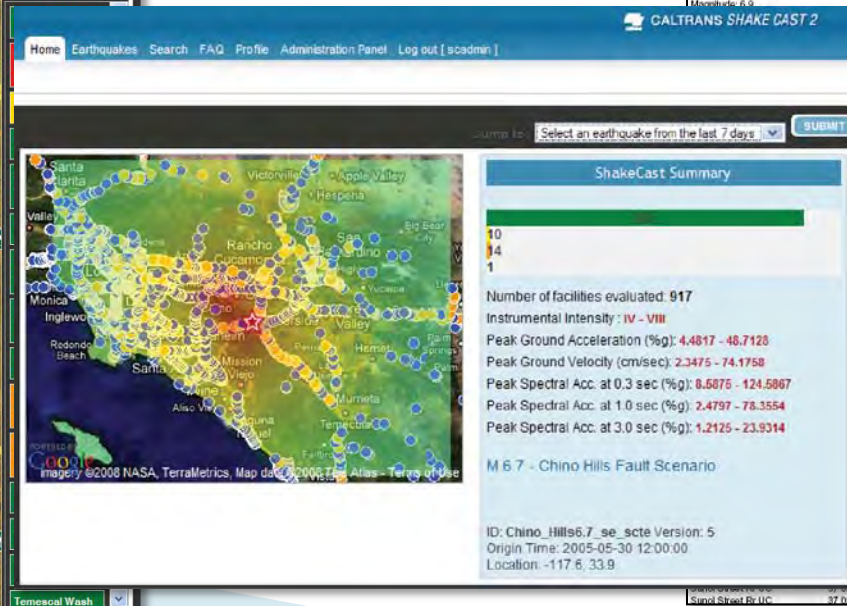
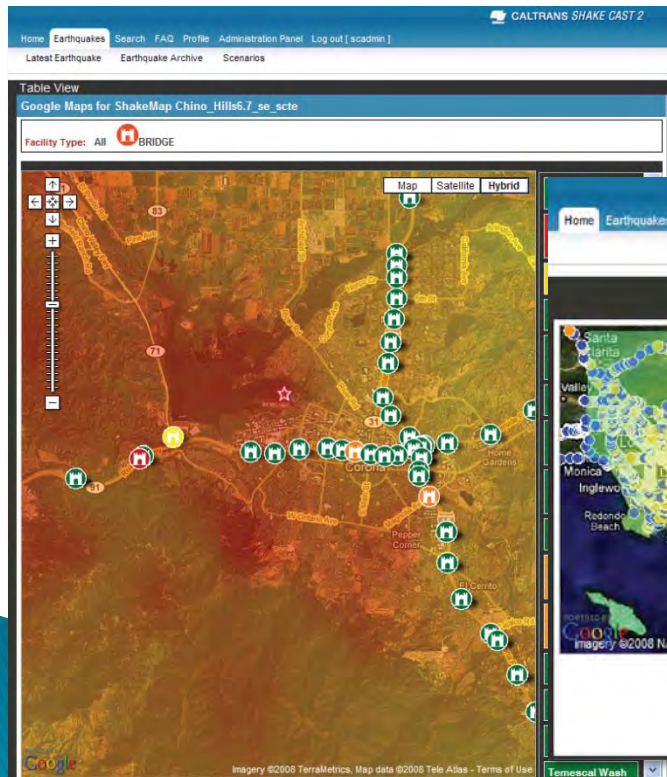
ShakeCast

- ▶ Suite of software that runs on a web server
- ▶ Retrieves measured shaking data within minutes after an earthquake
- ▶ Compares shaking distribution with unique bridge vulnerabilities
- ▶ Provides hierarchical lists and maps of bridges most likely impacted
- ▶ Emails info to responders within 10 to 15 minutes following event
- ▶ Provides suite of tools on ShakeCast website

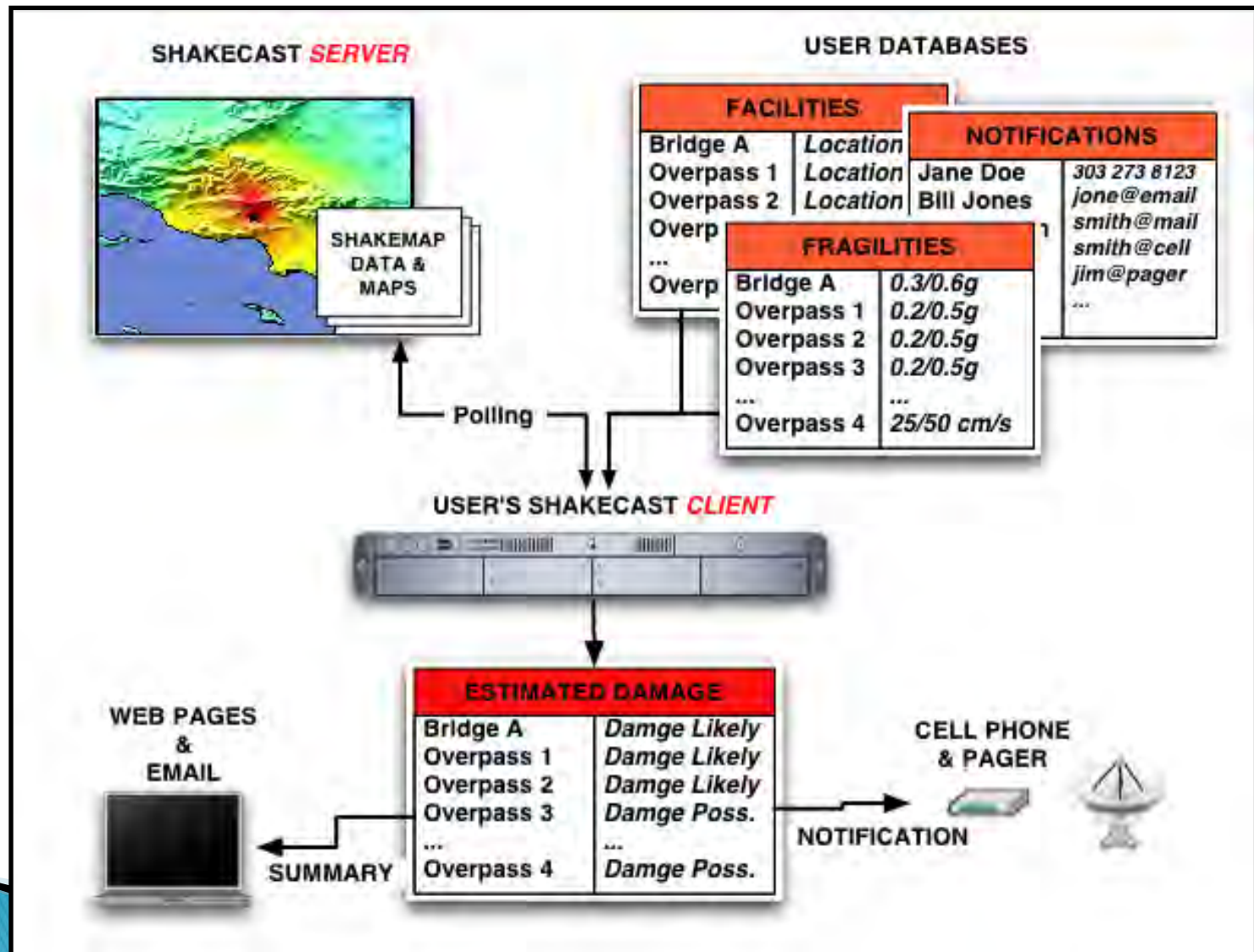


ShakeCast

- Provides situational awareness after an earthquake.
- Represents the most reliable information within the first minutes to hours following an event.



System Overview



ShakeCast Technologies

- ▶ Developed using open-source tools:
 - WAMP stack
 - Windows (Server 2003)
 - Apache
 - MySQL
 - PHP
 - Perl
 - Javascript
 - RSS
 - GoogleMaps API
- ▶ Stand-alone version can run the stack off a flash drive.



ShakeCast Products

- ▶ Email notification
 - ▶ ShakeCast Website
 - ▶ GoogleEarth products
 - ▶ Other products
- 

Email Notifications

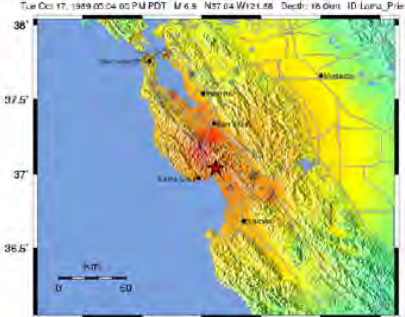
- ▶ ShakeMaps available 5–10 minutes after an earthquake.
- ▶ “NEW EVENT” messages sent out by ShakeCast as soon as ShakeMaps are generated.
- ▶ “BRIDGE ASSESSMENT” messages are sent within 1 minute from receipt of ShakeMaps.
- ▶ 10–15 minutes total.

Caltrans ShakeCast Server (C) To: Caltrans-ShakeCastAdmin@dot.ca.gov
cc: Loren.Turner@dot.ca.gov
05/09/2008 11:18 AM bcc: BRIDGE ASSESSMENT: 6.9, 7 km NNE of Aptos, CA (Loma Prieta Version 1)
Subject:

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 (CISN). The analysis of potential bridge damage in this report is based upon an initial [ShakeMap](#) (unverified) and estimated fragilities for Caltrans bridges. Bridge fragility models were adopted from HAZUS and Basoz & Mander (1999). This report is intended to be used as a first response tool to assist in identifying Caltrans bridges most likely impacted by the event.

CISN ShakeMap for Loma Prieta Earthquake
Tue Oct 17, 1989 05:04:05 PM PDT M 6.9 N17.64 W121.86 Depth: 16.0 km ID: Loma_Prieta



Map Version: 3 Processed Fri Oct 16, 2008 10:12:25 AM EDT - NOT REVIEWED BY HUMAN

Intensity	Peak Acc.	Peak Vel.	Peak Disp.	Peak Acc. (mm/s²)	Peak Vel. (mm/s)	Peak Disp. (mm)
II	0.17	17.14	1.42	3.98	82.38	10.34
III	0.11	11.11	0.91	2.52	53.55	6.67
IV	0.07	7.07	0.57	1.68	35.70	4.44
V	0.04	4.04	0.38	1.12	23.80	2.96
VI	0.02	2.02	0.25	0.74	15.87	1.97
VII	0.01	1.01	0.16	0.49	10.58	1.31
VIII	0.00	0.00	0.00	0.00	0.00	0.00

Event Summary
Name: (Unnamed Event), Version 1
Magnitude: 6.9
ID: Loma_Prieta_sca-1
Location: 7 km NNE of Aptos, CA
Latitude: 37.04
Longitude: -121.88
Time: 1989-10-18 05:04:05 GMT

Downloads & Resources
Caltrans Intranet Links: [Caltrans ShakeCast Intranet](#), [Caltrans ShakeMap Products](#)
GoogleEarth KMZ files: [ShakeCast Bridge Assessment](#), [ShakeCast Bridge Inventory](#), [Caltrans Real-time Traffic](#), [USGS Real-time Earthquakes](#)

Bridge Assessment Summary
Maximum Peak 1.0 sec Spectral Acceleration: 105.3603%
Maximum Acceleration: (not measured)
Total number of bridges assessed: 2030
Summary by inspection priority:

Priority	Count	Description
High	22	High Priority for full engineering assessment
Medium-High	107	Medium-High Priority for full engineering assessment
Medium	106	Medium Priority for full engineering assessment
Low	1795	Low Priority for full engineering assessment; quick visual inspection likely sufficient.

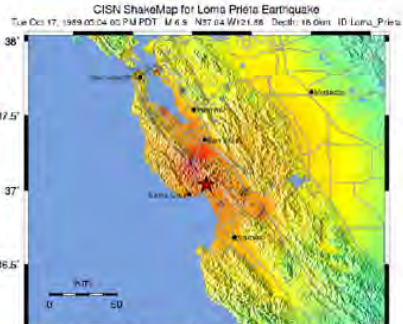
Bridge Assessment Details
Bridges presented in the table below are sorted in order of severity of impact to bridges.

Bridge Name	Bridge Number	Dist-City-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%)	Exceedance Ratio
Raton Avenue OC	35 0114	04-SM-101-4.55-BMT	High	105.3603	2.934
Via Del Oro OH	37 0477L	04-SCL-085-1.22-SJS	High	49.2711	2.472
San Mateo-Hayward Bridge	35 0054	04-SM-002-R14.44-FSTC	High	49.6514	2.167
Constitution Way OC	33 0513K	04-ALA-260-R.86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0258	04-SCL-280-R3.89-SJS	High	59.9229	1.122
Campbell Underpass	37 0135	04-SCL-017-12.22-CMB	High	70.2112	1.087
East Hillsdale Blvd OC	35 0138	04-SM-101-11.15-SM	High	68.3762	1.071
Redwood Creek	35 0145	04-SM-101-6.2-RDWC	High	61.0924	1.064
Stebb-Approach Lower Deck	34 0118R	04-SF-080-4.95-SF	High	33.2578	1.057
Holly Street OC	35 0037	04-SM-101-8.4	High	65.004	1.048
Route 1380 Separation (North)	33 0191G	04-ALA-013-13.92-BER	High	66.6766	1.046
Race Street Overcrossing	37 0260	04-SCL-280-R3.76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-9.14-SF	High	68.3123	1.035
South Delaware Street UC	35 0158L	04-SM-002-R11.61-SM	High	35.1822	1.030
South Delaware Street UC	35 0158R	04-SM-002-R11.61-SM	High	35.1822	1.030
Powell Street UC	33 0020	04-ALA-080-3.79-EMV	High	66.6766	1.020
Redwood Harbor Overhead	35 0065	04-SM-101-5.5-RDWC	High	56.8606	1.018
MacArthur Avenue OC	37 0100	04-SCL-280-L5.18-SJS	High	54.4613	1.012
N101-S84 Connector OC	35 0081G	04-SM-101-5.39-RDWC	High	56.8906	1.009
N171-S85 Connector Separation	37 0515G	04-SCL-017-24-LGT5	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678	1.007
N5587-S280 Connector Separation	37 0396H	04-SCL-087-5.1-SJS	High	50.5564	1.001
Blossom Hill Road OC	37 0345	04-SCL-082-R.35-SJS	Medium-High	49.4998	0.951
Hawkins Slough Road OC	35 0069	05-SCL-R01-R2.27-WAT	Medium-High	36.0768	0.938
Sand Street Br UC	37 0263L	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909
Sand Street Br UC	37 0263R	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909

Caltrans ShakeCast Server (C)
-Loren.Turner@dot.ca.gov-
05/09/2009 11:18 AM
To: Caltrans-ShakeCastAdmin@dot.ca.gov
cc:
bcc:
Subject: BRIDGE ASSESSMENT: 6.9, 7 km SSE of Aptos, CA (Loma_Prima_20090509_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 (CISN). The analysis of potential bridge damage in this report is based upon an initial [ShakeMap](#) (unverified) and estimated fragilities for Caltrans bridges. Bridge fragility models were adopted from HAZUS and Basoz & Mander (1999). This report is intended to be used as a first response tool to assist in identifying Caltrans bridges most likely impacted by the event.



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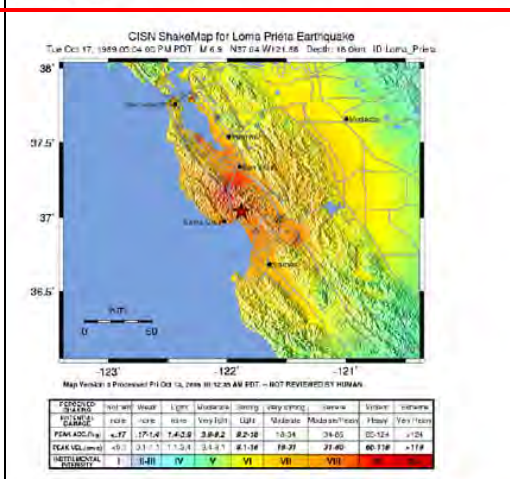
Event Name
Magnitude
Location
Latitude
Longitude
Time, H
Bridge
Maximum
Total no
Summary
High
Medium
Low
Bridge
ShakeMap
Bridge

			(g)	
Palston Avenue OC	35 0114	04-SM-101-9-55-BMT	High	105.3903
Via Del Oro OH	37 0477L	04-SCL-085-1-22-SJS	High	49.2711
San Mateo-Hayward Bridge	35 0054	04-SM-092-R14-44-FSTC	High	49.6514
Constitution Way OC	33 0513K	04-ALA-260-R-86-ALA	High	68.2755
Meridian Road Underpass	37 0258	04-SCL-280-R3-89-SJS	High	59.9229
Campbell Underpass	37 0135	04-SCL-017-12-22-CMB	High	70.2112
East Hillside Blvd OC	35 0138	04-SM-101-11-15-SM	High	68.3752
Redwood Creek	35 0145	04-SM-101-6-2-RDWC	High	61.9924
Steele-Approach Lower Deck	34 0118R	04-SF-080-4-95-SF	High	33.2578
Holly Street OC	35 0037	04-SM-101-8-4	High	65.904
Route 1380 Separation (North)	33 0191G	04-ALA-013-13-02-BER	High	66.8786
Race Street Overcrossing	37 0200	04-SCL-280-R3-76-SJS	High	59.9229
Presidio Viaduct	34 0019	04-SF-101-9-14-SF	High	68.3123
South Delaware Street UC	35 0158L	04-SM-092-R11-61-SM	High	35.1522
South Delaware Street UC	35 0158R	04-SM-092-R11-61-SM	Low	35.1522
Powell Street UC	33 0020	04-ALA-080-3-79-EMV	High	66.6766
Redwood Harbor Overhead	35 0065	04-SM-101-5-3-RDWC	High	56.8606
Macarthur Avenue OC	37 0100	04-SCL-280-L5-18-SJS	High	54.4613
N101-S84 Connector OC	35 0081G	04-SM-101-5-39-RDWC	High	56.8606
M17-N85 Connector Separation	37 0515G	04-SCL-017-9-24-LGT5	High	86.2137
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678
N85-S7-5280 Connector Separation	37 0366H	04-SCL-087-5-1-SJS	High	50.5564
Blossom Hill Road OC	37 0345	04-SCL-082-R-35-SJS	Medium-High	49.4998
Harkins Slough Road OC	36 0080	05-SCR-001-R2-27-WAT	Medium-High	56.0768
Sunset Street R-UC	37 0263L	04-SCL-280-R3-41-SJS	Medium-High	52.8878
Sunset Street R-UC	37 0263R	04-SCL-280-R3-41-SJS	Medium-High	52.8878

Caltrans ShakeCast Server (C)
-Loren.Turner@dot.ca.gov-
05/09/2004 11:18 AM
Subject: BRIDGE ASSESSMENT: 6.9, 7 km NNE of Aptos, CA (Loma_Prieta_ade_Version 1)

Caltrans ShakeCast Preliminary Earthquake Bridge Impact Report

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Event Summary

Name: (Unnamed Event), Version 1
Magnitude: 6.9
ID: Loma Prieta, sds-1
Location: 7 km NNE of Aptos, CA
Latitude: 37.04
Longitude: -121.88
Time: 1989-10-18 05:04:00 GMT

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 105.3003%g
Maximum Acceleration: (not measured)
Total number of bridges assessed: 2030
Summary by inspection priority:

High	22	High Priority for full engineering assessment
Medium-High	107	Medium-High Priority for full engineering assessment
Medium	106	Medium Priority for full engineering assessment
Low	1795	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 to bridges.

Bridge Name	Bridge Number	Dist-City-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%g)	Exceedance Ratio
Relston Avenue OC	35 0114	04-SM-101-A-55-BMT	High	105.3003	2.934
Via Del Oro OH	37 0477L	04-SCL-085-1-22-SJS	High	49.2711	2.472
San Mateo-Hayward Bridge	35 0054	04-SM-092-R14-44-FSTC	High	49.6514	2.167
Constitution Way OC	33 0513K	04-ALA-260-R-86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0256	04-SCL-280-R3-80-SJS	High	59.9229	1.122
Campbell Underpass	37 0136	04-SCL-017-12-22-CMB	High	70.2112	1.087
East Hillside Blvd OC	35 0138	04-SM-101-11-15-SM	High	68.3762	1.071
Ridewood Creek	35 0145	04-SM-101-A-2-RDWC	High	61.0924	1.064
Steeb-Approach Lower Deck	34 0118R	04-SF-080-A-95-SF	High	33.2578	1.057
Holly Street OC	35 0037	04-SM-101-B-4	High	65.004	1.048
Route 1380 Separation (North)	33 0191G	04-ALA-013-13-02-BER	High	66.6786	1.046
Race Street Overcrossing	37 0200	04-SCL-280-R3-76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-A-14-SF	High	68.3123	1.035
South Delaware Street UC	35 0156L	04-SM-092-R11-61-SM	High	35.1822	1.030
South Delaware Street UC	35 0156R	04-SM-092-R11-61-SM	High	35.1822	1.030
Powell Street UC	33 0020	04-ALA-080-3-79-EMV	High	66.6786	1.020
Ridewood Harbor Overhead	35 0065	04-SM-101-5-RDWC	High	56.8606	1.018
Macarthur Avenue OC	37 0100	04-SCL-280-L5-18-SJS	High	54.4613	1.012
N101-SB4 Connector OC	35 0081G	04-SM-101-5-39-RDWC	High	56.8606	1.009
M17-NB5 Connector Separation	37 0515G	04-SCL-017-9-24-LGT5	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678	1.007
NB587-SB200 Connector Separation	37 0366H	04-SCL-087-5-1-SJS	High	50.5564	1.001
Blossom Hill Road OC	37 0345	04-SCL-082-R-35-SJS	Medium-High	49.4998	0.951
Harkins Slough Road OC	36 0080	05-SCR-001-R2-27-WAT	Medium-High	56.0768	0.938
Sunset Street R-UC	37 0263L	04-SCL-280-R3-41-SJS	Medium-High	52.8878	0.909
Sunset Street R-UC	37 0263R	04-SCL-280-R3-41-SJS	Medium-High	52.8878	0.909

CISN Rapid Instrumental Intensity Map for Loma Prieta Earthquake Tue Oct 17, 1989 05:04:00 PM PDT M 6.9 N37.04 W121.88 Depth: 18.0km ID:Loma_Prieta

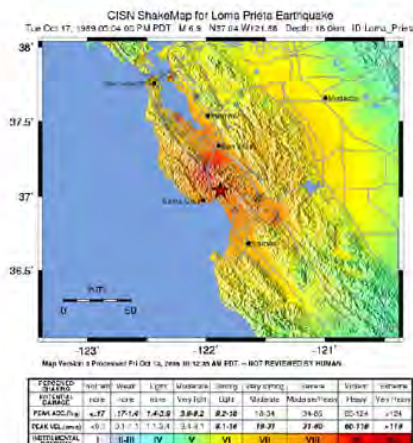


PROCESSED: Thu Nov 6, 2003 05:53:05 AM PST.

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
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

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Event Summary

Name: (Unnamed Event) , Version 1

Magnitude: 6.9
 ID: Loma_Prieta_scte-1
 Location: 7 km NNE of Aptos, CA
 Latitude: 37.04
 Longitude: -121.88
 Time: 1989-10-18 00:04:00 GMT

Downloads & Resources

Caltrans Intranet Links:

[Caltrans ShakeCast Intranet](#)
[Caltrans ShakeMap Products](#)
 GoogleEarth KML files:
 (save to your computer as a KML file and open with GoogleEarth)
[ShakeCast Bridge Assessment](#)
[Statewide Bridge Inventory](#)
[Caltrans Real-time Traffic](#)
[USGS Real-time Earthquakes](#)

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 105.3003g

Maximum Acceleration: (not measured)

Total number of bridges assessed: 2030

Summary by inspection priority:

High 22 High Priority for full engineering assessment
Medium-High 107 Medium-High Priority for full engineering assessment
Medium-Low 106 Medium Priority for full engineering assessment
Low 1795 Low Priority for full engineering assessment; quick visual inspection likely sufficient.

Bridge Assessment Details

Bridges presented in this table below are sorted in order of severity of impact to bridges.

Bridge Name	Bridge Number	Dist-Cty-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (g)	Exceedance Ratio
Palston Avenue OC	35 0114	04-SM-101-A-55-BMT	High	105.3003	2.934
Via Del Oro OH	37 0477L	04-SCL-085-1-22-SJS	High	49.2711	2.472
San Mateo-Highway Bridge	35 0054	04-SM-092-R14-44-FSTC	High	49.6514	2.167
Constitution Way OC	33 0513K	04-ALA-260-R-86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0256	04-SCL-280-R3-80-SJS	High	59.9229	1.122
Campbell Underpass	37 0136	04-SCL-017-12-22-CMB	High	70.2112	1.087
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Holly Street OC	35 0037	04-SM-101-8-4	High	65.904	1.048
Road 1380 Separation (North)	33 0191G	04-ALA-013-13-02-BER	High	66.8786	1.046
Race Street Overcrossing	37 0200	04-SCL-280-R3-76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-9-14-SF	High	68.3123	1.035
South Delaware Street UC	35 0156L	04-SM-092-R11-61-SM	High	35.1822	1.030
South Delaware Street UC	35 0156R	04-SM-092-R11-61-SM	High	35.1822	1.030
Powell Street UC	33 0020	04-ALA-080-3-79-EMV	High	66.6766	1.020
Redwood Harbor Overhead	35 0065	04-SM-101-5-5-RDWC	High	56.8606	1.018
Macarthur Avenue OC	37 0100	04-SCL-280-L5-18-SJS	High	54.4613	1.012
N101-S84 Connector OC	35 0081G	04-SM-101-5-39-RDWC	High	56.8606	1.009
N17-N85 Connector Separation	37 0515G	04-SCL-017-9-24-LGT5	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678	1.007
N85-S7-5280 Connector Separation	37 0366H	04-SCL-087-5-1-SJS	High	50.5564	1.001
Blossom Hill Road OC	37 0345	04-SCL-082-R-35-SJS	Medium-High	49.4998	0.951
Harkins Slough Road OC	36 0080	05-SCR-001-R2-27-WAT	Medium-High	56.0768	0.938
Sunset Street R UC	37 0263L	04-SCL-280-R3-41-SJS	Medium-High	52.8878	0.909
Sunset Street R UC	37 0263R	04-SCL-280-R3-41-SJS	Medium-High	52.8878	0.909

Event Summary

Name: (Unnamed Event) , Version 1

Magnitude: 6.9

ID: Loma_Prieta_scte-1

Location: 7 km NNE of Aptos, CA

Latitude: 37.04

Longitude: -121.88

Time: 1989-10-18 00:04:00 GMT

Downloads & Resources

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[Caltrans ShakeMap Products](#)

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(save to your computer as a KML file
 and open with GoogleEarth)

[ShakeCast Bridge Assessment](#)
[Statewide Bridge Inventory](#)
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[USGS Real-time Earthquakes](#)

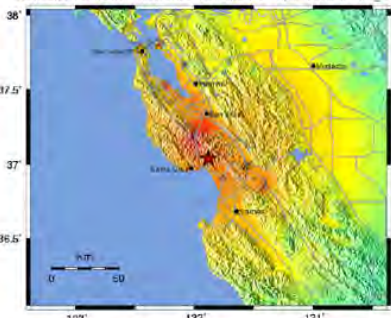
Caltrans ShakeCast Server (C)
-Loren.Turner@dot.ca.gov
05/09/2004 11:18 AM
Subject: BRIDGE ASSESSMENT: 6.9, 7 km NNE of Aptos, CA (Loma_Prieta_04c_Version 1)

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 (CISN). The analysis of potential bridge damage in this report is based upon an initial ShakeMap (unverified) and estimated fragilities for Caltrans bridges. Bridge fragility models were adopted from HAZUS and Baozou & Mander (1999). This report is intended to be used as a first response tool to assist in identifying Caltrans bridges most likely impacted by the event.

CISN ShakeMap for Loma Prieta Earthquake

Tue Oct 17, 1989 05:04:05 P.M. P.D.T. M 6.9 N37.04 W121.68 Depth: 18 km Loma Prieta



Map Version: 4 Processed: Fri Oct 15, 1989 08:12:35 AM PST - NOT REVIEWED BY HUMAN

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.(%)	<.17	17-14	14-10	10-8	8-5	5-3	3-2	2-1	1-0
PEAK VEL.(cm/sec)	<.1	1-1.5	1.5-2.5	2.5-5	5-10	10-20	20-40	40-80	80-160
INSTRUMENTAL INTENSITY	I	II	III	IV	V	VI	VII	VIII	IX

Event Summary

Name: (Unnamed Event), Version 1

Magnitude: 6.9
ID: Loma Prieta_04c-1
Location: 7 km NNE of Aptos, CA
Latitude: 37.04
Longitude: -121.68
Time: 1989-10-18 00:00:00 GMT

Downloads & Resources

Caltrans Intranet Links:

[Caltrans ShakeCast Intranet](#)
[Caltrans ShakeMap Products](#)
[ShakeCast Bridge Assessment](#)
[Statewide Bridge Inventory](#)
[Caltrans Real-time Traffic](#)
[USGS Real-time Earthquakes](#)

GoogleEarth KML files:
(Save to your computer as a KML file
and open with GoogleEarth)

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 105.3003%

Maximum Acceleration (not measured)

Total number of bridges assessed: 2930

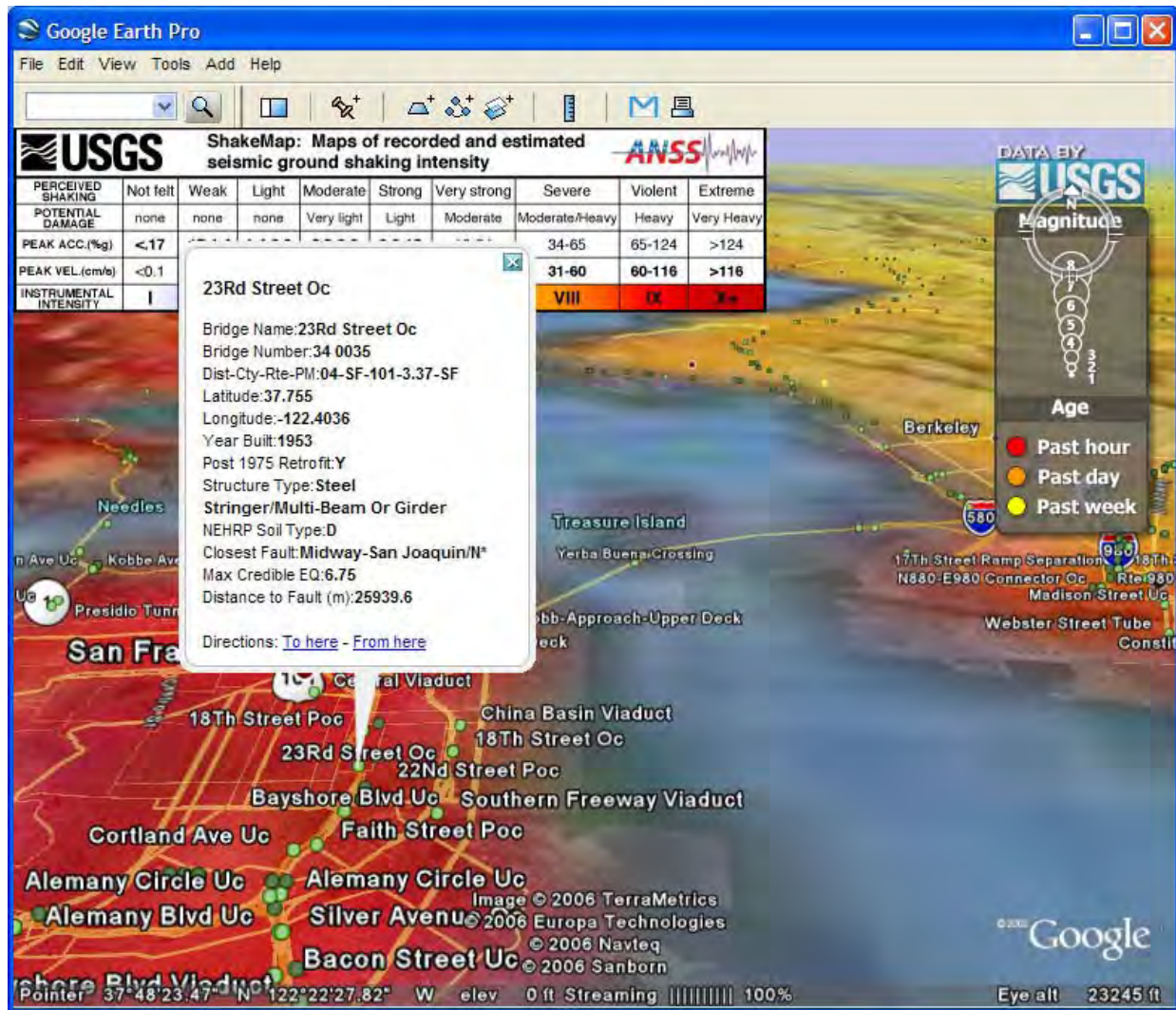
Summary by inspection priority:

High	22	High Priority for full engineering assessment
Medium-High	107	Medium-High Priority for full engineering assessment
Medium	106	Medium Priority for full engineering assessment
Low	1795	Low Priority for full engineering assessment; quick visual inspection likely sufficient.

Bridge Assessment Details

Bridges presented in this table below are sorted in order of severity of impact to bridges.

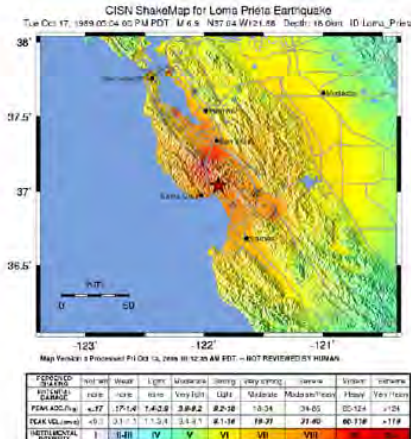
Bridge Name	Bridge Number	Dist-Cty-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%)	Exceedance Ratio
Ballston Avenue OC	35 0114	04-SM-101.4-55-BMT	High	105.3003	2.934
Via Del Oro OH	37 0477L	04-SCL-085-1-22-SJS	High	49.2711	2.472
San Mateo-Hayward Bridge	35 0054	04-SM-092-R14.44-FSTC	High	49.6514	2.167
Constitution Way OC	33 0513K	04-ALA-260-R86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0256	04-SCL-280-R3.80-SJS	High	59.9229	1.122
Campbell Underpass	37 0136	04-SCL-017-12-22-CMB	High	70.2112	1.087
East Hillsdale Blvd OC	35 0138	04-SM-101.1-15-SM	High	68.3752	1.071
Ridewood Creek	35 0145	04-SM-101.4-2-RDWC	High	61.9924	1.064
Stebb-Approach Lower Deck	34 0118R	04-SF-080-4-95-SF	High	33.2578	1.057
Holly Street OC	35 0037	04-SM-101.8-4	High	65.904	1.048
Route 1380 Separation (North)	33 0191G	04-ALA-013-13-02-BER	High	66.6786	1.046
Race Street Overcrossing	37 0200	04-SCL-280-R3.76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-9-14-SF	High	68.3123	1.035
South Delaware Street UC	35 0156R	04-SM-092-R11.61-SM	High	35.1822	1.030
South Delaware Street UC	35 0156R	04-SM-092-R11.61-SM	High	35.1822	1.030
Powell Street UC	33 0020	04-ALA-080-3.79-EMV	High	66.6786	1.020
Ridewood Harbor Overhead	35 0065	04-SM-101.5-RDWC	High	56.8606	1.018
Macarthur Avenue OC	37 0100	04-SCL-280-L5.18-SJS	High	54.4613	1.012
N101-S84 Connector OC	35 0081G	04-SM-101.5-39-RDWC	High	56.8606	1.009
N17-N85 Connector Separation	37 0515G	04-SCL-017-9-24-LGT5	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101.01	High	55.3678	1.007
N8587-S280 Connector Separation	37 0366H	04-SCL-087-5-1-SJS	High	50.5564	1.001
Blossom Hill Road OC	37 0345	04-SCL-082-R.35-SJS	Medium-High	49.4998	0.951
Harkins Slough Road OC	36 0080	05-SCR-001-R2.27-WAT	Medium-High	56.0768	0.938
Sanct Street R UC	37 0263L	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909
Sanct Street R UC	37 0263L	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909



Caltrans ShakeCast Server (C)
-Loren.Turner@dot.ca.gov
05/09/2009 11:18 AM
Subject: BRIDGE ASSESSMENT: 6.9, 7 km NNE of Aptos, CA (Loma_Prieta_2009_V1)

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 California Integrated Seismic Network (CISN). The analysis of potential bridge damage in this report is based upon an initial ShakeMap (unverified) and estimated fragilities for Caltrans bridges. Bridge fragility models were adopted from HAZUS and S&S (Mander (1999)). This report is intended to be used as a first response tool to assist in identifying Caltrans bridges most likely impacted by the event.



Event Summary

Name: (Unnamed Event), Version 1

Magnitude: 6.9

ID: Loma Prieta_sda-1

Location: 7 km NNE of Aptos, CA

Latitude: 37.04

Longitude: -121.68

Time: 1989-10-18 05:04:02 GMT

Downloads & Resources

Caltrans Intranet Links:

[Caltrans ShakeCast Intranet](#)

[Caltrans ShakeMap Products](#)

GoogleEarth KML files:

[ShakeCast Bridge Assessment](#)

[ShakeMap Bridge Inventory](#)

[Caltrans Real-time Traffic](#)

[USGS Real-time Earthquakes](#)

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 105.3903g

Maximum Acceleration: (not measured)

Total number of bridges assessed: 2030

Summary by inspection priority:

High	22	High Priority for full engineering assessment
Medium-High	107	Medium-High Priority for full engineering assessment
Medium	106	Medium Priority for full engineering assessment
Low	1795	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 to bridges.

Bridge Name	Bridge Number	Dist-Cty-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%)	Exceedance Ratio
Ralston Avenue OC	35 0114	04-SM-101-9.55-BMT	High	105.3903	2.934
Via Del Oro OH	37 0477L	04-SCL-085-1.22-SJS	High	49.2711	2.472
San Mateo-Hayward Bridge	35 0054	04-SM-092-R14.44-FSTC	High	49.6514	2.167
Constitution Way OC	33 0513K	04-ALA-260-R.86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0258	04-SCL-280-R3.89-SJS	High	59.9229	1.122
Campbell Underpass	37 0135	04-SCL-017-12.22-CMB	High	70.2112	1.087
East Hillsdale Blvd OC	35 0138	04-SM-101-11.15-SM	High	68.3762	1.071
Redwood Creek	35 0145	04-SM-101-6.2-RDWC	High	61.0924	1.064
Sfobb-Approach Lower Deck	34 0118R	04-SF-080-4.95-SF	High	33.2578	1.057
Holly Street OC	35 0037	04-SM-101-8.4	High	65.904	1.048
Route 13/80 Separation (North)	33 0191G	04-ALA-013-13.92-BER	High	66.6766	1.046
Race Street Overcrossing	37 0260	04-SCL-280-R3.76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-9.14-SF	High	68.3123	1.035
South Delaware Street UC	35 0158L	04-SM-092-R11.61-SM	High	35.1822	1.030
South Delaware Street UC	35 0158R	04-SM-092-R11.61-SM	High	35.1822	1.030
Powell Street UC	33 0020	04-ALA-080-3.79-EMV	High	66.6766	1.020
Redwood Harbor Overhead	35 0065	04-SM-101-5.5-RDWC	High	56.8606	1.018
Macarthur Avenue OC	37 0100	04-SCL-280-L5.18-SJS	High	54.4613	1.012
N101-S84 Connector OC	35 0081G	04-SM-101-5.39-RDWC	High	56.8606	1.009
N17-N85 Connector Separation	37 0515G	04-SCL-017-9.24-LGTS	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678	1.007
N&S87-S280 Connector Separation	37 0396H	04-SCL-087-5.1-SJS	High	50.5564	1.001
Blossom Hill Road OC	37 0345	04-SCL-082-R.35-SJS	Medium-High	49.4998	0.951
Harkins Slough Road OC	36 0089	05-SCR-001-R2.27-WAT	Medium-High	56.0768	0.938
Sunol Street Rr UC	37 0263L	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909
Sunol Street Rr UC	37 0263R	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909
Winchester Boulevard OC	37 0195	04-SCL-280-4.57-SJS	Medium-High	55.327	0.898
Lincoln Avenue UC	37 0262L	04-SCL-280-R3.51-SJS	Medium-High	52.8878	0.896
South Gilroy OH	37 0305L	04-SCL-101-R5.1	Medium-High	43.2728	0.896

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 188.76%g

Maximum Acceleration: (not measured)

Total number of bridges assessed: 3133

Summary by inspection priority:

High	119	High Priority for full engineering assessment
Medium-High	156	Medium-High Priority for full engineering assessment
Medium	152	Medium Priority for full engineering assessment
Low	2706	Low Priority for full engineering assessment; quick visual inspection likely sufficient.

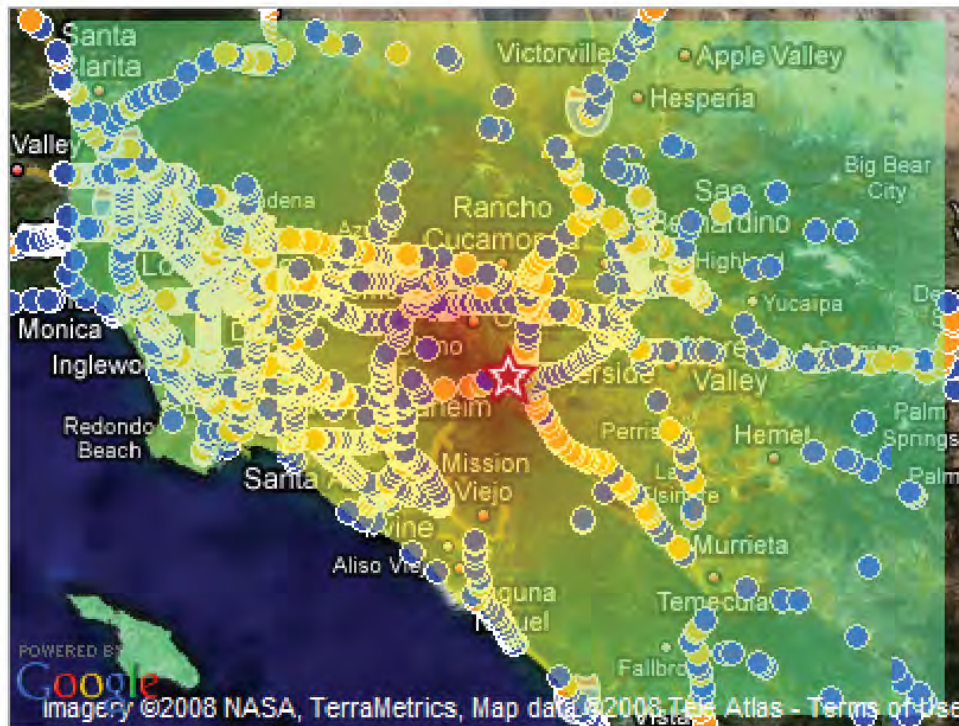
Bridge Assessment Details

Bridges presented in the table below are sorted in order of severity of impact to bridges.

Bridge Name	Bridge Number	Dist-Cty-Rte-PM	Inspection Priority	1sec Peak Spectral Acceleration (%)	Exceedance Ratio
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Constitution Way OC	33 0513K	04-ALA-260-R.86-ALA	High	68.2755	1.415
Meridian Road Underpass	37 0258	04-SCL-280-R3.89-SJS	High	59.9229	1.122
Campbell Underpass	37 0135	04-SCL-017-12.22-CMB	High	70.2112	1.087
East Hillsdale Blvd OC	35 0138	04-SM-101-11.15-SM	High	68.3762	1.071
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Sfobb-Approach Lower Deck	34 0118R	04-SF-080-4.95-SF	High	33.2578	1.057
Holly Street OC	35 0037	04-SM-101-8.4	High	65.904	1.048
Route 13/80 Separation (North)	33 0191G	04-ALA-013-13.92-BER	High	66.6766	1.046
Race Street Overcrossing	37 0260	04-SCL-280-R3.76-SJS	High	59.9229	1.045
Presidio Viaduct	34 0019	04-SF-101-9.14-SF	High	68.3123	1.035
South Delaware Street UC	35 0158L	04-SM-092-R11.61-SM	High	35.1822	1.030
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Powell Street UC	33 0020	04-ALA-080-3.79-EMV	High	66.6766	1.020
Redwood Harbor Overhead	35 0065	04-SM-101-5.5-RDWC	High	56.8606	1.018
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N17-N85 Connector Separation	37 0515G	04-SCL-017-9.24-LGTS	High	86.2137	1.008
San Francisco Creek	35 0013	04-SM-101-01	High	55.3678	1.007
N&S87-S280 Connector Separation	37 0396H	04-SCL-087-5.1-SJS	High	50.5564	1.001
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Sunol Street Rr UC	37 0263R	04-SCL-280-R3.41-SJS	Medium-High	52.8878	0.909
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South Gilroy OH	37 0305L	04-SCL-101-R5.1	Medium-High	43.2728	0.896

Jump to:

SUBMIT



ShakeCast Summary

892

10
14
1

Number of facilities evaluated: **917**

Instrumental Intensity : **IV - VIII**

Peak Ground Acceleration (%g): **4.4817 - 48.7128**

Peak Ground Velocity (cm/sec): **2.3475 - 74.1758**

Peak Spectral Acc. at 0.3 sec (%g): **8.5875 - 124.5867**

Peak Spectral Acc. at 1.0 sec (%g): **2.4797 - 78.3554**

Peak Spectral Acc. at 3.0 sec (%g): **1.2125 - 23.9314**

M 6.7 - Chino Hills Fault Scenario

ID: Chino_Hills6.7_se_scte Version: 5

Origin Time: 2005-05-30 12:00:00

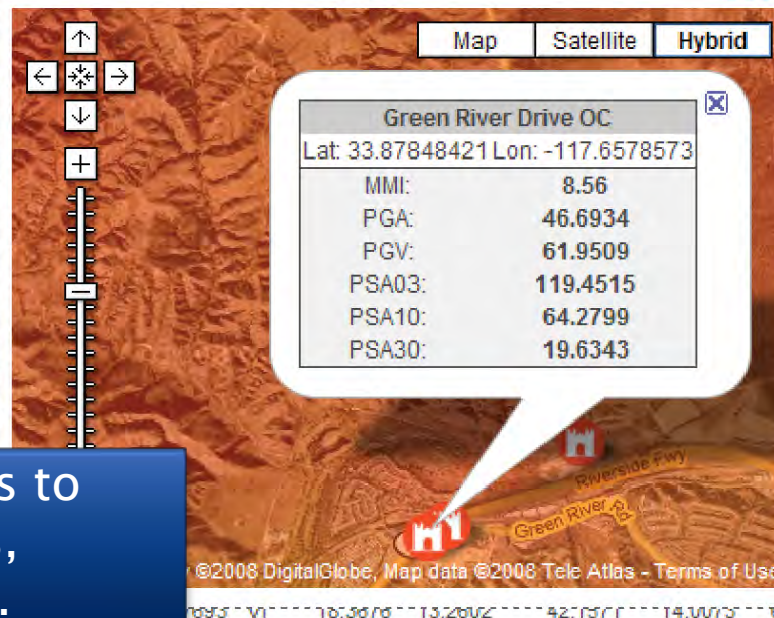
Location: -117.6, 33.9

Responders can use the link in the email to go to the ShakeCast website for additional information.

Map View

M 6.7 - Chino Hills Fault Scenario (ID: Chino_Hills6.7_se_scte - 5)

Facility ID	Type	Description	Inspection Priority ▼	Latitude	Longitude	MMI	PGA (%g)	PGV (cm/sec)	PSA03 (%g)	PSA10 (%g)	PSA30 (%g)
56 0633	BRIDGE	Green River Drive OC	High	33.87848421	-117.6578573	VIII	46.6934	61.9509	119.4515	64.2799	19.6343
54 0748	BRIDGE	Benson Avenue OC	Medium-High	34.03032662	-117.6804218	VIII	37.8311	42.8441	96.2983	45.2159	16.1476
54 0747	BRIDGE	Central Avenue OC	Medium-High	34.03026777	-117.6891927	VIII	37.8311	42.8441	96.2983	45.2159	16.1476
53 1873G	BRIDGE	E60-N57 Connector OC	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044
53 1788	BRIDGE	Fairway Drive UC	Medium-High	33.94652901	-117.8713081	VIII	35.7487	38.3302	90.7822	40.4888	16.1639
56 0497	BRIDGE	Magnolia Avenue OC	Medium-High	33.87848421	-117.6578573	VIII	46.6934	61.9509	119.4515	64.2799	19.6343
54 0746	BRIDGE	Monte Vista Avenue OC	Medium-High	34.03032662	-117.6804218	VIII	37.8311	42.8441	96.2983	45.2159	16.1476
54 0744	BRIDGE	Pipeline Avenue OC	Medium-High	34.03026777	-117.6891927	VIII	37.8311	42.8441	96.2983	45.2159	16.1476
53 1873	BRIDGE	Prospectors UC	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044
54 0745	BRIDGE	Ramona Avenue OC	Medium-High	34.03032662	-117.6804218	VIII	37.8311	42.8441	96.2983	45.2159	16.1476
53 1933	BRIDGE	Spadra OH	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044
53 2106	BRIDGE	State Street OC	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044
53 2078K	BRIDGE	Valley Blvd UC	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044
53 2078	BRIDGE	Valley Blvd UC	Medium-High	34.02202039	-117.8133506	VIII	39.693	47.723	101.3087	50.4097	17.9044

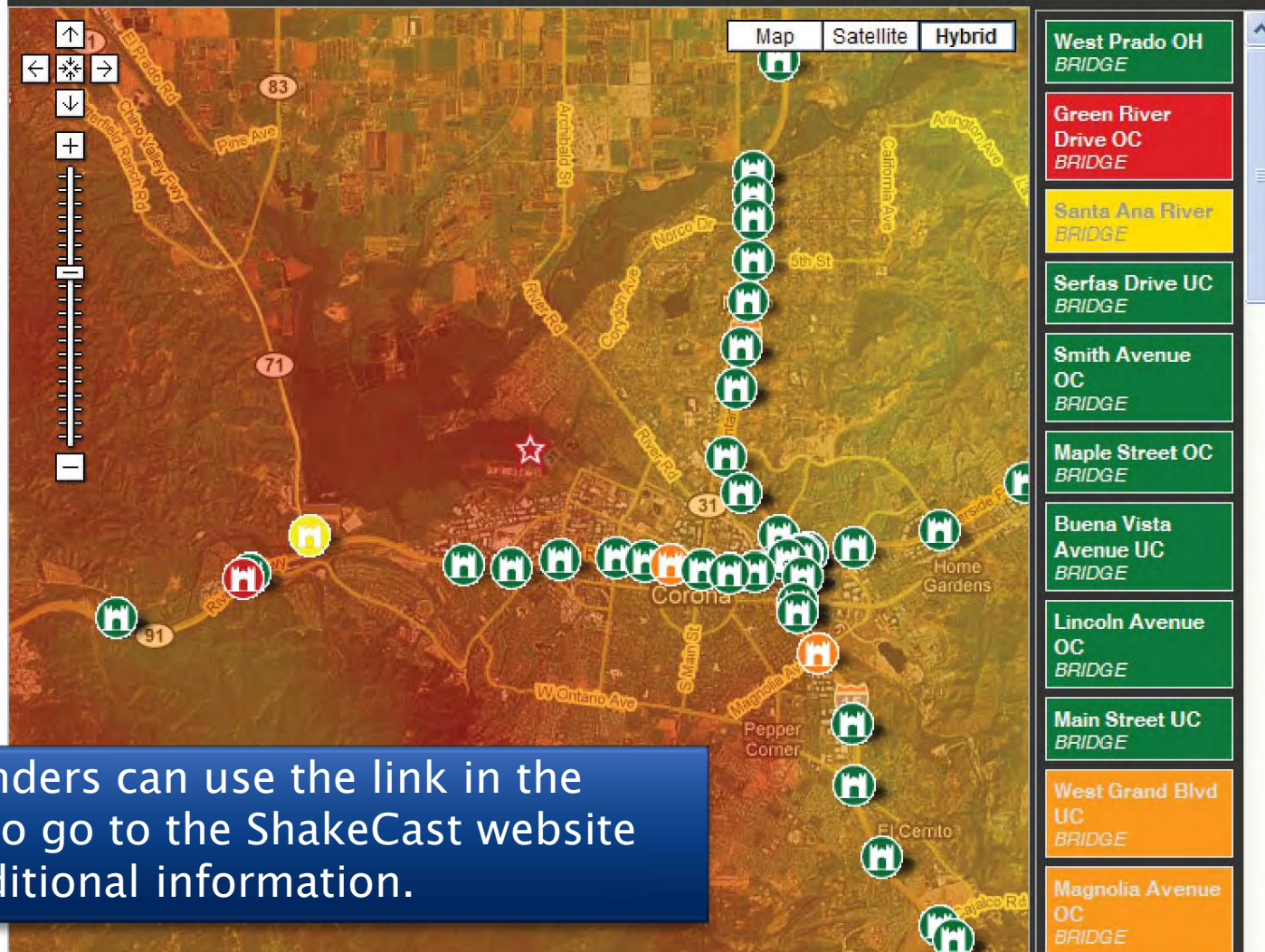


The website offers different ways to view the bridge data using maps, tables, or a combination of both.

Table View

Google Maps for ShakeMap Chino_Hills6.7_se_scte

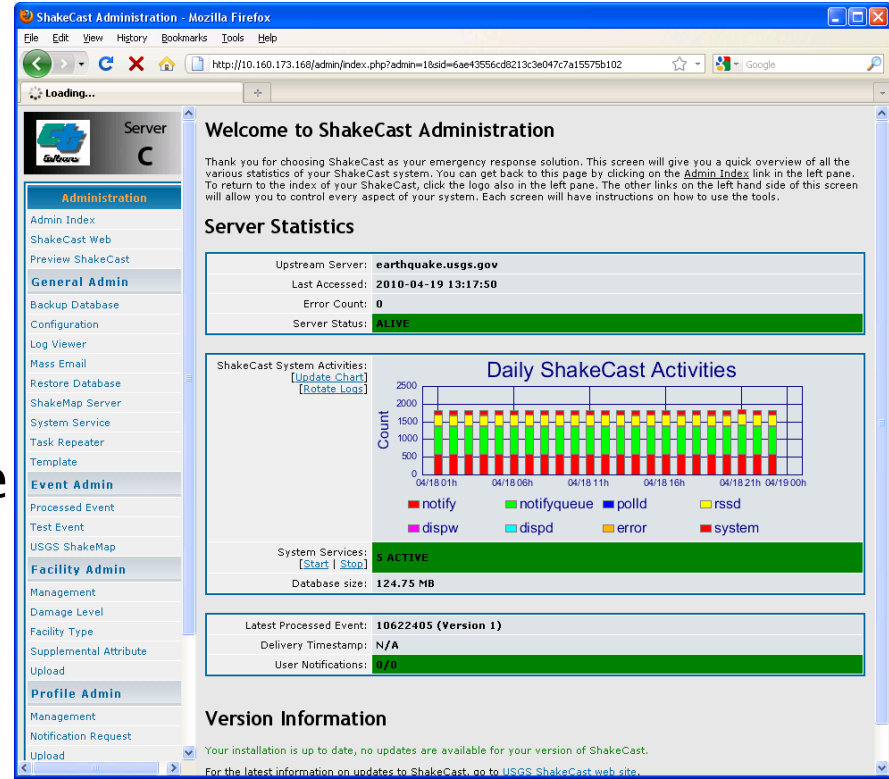
Facility Type: All  BRIDGE

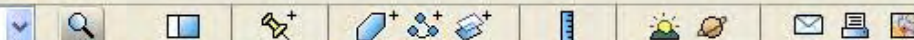


Responders can use the link in the email to go to the ShakeCast website for additional information.

System Administration

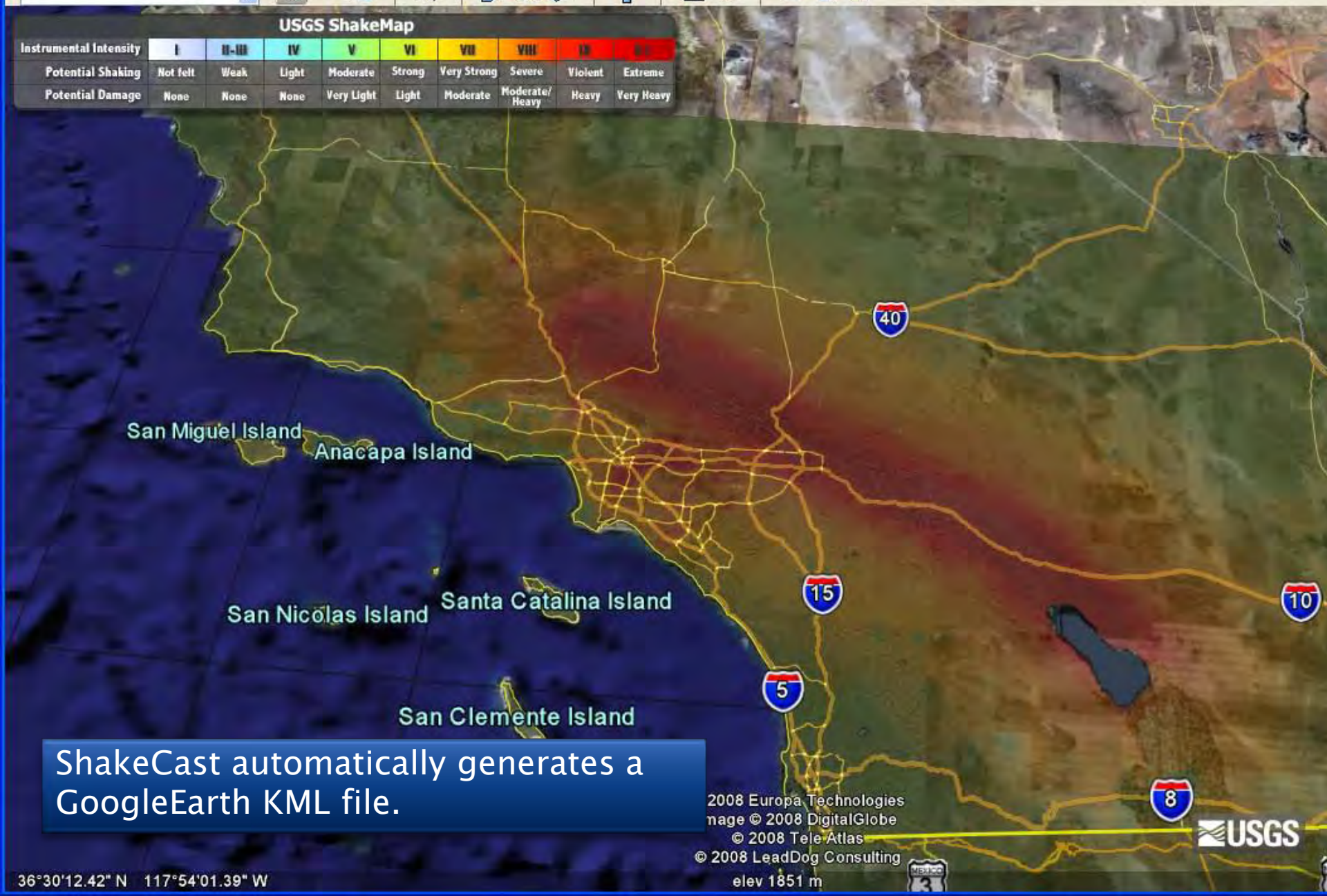
- ▶ ShakeCast is administered through a web browser interface.
 - User group accounts.
 - Notification preferences.
 - Notification profiles.
 - Manage processed earthquake events.
 - Facility inventories and fragilities.
 - Server and database settings.





USGS ShakeMap

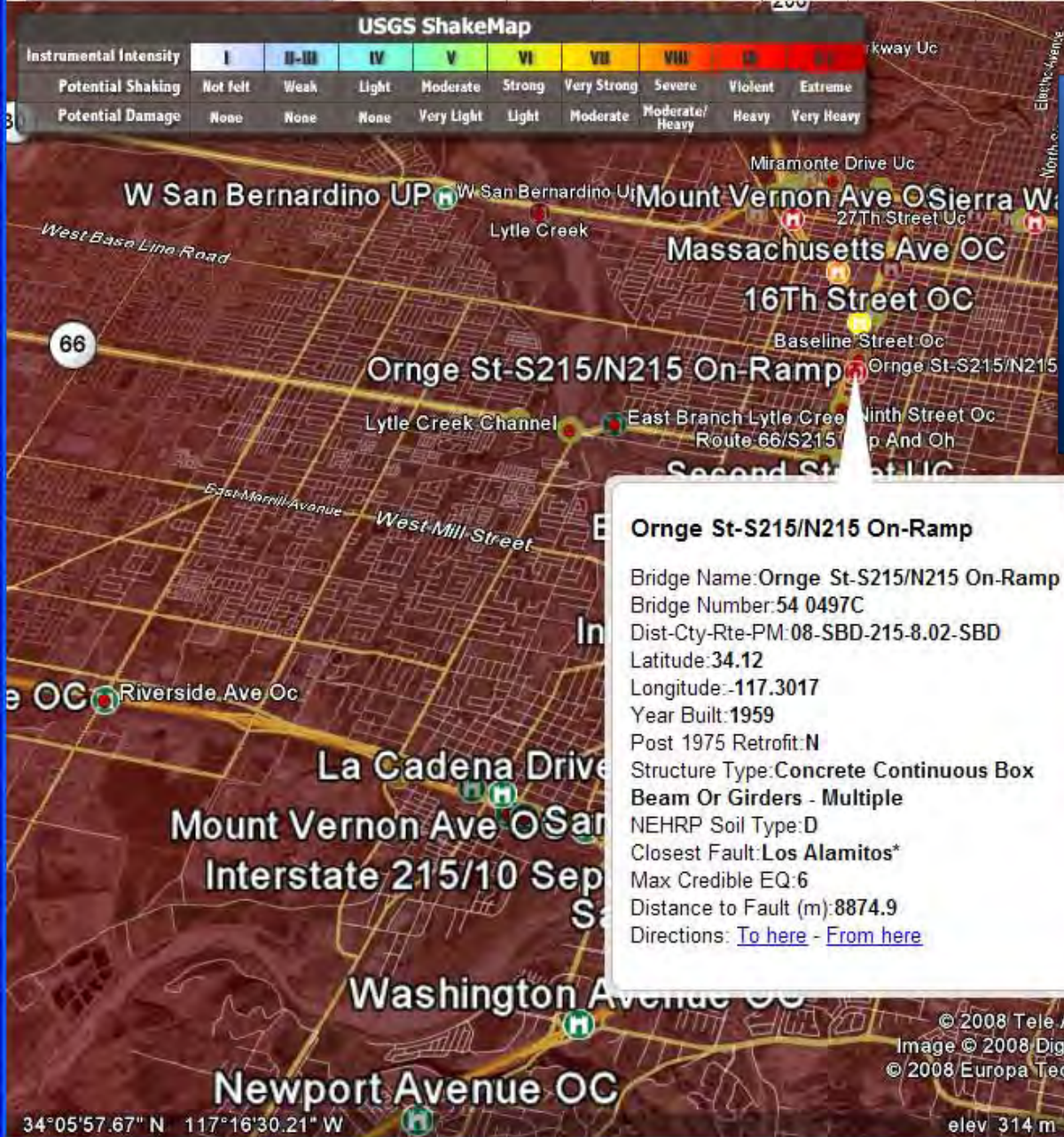
Instrumental Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Potential Shaking	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
Potential Damage	None	None	None	Very Light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy



ShakeCast automatically generates a GoogleEarth KML file.

2008 Europa Technologies
 nage © 2008 DigitalGlobe
 © 2008 Tele Atlas
 © 2008 LeadDog Consulting
 elev 1851 m





The GoogleEarth interface provides tools to “fly through” the earthquake zone and get a better perspective on the event and the impacts to the highway infrastructure.

USGS ShakeMap

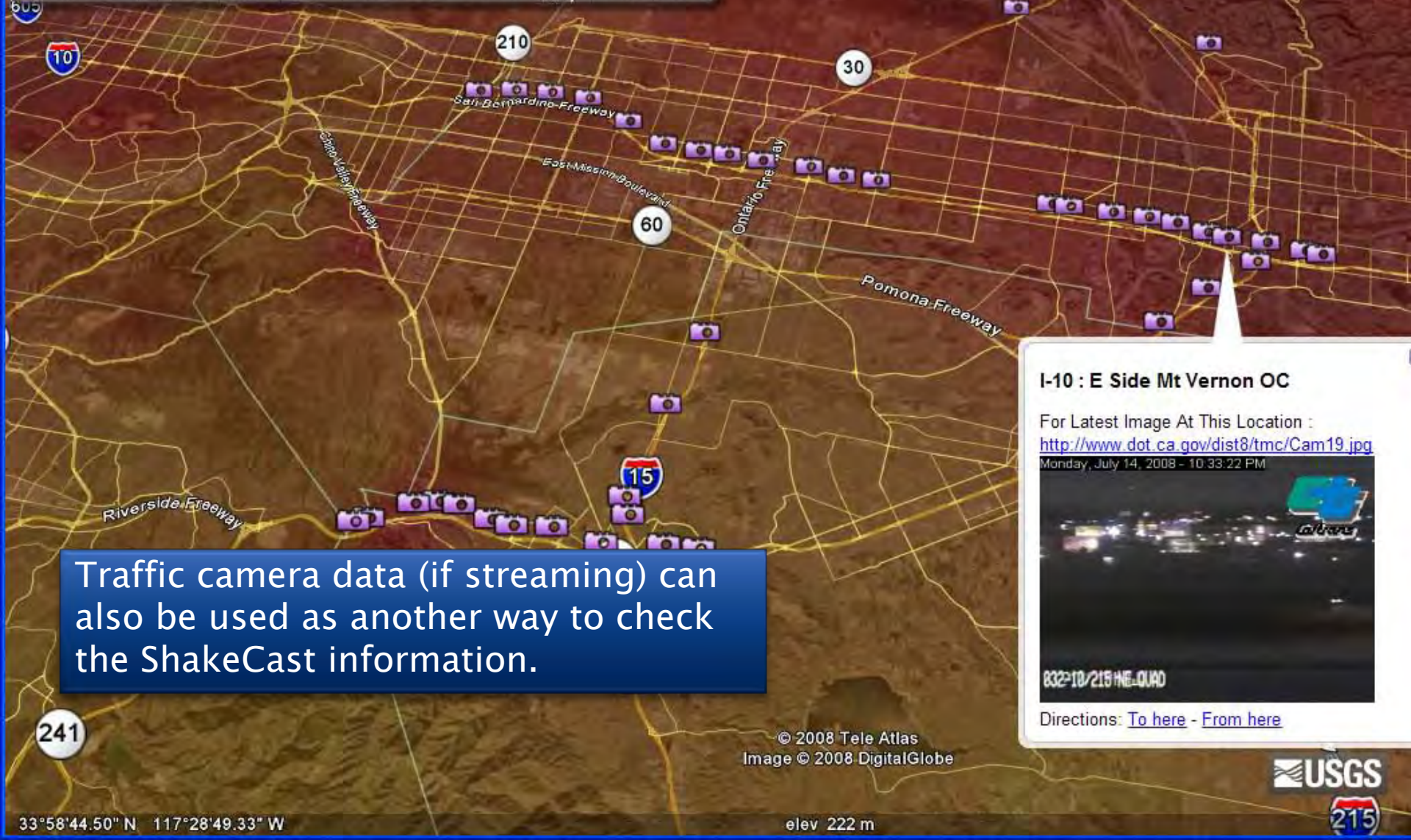
Instrumental Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Potential Shaking	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
Potential Damage	None	None	None	Very Light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy

VDS: 763656
 Freeway: 605 S
 Flow: 53
 Occupancy: .0295
 Speed: 75

Directions: [To here](#) - [From here](#)

In GoogleEarth, other types of real-time data can be brought in. For example, traffic speed data may help verify whether or not a bridge flagged "red" in ShakeCast is actually damaged.

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



I-10 : E Side Mt Vernon OC

For Latest Image At This Location :

<http://www.dot.ca.gov/dist8/tmc/Cam19.jpg>

Monday, July 14, 2008 - 10:33:22 PM



Directions: [To here](#) - [From here](#)

© 2008 Tele Atlas
Image © 2008 DigitalGlobe

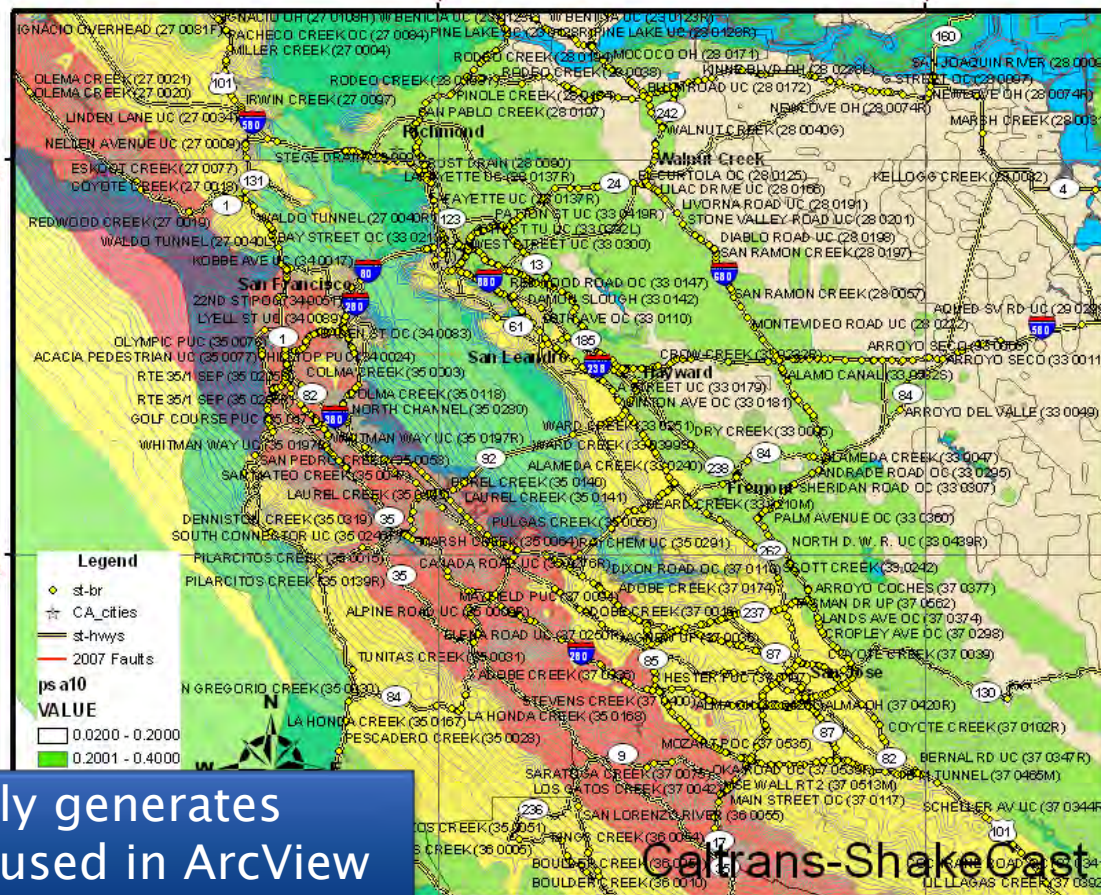
Layers

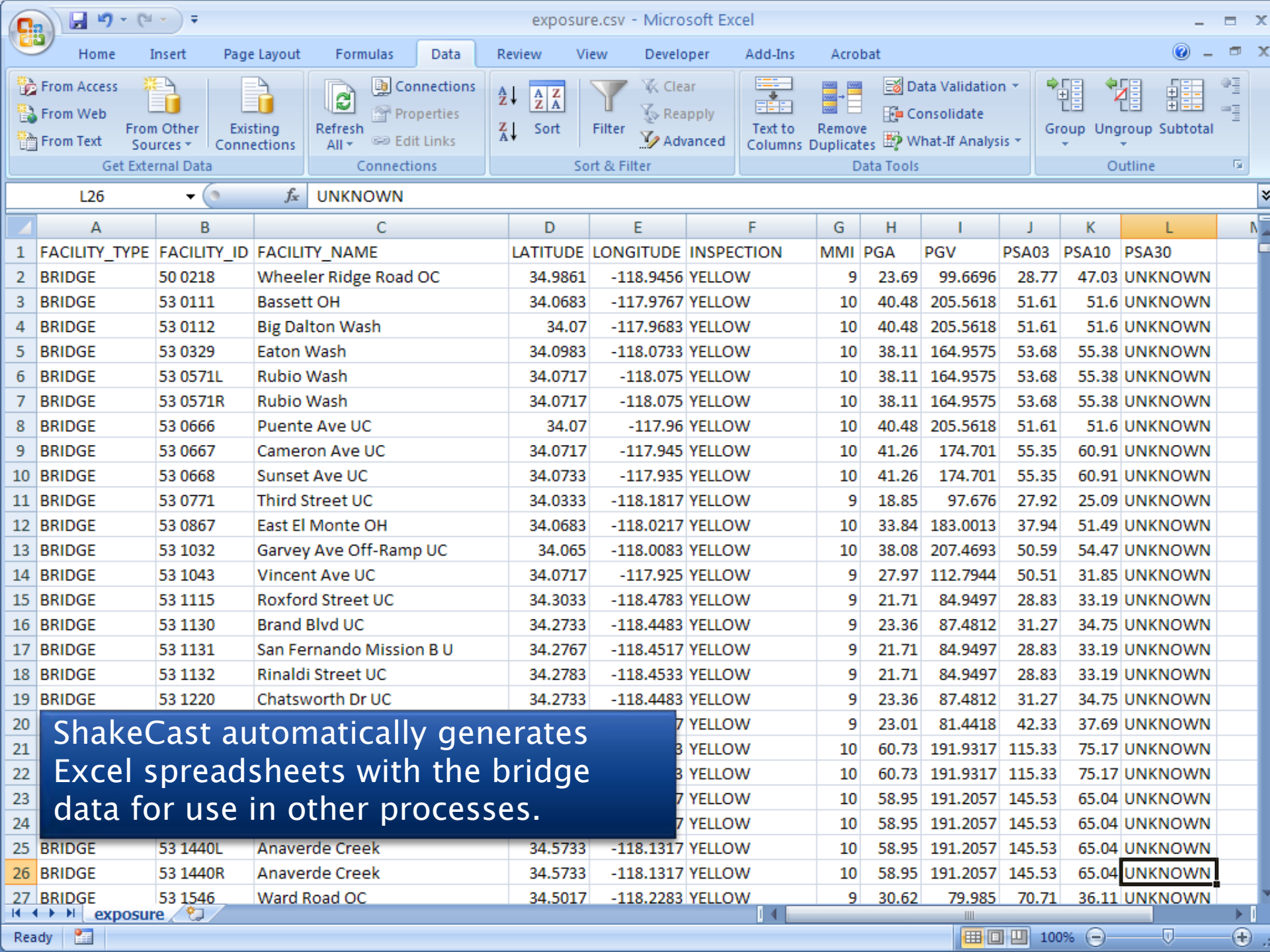
- ☒ st-br
- ☒ CA_cities
- ☒ st-hwys
- ☒ 2007 Faults
- ☒ ps a10
 - VALUE
 - ☐ 0.0200 - 0.2000
 - ☐ 0.2001 - 0.4000
 - ☐ 0.4001 - 0.9000
 - ☐ 0.9001 - 5.0000
- ☒ hydro_lk
- ☒ district

Legend

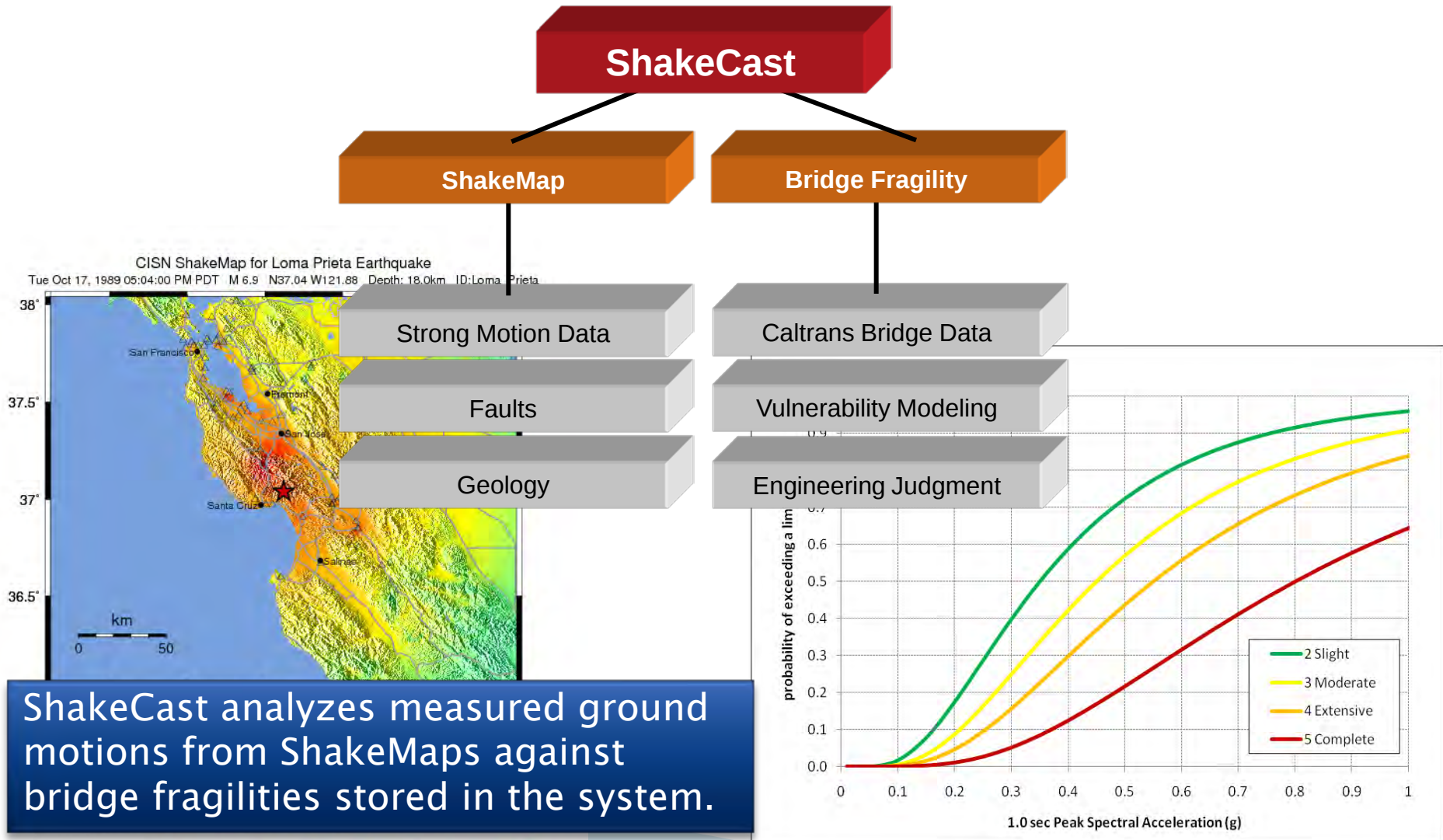
- ☒ st-br
- ☒ CA_cities
- ☒ st-hwys
- ☒ 2007 Faults
- ☒ ps a10
 - VALUE
 - ☐ 0.0200 - 0.2000
 - ☐ 0.2001 - 0.4000

ShakeCast automatically generates shapefiles that can be used in ArcView products to create report-quality maps.





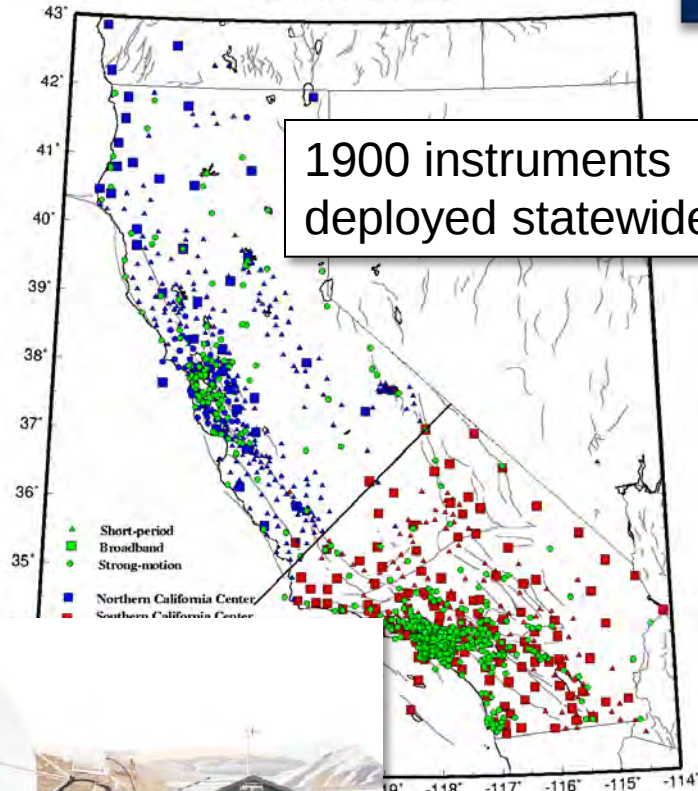
Foundation for ShakeCast



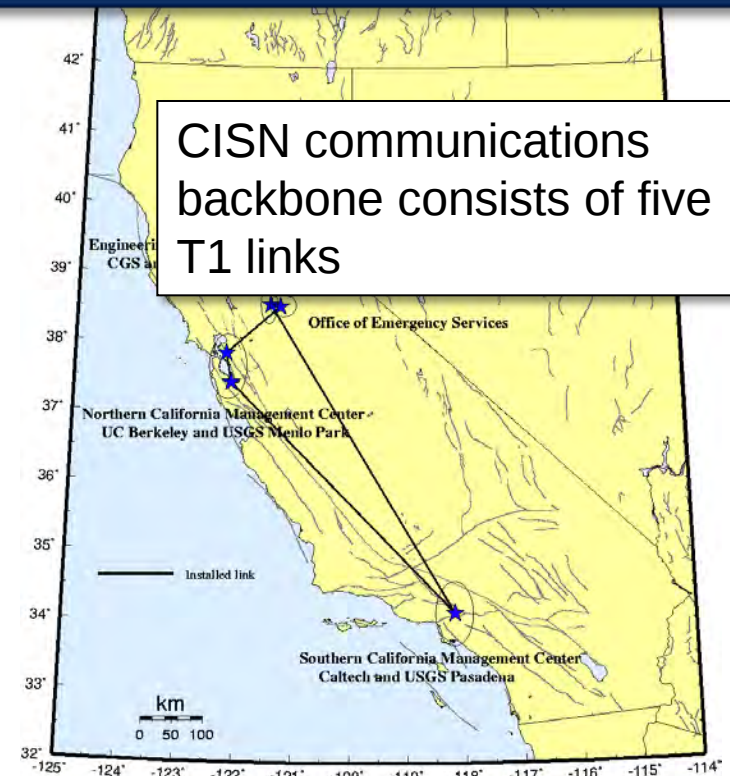
California Integrated Seismic Network (CISN)

ShakeMaps are generated from a statewide array of strong motion sensors processed by CISN.

Stations of the CISN



CISN communications backbone consists of five T1 links



CGS



USGS



Caltech



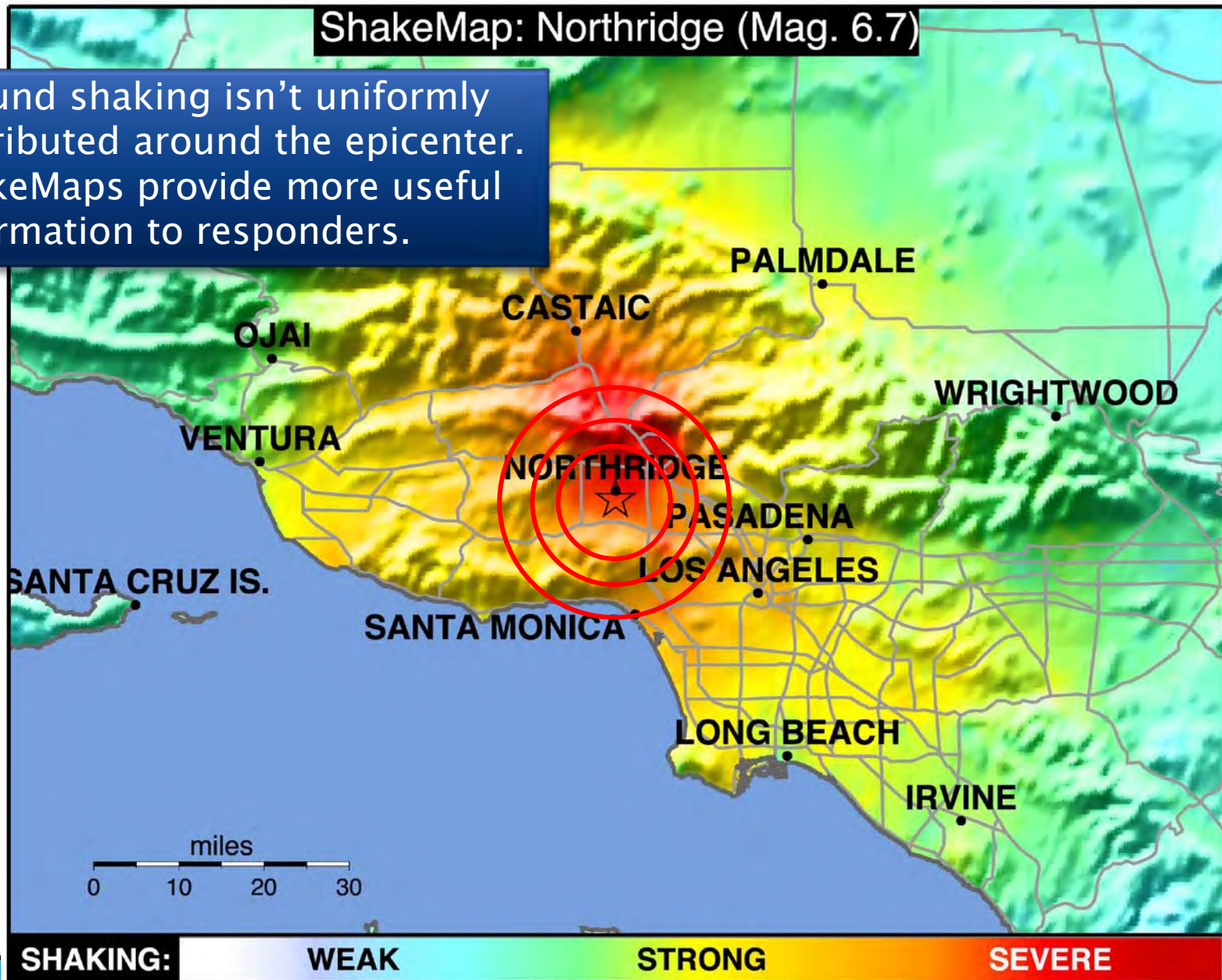
OES



UC
Berkeley

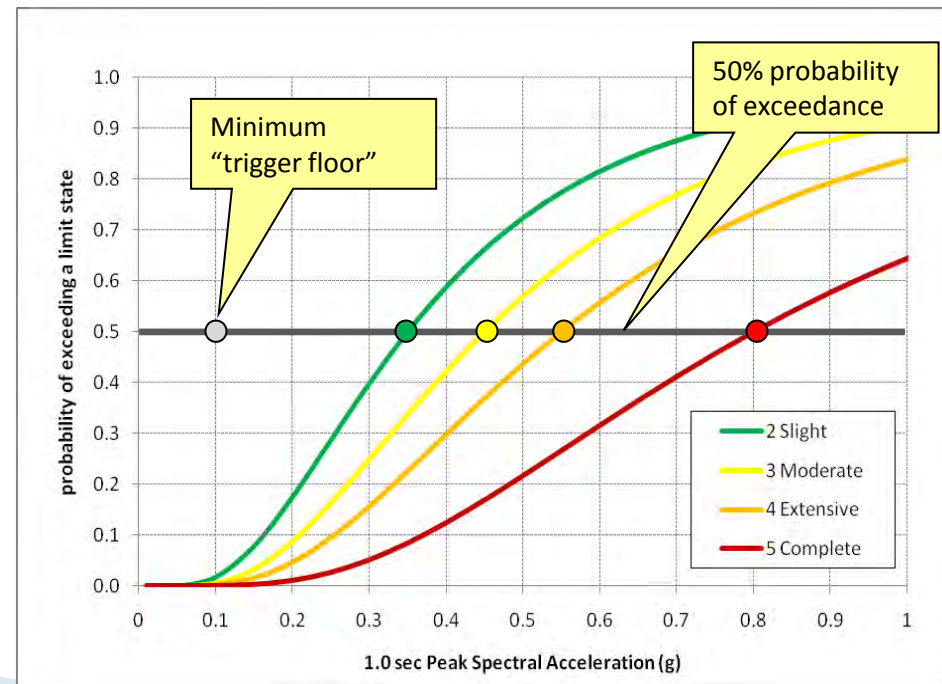
ShakeMap: Northridge (Mag. 6.7)

Ground shaking isn't uniformly distributed around the epicenter. ShakeMaps provide more useful information to responders.



Bridge Fragility

- ▶ Bridge fragility method is based upon work originally published by Basöz and Mander.
- ▶ Method was implemented in FEMA's HAZUS-MH software.
- ▶ Uses data from National Bridge Inventory (NBI) as inputs:
 - Year built
 - Year improved or retrofit
 - Angle of skew
 - Bridge type
 - Number of spans
 - Maximum span length
 - Total bridge length
 - Deck width



Bridge Fragility

HAZUS Damage State	Definitions of HAZUS Damage States (FEMA 2009)	ShakeCast Inspection Priority	Definition of ShakeCast Inspection Priority
Complete (ds5)	ds5 is defined by any column collapsing and connection losing all bearing support, which may lead to imminent deck collapse, tilting of substructure due to foundation failure.	High	High Priority for full engineering assessment
Extensive (ds4)	ds4 is defined by any column degrading without collapse – shear failure - (column structurally unsafe), significant residual movement at connections, or major settlement approach, vertical offset of the abutment, differential settlement at connections, shear key failure at abutments.	Medium-High	Medium-High Priority for full engineering assessment
Moderate (ds3)	ds3 is defined by any column experiencing moderate (shear cracks) cracking and spalling (column structurally still sound), moderate movement of the abutment (<2"), extensive cracking and spalling of shear keys, any connection having cracked shear keys or bent bolts, keeper bar failure without unseating, rocker bearing failure or moderate settlement of the approach.	Medium	Medium Priority for full engineering assessment
Slight/Minor (ds2)	ds2 is defined by minor cracking and spalling to the abutment, cracks in shear keys at abutments, minor spalling and cracks at hinges, minor spalling at the column (damage requires no more than cosmetic repair) or minor cracking to the deck		
		Low	Low Priority for full engineering assessment; quick visual inspection likely sufficient. (1.0 second peak spectral acceleration exceeds 0.10g.)
None (ds1)			

Bridge Fragility

- ▶ Filemaker Pro software is used to calculate bridge fragility parameters.
- ▶ Calculations are revised annually as the bridge inventory changes.
- ▶ New fragility parameters are ported to the ShakeCast MySQL database annually.

FileMaker Pro Advanced - [Bridge Inventory 090208]

File Edit View Insert Format Records Scripts Tools Window Help

Browse

Layout: SMART

Record: 11201

Found: 12897

Total: 25338

Unsorted

Bridge Data from SMART

BRKEY 56 0505
Strucname SANTA MARIA ROAD OC
District 8
Co RIV
Rte 215
PM R038.920
Location 08-RIV-215-R38.92-RIV

Length 64.3
Facility SANTA MARIA ROAD
Featint ROUTE 215

Aroadwidth 12.5
Designload 6 Design_Live_Load HS 20+Mod
Lftourbsw 0
Rtourbsw 1.5
Deckwidth 14.4
Volrunder 4.55
Trafficdir 2
Skew 0

Mainspans 2
Appspans 2
Maxspan 23

Lanes_on 2
Lanes_under 6
Strflared 0
Dkrating 7
Suprating 7
Subrating 7
Culvrating N
Ortype 1
Orload 47.9
Irttype 1
Irlload 28.8
Strrating 7
Deckgeom 6
Dkmembtype 0
Dkprotect 0
Dkstrucryp 1
Dksurtype 1
Last Update 5/28/2008

Bridge Design Assessment

Materialappr 1	Material Concrete
Designappr 0	Design Other
Materialmain 1	Material Concrete
Designmain 2	Design Stringer/Multi-beam or Girder

NBI Class 102 Yearbuilt 1966
HAZUS Classification (if Conventional) HWB6 Yearrecon 0
HAZUS Classification (if Seismic) HWB7 Rebuilt_widen_etc_date 0
HAZUS Classification (if no NBI Class) Phase 1 As_Built retrofit date
HAZUS Classification (if Single Span) Phase 2 P_S_E Retrofit Date 0
HAZUS Classification (if Max Span<150m) Year of Most Recent Improvement 1966
HAZUS Classification (if Max Span<20m) Seismic Design N

Location Data

SMART Lat 33.94830000	SMART Lon -117.3000000
TASAS latitude 33.9481940	TASAS longitude -117.3013900
Latitude Updated 33.9481940	Longitude Updated -117.3013900

Formatted Bridge Name and Description

Formatted Structure Name	56 0505 - SANTA MARIA ROAD OC
Bridge Description	2-span; Concrete; Stringer/Multi-beam or Girder
Owner	State

HAZUS Fragility Calculations

FINAL HAZUS Classification	HWB6
Description	Multi-Col. Bent, Simple Support - Concrete
K3D Equation	EQ1
K3D	1.250
Ishape	0
Kskew	1.000

1 sec SA Moderate	0.50
1 sec SA Extensive	0.60
1 sec SA Complete	0.90

Bridge Fragility (%)

Modified 1 sec SA DS2	10.00
Modified 1 sec SA DS3	62.50
Modified 1 sec SA DS4	75.00
Modified 1 sec SA DS5	112.50

100% Browse

For Help, press F1

NUM

Caltrans-ShakeCast Usage

- ▶ 350+ current subscribers to ShakeCast
 - Structures Maintenance & Investigations
 - Earthquake Engineering
 - Post EQ Investigations Team
 - Structures Construction
 - Geotechnical Services Office Chiefs
 - Traffic Management Centers
 - Mid/Upper Caltrans Management
- ▶ ShakeCast is now an integral component of Caltrans' response protocol

Golden Guardian November 2008

CALTRANS SHAKE CAST 2

Home Earthquakes Search FAQ Profile Administration Panel Log out | Session 1

Latest Earthquake Earthquake Archive

Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 273.702%g

Maximum Acceleration: (not measured)

Total number of bridges assessed: **5012**

Summary by inspection priority:

High	49	High Priority for full engineering assessment
Medium-High	130	Medium-High Priority for full engineering assessment
Medium	109	Medium Priority for full engineering assessment
Low	4724	Low Priority for full engineering assessment; quick visual inspection likely sufficient.

Table View

Google Maps for ShakeMap ShakeOut

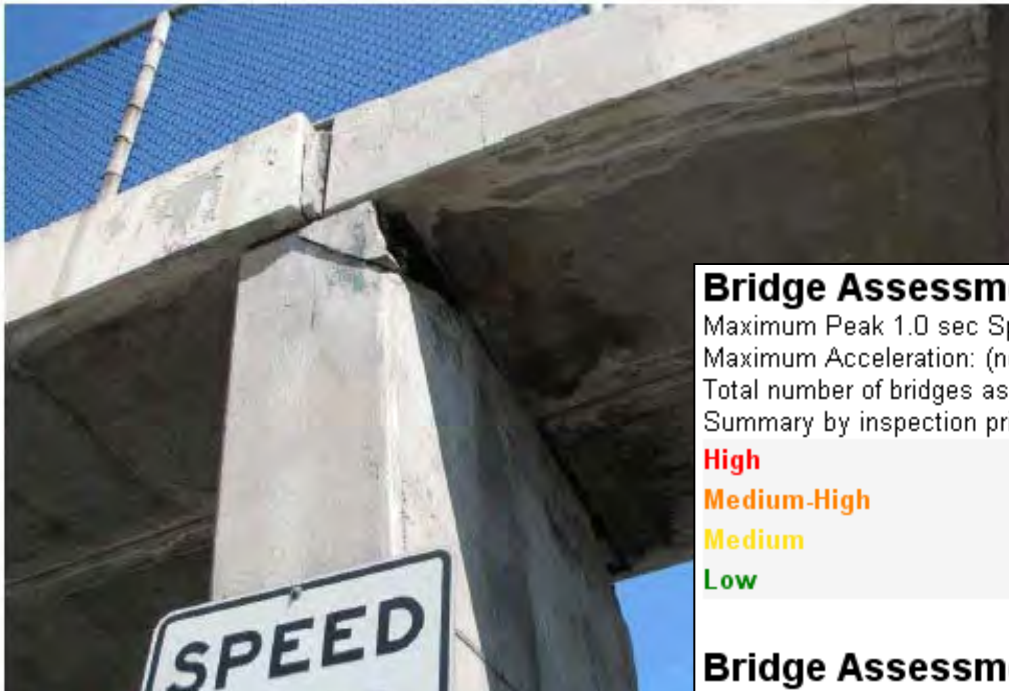
Facility Type: All  BRIDGE



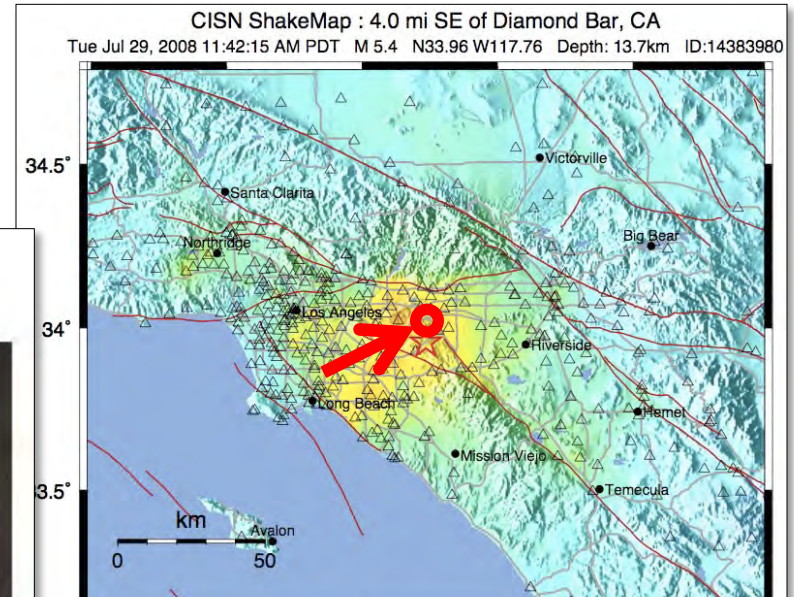
Response exercise in Southern CA used ShakeCast to carry out the scenario.

5.4 Chino Hills July 2008

Grier St. POC on Route 71
Bridge 53-1158
7/30/08



ShakeCast identified the only bridge damaged in this event as the 3rd highest priority for inspection.



Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 34.7183%g

Maximum Acceleration: (not measured)

Total number of bridges assessed: **468**

Summary by inspection priority:

High	[NULL]	High Priority for full engineering assessment
Medium-High	[NULL]	Medium-High Priority for full engineering assessment
Medium	[NULL]	Medium Priority for full engineering assessment
Low	468	Low Priority for full engineering assessment

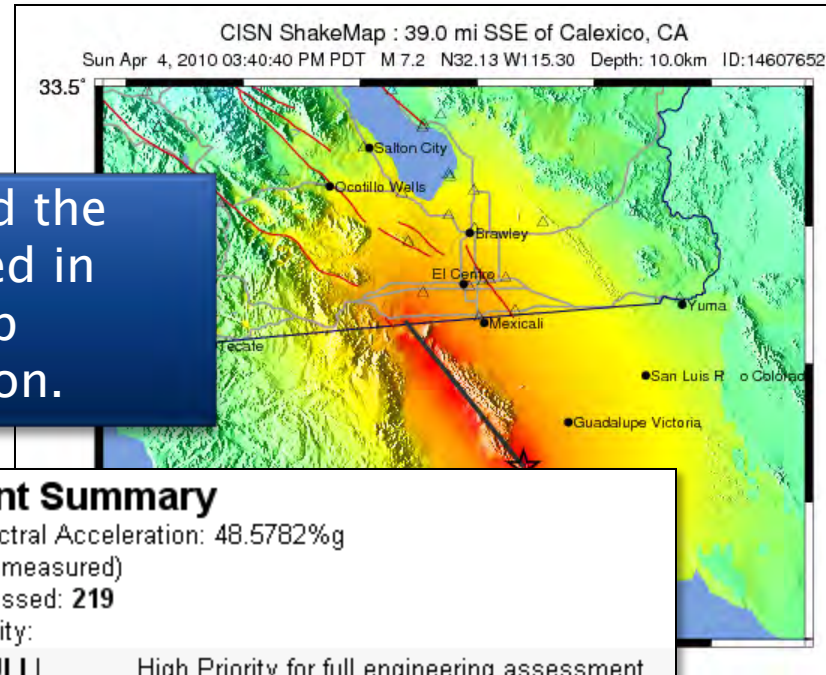
Bridge Assessment Details

Bridges presented in the table below are sorted in order of severity of impact (exceedance ratio). The list includes

Bridge Name	Bridge Number	Dist-C
53 2078 - VALLEY BLVD UC	53 2078	07-LA
53 2078K - VALLEY BLVD UC	53 2078K	07-LA
53 1158 - GRIER STREET POC	53 1158	07-LA
53 2107 - TEMPLE AVENUE UC	53 2107	07-LA

7.2 Calexico April 2010

ShakeCast identified the only bridge damaged in this event as the top priority for inspection.



Bridge Assessment Summary

Maximum Peak 1.0 sec Spectral Acceleration: 48.5782%g

Maximum Acceleration: (not measured)

Total number of bridges assessed: **219**

Summary by inspection priority:

High	[NULL]	High Priority for full engineering assessment
Medium-High	[NULL]	Medium-High Priority for full engineering asses
Medium	[NULL]	Medium Priority for full engineering assessment
Low	219	Low Priority for full engineering assessment; q

Bridge Assessment Details

Bridges presented in the table below are sorted in order of severity of impact (exceedance ratio). The list Acceleration exceeds 10% g.

Bridge Name	Bridge Number	Dist-Cty-Rte-PM
58 0274 - WESTSIDE MAIN CANAL	58 0274	11-IMP-098-22.02
58 0275 - WORMWOOD CANAL	58 0275	11-IMP-098-22.07
58 0212L - COYOTE WELLS OH	58 0212L	11-IMP-008-R13.97
58 0212R - COYOTE WELLS OH	58 0212R	11-IMP-008-R13.93



USGS
Science for a changing world

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 tool used to deliver specific ShakeMap products to established post-earthquake responders.



TRANSPORTATION RESEARCH NEWS
OF THE NATIONAL ACADEMIES

RESEARCH PAYS OFF

ShakeCast
Caltrans Deploys a Tool for Rapid Postearthquake Response

LOREN L. TURNER, DAVID WALD, AND KUO-WAN LIN

After a major earthquake, one of the most critical tasks for the California Department of Transportation (Caltrans) is to assess the impact on the condition of all bridges and roadway corridors in the state highway system. Timely response ensures public safety, guides emergency vehicle traffic, and reestablishes critical lifeline routes.

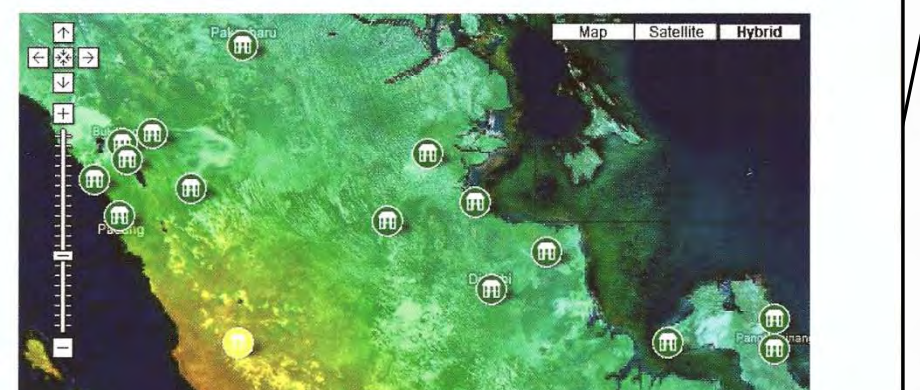
Problem
Immediately after an earthquake, bridge inspection teams had difficulty accessing bridges that were damaged.

ShakeCast was built on ShakeMap, a USGS product that receives measured ground motion data from a network of more than 1,000 sensors throughout California—approximately two-thirds of all sensors nationwide—and combines the information with geologic data to create maps that show ground-shaking data and analyzes the data in relation to individual bridge performance characteristics. Within minutes of an event, the program generates e-mails to set priorities for inspection and assembles other web-based products to assist emergency responders.

VOLUME 24, NUMBER 2 MAY 2008

EARTHQUAKE SPECTRA

The Professional Journal of the Earthquake Engineering Research Institute



ShakeCast: Automating and Improving the Use of ShakeMap for Post-Earthquake Decision-Making and Response

David Wald,^{a)} M.EERI, Kuo-Wan Lin,^{a)} Keith Porter,^{b)} M.EERI, and Loren Turner^{c)}

When a potentially damaging earthquake occurs, utility managers, emergency responders, and other crisis management personnel need information about the impact of the earthquake on critical infrastructure systems. ShakeCast is a web-based application that provides this information by automatically retrieving earthquake shaking data from ShakeMap, comparing intensity measures against users' facilities, and generating potential damage assessment notifications, facility damage maps, and other Web-based products for emergency managers and responders.

A ShakeCast User's Observations on the Benefits of Situational Awareness for Seismic Risk Management

Loren Turner

Caltrans

Division of Research & Innovation

David Wald

Kuo-Wan Lin

U.S. Geological Survey

