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16. ABSTRACT Following a major earthquake, one of Caltrans' most critical tasks is to assess the condition of all potentially impacted bridges and roadway corridors in the state highway system. Timely response is important to ensure public safety, guide emergency vehicle traffic, and re-establish critical lifeline routes. In the past, bridge inspection teams had difficulties setting priorities immediately following an earthquake, because they lacked precise information about where the worst shaking and, most likely, the greatest damage had occurred. In 2005 Caltrans initiated a contract with the United States Geological Survey (USGS) to develop and implement a Caltrans-specific version of their ShakeCast system, a post-event software analysis tool that was anticipated to change the way Caltrans responds following a major earthquake. ShakeCast is a web-based application that automatically retrieves measured earthquake shaking data, analyzes it against individual bridge performance characteristics, and generates inspection prioritization emails and other web-based products for emergency responders within minutes of an event. Benefits have already been realized over the course of the test deployment phase. The ShakeCast system has proved to be a valuable tool for post-earthquake response for Caltrans during real events as well as for scenario planning exercises.					
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Division of Research
& Innovation

ShakeCast - Developing a Tool for Rapid Post-Earthquake Response

Final Report



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ShakeCast - Developing a Tool for Rapid Post-Earthquake Response

**Final Report No. CA09-0734
June 2009**

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EXECUTIVE SUMMARY

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

Immediately after an earthquake, bridge inspection teams had difficulty setting priorities in the past, because precise information was not available to locate the most severe shaking, where the greatest damage was likeliest. After the 1994 Northridge earthquake, identifying the damage areas and mobilizing bridge inspection teams took several hours. Without sufficient data, Caltrans had to locate the earthquake's epicenter, find the closest fault, and develop a list of bridges within a specified buffer zone around the fault or the epicenter. Television newscasts often provided the best indicator of damage areas. With this information, inspection teams were dispersed widely within the region to perform the initial reconnaissance. This task took up precious time. Moreover, the shaking levels can vary dramatically within a buffer zone. An earthquake rarely ruptures along the entire length of a fault. Furthermore, ground shaking at the same distance from a rupture zone can vary by nearly tenfold, because of various seismological and geotechnical effects. A buffer zone large enough to account for all areas that could have been shaken strongly will include wide swaths of undamaged zones, which can lead to an inefficient use of limited resources.

In 2005, Caltrans initiated a research contract with the United States Geological Survey (USGS) to develop and implement a Caltrans-specific version of *ShakeCast*, a postevent software analysis tool. The goal was to change the way that Caltrans responds to a major earthquake. *ShakeCast* is a web-based application that automatically retrieves measured earthquake 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.

ShakeCast was built on *ShakeMap*, a USGS product that receives measured ground motion data from a network of more than 1,900 sensors throughout California (approximately two-thirds of all sensors nationwide) and combines the information with geological data to create maps that show ground-shaking intensity. The maps provide a level of detail that far surpasses the general information about the earthquake's epicenter and magnitude, which the news media commonly report. *ShakeMap* provides the input parameters for *ShakeCast*, which in turn uses the Caltrans bridge and highway inventory data to develop automated analyses and to produce prioritized lists for bridge inspection.

ShakeCast features internet-based account management, system administration, and Google Maps visualization tools (Figures 1-1 and 1-2). In addition, it automatically generates products for direct use in Google Earth®, ArcGIS®, and Excel®. Caltrans operates *ShakeCast* on two redundant servers at the Transportation Laboratory in Sacramento, supporting a group of 300 responders who are involved in post-earthquake bridge inspections. The servers operate 24 hours a day, 7 days a week, and rely on a robust system of Caltrans e-mail servers to distribute the notification messages.

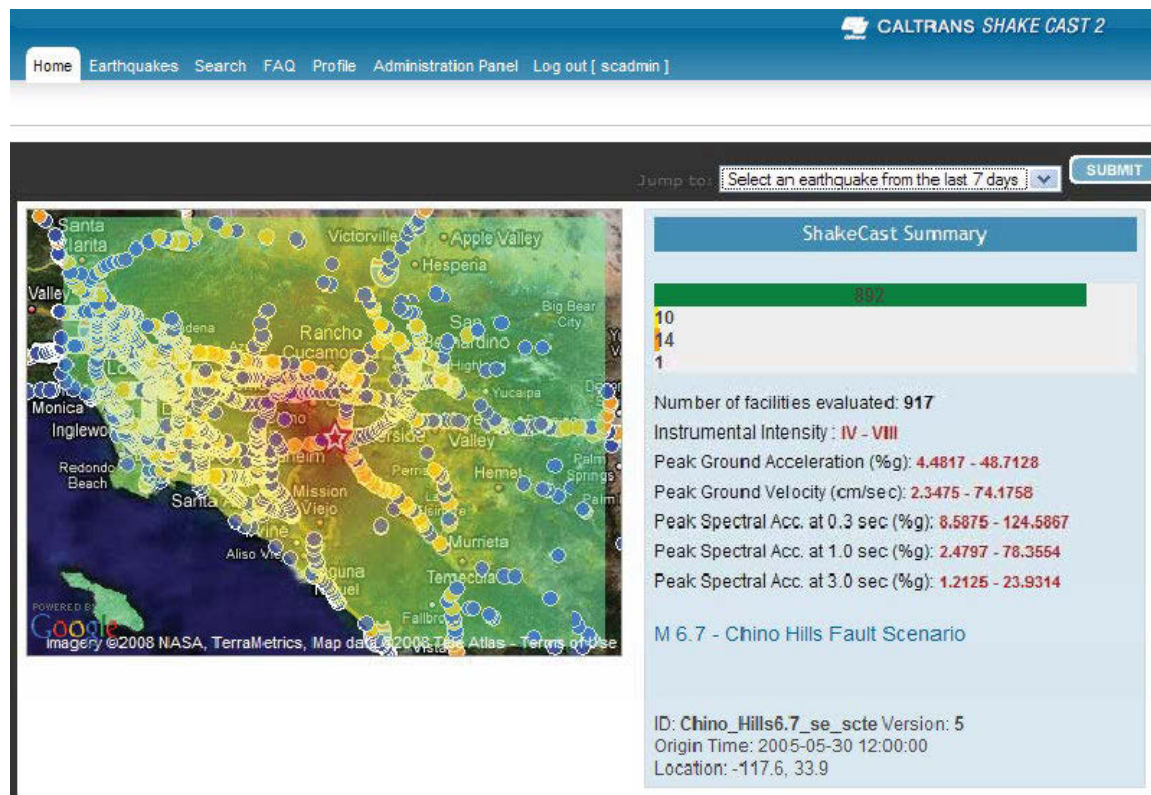


Figure 1-1 – ShakeCast web interface opening screen

For events greater than magnitude 4.0, ShakeCast automatically determines the shaking value at the locations of more than 12,700 state bridges and facilities, compares the values with the threshold pre-established for each facility, and distributes e-mails to designated responders within 15 minutes of the event. The e-mails contain general information about the event and a table of bridges sorted by inspection priority.

Each bridge in the system's database has a unique fragility, determined with bridge damage models originally published by Basöz and Mander (Basöz and Mander 1999) and implemented in the Hazards U.S. (HAZUS) software of the Federal Emergency Management Agency (FEMA 2009). The fragility models employ 1-second peak-spectral accelerations and take into account bridge geometry, such as span lengths, number of spans, column heights, and skew; the years of design, construction, and retrofit; and the component material types.

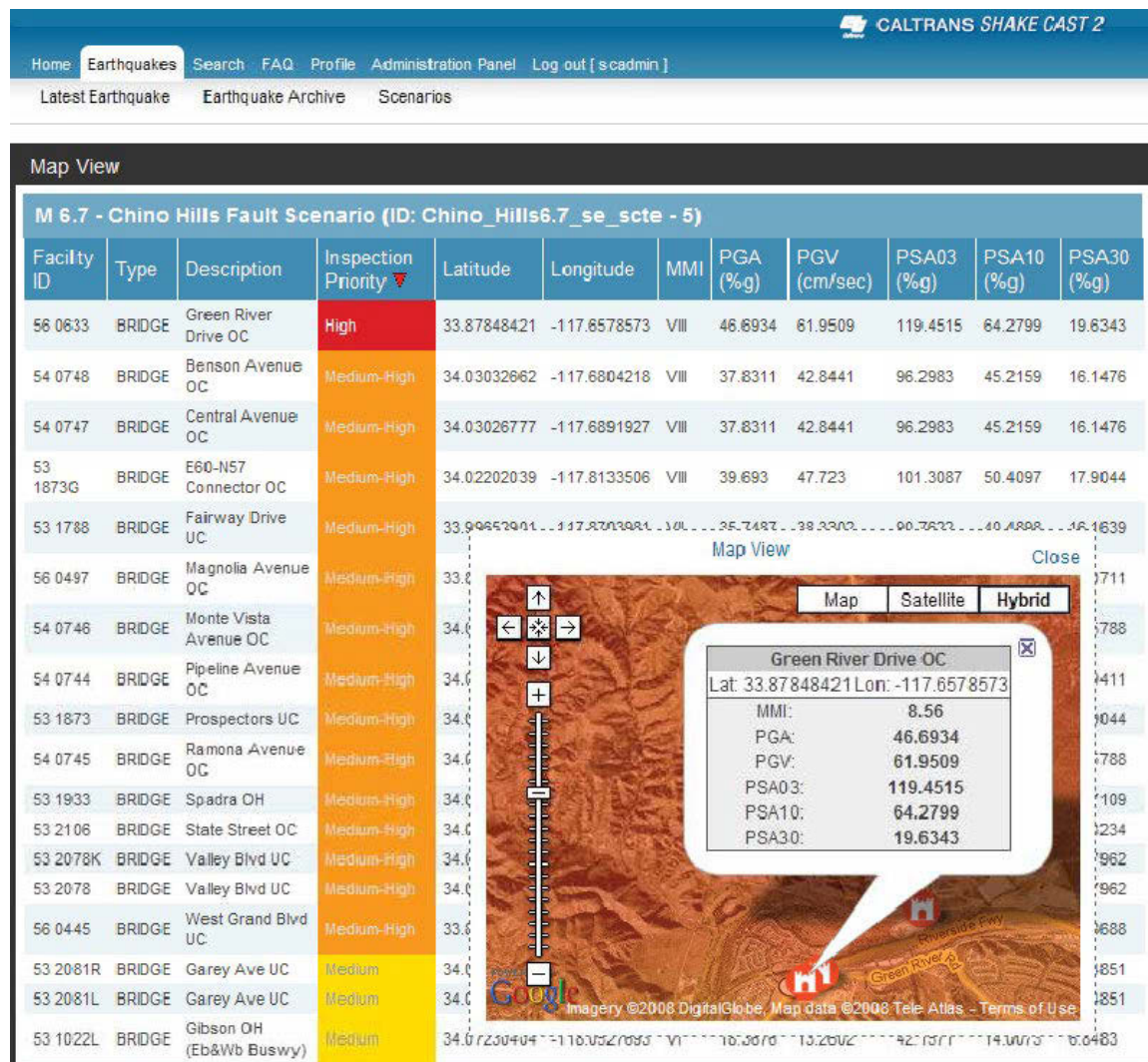


Figure 1-2 – ShakeCast web interface for bridge inspection list

Although the fragility methodology generates probabilities that a structure will be at a defined damage level, the results are presented in the context of inspection prioritization, to avoid any perception that the analysis represents actual damage. Because of the uncertainties in the range of ground motions and the assumptions made in bridge fragility computations, the tool is considered effective in prioritizing resources if the bridges with actual damage in an earthquake were flagged in the top 10 percent of the ShakeCast analysis. Inspection priorities are coded red, orange, yellow, and green, corresponding to high, medium-high, medium, and low priority for full engineering assessment.

In the July 2008 earthquake near Chino Hills (magnitude 5.4), only one bridge sustained significant damage. The damage included concrete spalling and transverse displacement of a deck span at the center pier (Figure 1-3) of the Grier St. Pedestrian Overcrossing (POC). The initial Caltrans ShakeCast notification identified the bridge as the 40th highest inspection priority of the more than 300 bridges assessed. A follow-up notification message, which took into account more comprehensive ground motion measurements, listed the bridge as the third highest inspection priority after assessing more than 400 bridges. Although not considered a major event, the Chino Hills earthquake provided an opportunity to exercise the capabilities of ShakeCast during the test deployment phase and to build confidence in the system.



Figure 1-3 – Damage at Grier St. POC from the M5.4 Chino Hills earthquake

The Golden Guardian earthquake preparedness exercise in November 2008 deployed ShakeCast to generate assignments for Caltrans bridge inspections. The exercise scenario hypothesized a magnitude 7.8 earthquake on Southern California's San Andreas Fault to test the coordination efforts of regional responders. The Golden Guardian exercise gave Caltrans responders valuable insight into the potential impacts a severe event would have on the highway infrastructure because of bridge damage.

The test deployment phase of the ShakeCast software already has realized benefits. The ShakeCast system has proved a valuable tool for Caltrans in post-earthquake response during real events and in scenario planning exercises.

ShakeCast facilitates the complicated assessment of potential damage to widely distributed facilities. The system compares the complex distribution of the shaking with the bridge inventory's damageability—which can be highly variable—and provides a simple, hierarchical list with maps of the structures and facilities most likely affected. By focusing inspection efforts on the most critically shaken areas, ShakeCast has drastically reduced Caltrans' response time to assess potentially damaged structures after an earthquake.

PROJECT BACKGROUND

The first version of *ShakeCast* was developed by the USGS in 2003 (Wald 2003). In 2005 Caltrans contracted with the USGS to develop a version of *ShakeCast* that would meet the specific needs of Caltrans in post-earthquake bridge inspection prioritization. The project was funded through the Caltrans Division of Research & Innovation and supported by key stakeholders in Structure Maintenance & Investigations and Traffic Operations. A Feasibility Study Report (FSR) was prepared to support the contract, and was approved in October 2005 by the Department's Chief Information Officer, the Chief Information Security Officer, the Budget Officer, and the Director. The approved FSR is included in Appendix 1 for reference.

2.1 Objectives

The objective of this project was to improve Caltrans' ability to respond following a major earthquake by prioritizing bridge inspections, while also providing timely information to partner agencies on potential route closures. This project proposed to achieve these objectives through further development, integration of Caltrans-specific features, and test deployment of *ShakeCast*, a system to automate the retrieval of *ShakeMaps* to analyze earthquake shaking levels against Caltrans bridges and infrastructure, and deliver bridge inspection priority lists by pager and e-mail.

The work had three primary objectives:

- Improve bridge inspection response after an earthquake occurs by deploying a new response system called *ShakeCast*.
- Automate analysis of real-time earthquake ground shaking data against Caltrans bridge design data and deliver bridge inspection priority lists by pager or email to key response personnel.
- Improve emergency response, and public safety, from having this information within minutes following an earthquake to more effectively focus inspection efforts.

2.2 Scope of Work

The work was carried out by the USGS over a three year period beginning March 2006 and ending in June 2008. Seven major sub-tasks were identified in the contract.

1. Conduct a needs assessment with Caltrans to enhance current web page navigation in *ShakeCast*. Develop a detailed specification for a revised web interface, including story board, mockups, and explanation of new features.
2. Revise front-end web interface to *ShakeCast* to facilitate system administrators, establishing accounts, maintaining system, and setting fragility parameters.
 - 2.1. Implement recommendations from needs assessment.
 - 2.2. Integrate server verification tools to allow validation of communications with USGS servers. Validation should be automated when identifying a new upstream, downstream, poll, or query server.
 - 2.3. Integrate tool to view error logging and error checking.
 - 2.4. Revise pages to set up *ShakeCast* server, combining all settings in one page (e.g. set server passwords in same screen when setting other server parameters.)
 - 2.5. Apply global fragility parameters to groups of facilities in a single interface. For example, the facility table for Caltrans bridges will likely be expanded into classes of bridge (i.e. Type A, Type B, etc.). The interface needs to allow the system administrator to apply a single set of fragility parameters to a type of bridge.

3. Revise front-end web interface to *ShakeCast* to facilitate Users setting up accounts and maintaining notification preferences.
 - 3.1. Implement recommendations from needs assessment.
 - 3.2. "Event," "Product," "Shaking," and "Damage" notifications selectable by region.
Incorporate map interface to select by district or county.
4. Develop and implement user types ("Administrator" and "User") to access ShakeCast server, with password management.
 - 4.1. Administrators have access to all ShakeCast features.
 - 4.2. Users should only be permitted to update contact information (phone, e-mail, address) and notification settings (facility, region, etc.).
 - 4.3. New users should be permitted to access the server and set up an account.
5. Develop a web-enabled map interface (ArcIMS or similar companion product) to ShakeCast for graphical map display of analyzed post-earthquake output data.
 - 5.1. Application runs on the same ShakeCast server.
 - 5.2. Provides graphical map output via internet.
 - 5.3. Displays facilities and their potential damage status based upon the ShakeCast analysis and defined fragilities (e.g. facilities are color coded red/yellow/green).
 - 5.4. Displays facility inspection priority lists, with attributes for each facility. Sort table in ascending or descending order by any column attribute.
6. Create training and support materials to assist in deployment of *ShakeCast* within Caltrans, and evaluate system performance through test deployments.
 - 6.1. Create an informational brochure describing the application of ShakeCast within Caltrans.
 - 6.2. Provide electronic files (text, html, and images) to assemble a web-based version of the informational brochure. Caltrans will implement the web site on its intranet.
 - 6.3. Develop a user's guide tailored to the Caltrans application.
 - 6.4. Provide technical support via phone and e-mail over the duration of the contract for installation, setup, and usage.
 - 6.5. Provide onsite deployment support for two locations in California. This includes installation of software and training for site staff.
7. Provide support for a redundant ShakeCast upstream server at the USGS, Golden Colorado facility. Implement dedicated, high-priority, robust communications to insure that earthquake data is reliably transmitted to Caltrans in the shortest possible time frame.

Reports, manuals, and documentation resulting from the sub-tasks are included in Appendices 2 through 9.

Targeted and actual completion dates for major accomplishments during the project are presented in the table below.

Major Milestone (Deliverable)	Planned Start Date	Actual Start Date	Planned Completion Date	Actual Completion Date
User needs assessment (report)	9/1/2005	3/6/2006	5/30/2006	5/22/2006
Specification for web interface (report)	12/1/2005	5/22/2006	6/30/2006	9/15/2006
Front-end interface to ShakeCast	3/1/2006	9/15/2006	6/30/2007	2/29/2008
Map interface to ShakeCast	6/1/2006	3/1/2007	9/30/2007	8/1/2007
Training and support materials	12/1/2006	9/1/2007	3/1/2008	2/29/2008
Test deployment support (services)	9/1/2005	9/1/2005	6/30/2008	6/30/2008
Shakecast communications (services)	12/1/2005	4/1/08	6/30/2008	6/30/2008

Delays in the first few deliverables were due to a delayed contract start date of 2/27/06 resulting from unanticipated delays in getting a Feasibility Study Report (FSR) approved and the contract package approved. Subsequent deliverables were delivered as planned.

KEY SHAKECAST COMPONENTS

The ShakeCast system utilizes two key data components (Figure 3-1) in generating post-earthquake bridge prioritization information: (1) ShakeMap, and (2) Bridge Fragility. ShakeMap provides the earthquake motions, while the bridge fragility defines how a bridge will perform given those motions.

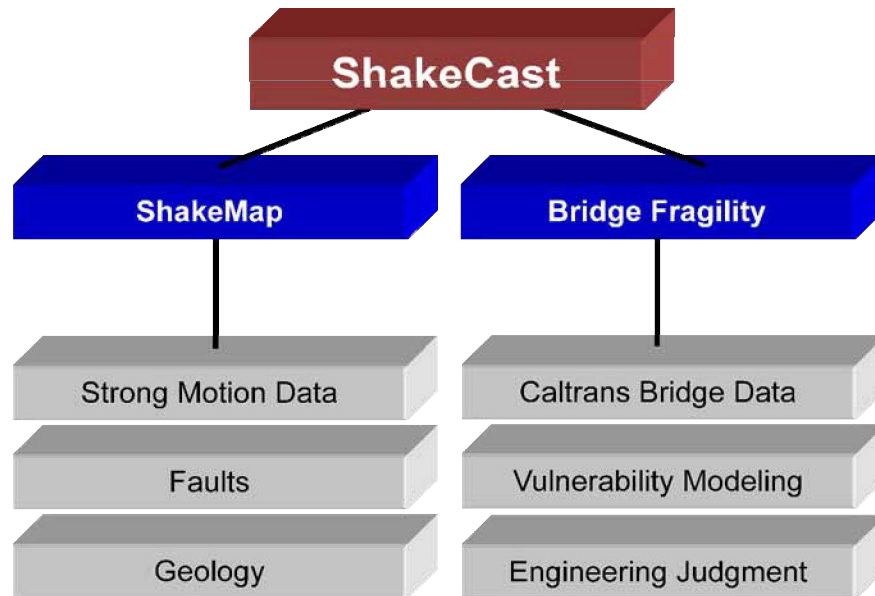


Figure 3-1 – Key ShakeCast components

ShakeMap provides ground motion information throughout the earthquake region. The information in ShakeMap data sets become available typically within 5 to 10 minutes following an earthquake. The data is based upon seismic recordings obtained at physical sensor installations distributed throughout California. Estimates of ground motion for specific bridge locations are interpolated between measurement sites, taking into account geologic and other fault-based factors. The net result is timely and best estimates of ground motion parameters at specific bridge sites. A more detailed discussion is provided in Section 4 of this report.

Bridge fragility refers to a series of unique statistical curves that define the probabilities that a bridge will be in any one particular damage state based upon a single ground motion metric. These curves were developed through years of research, bridge modeling, and engineering observations of damage from prior earthquakes. Fragility parameters are determined for each bridge in the state inventory based upon the unique attributes of each structure, including span lengths; number of spans; column heights; skew; the year of design, construction, and retrofit; and the component material types. A more detailed discussion is provided in Section 5 of this report.

SHAKEMAP DATA

ShakeCast is built from *ShakeMap*, a system for automatically generating data sets and maps of ground motion metrics in the minutes immediately following an earthquake (Wald 2005). Figure 4-1 shows an example ShakeMap Instrumental Intensity for the 1994 Northridge earthquake.

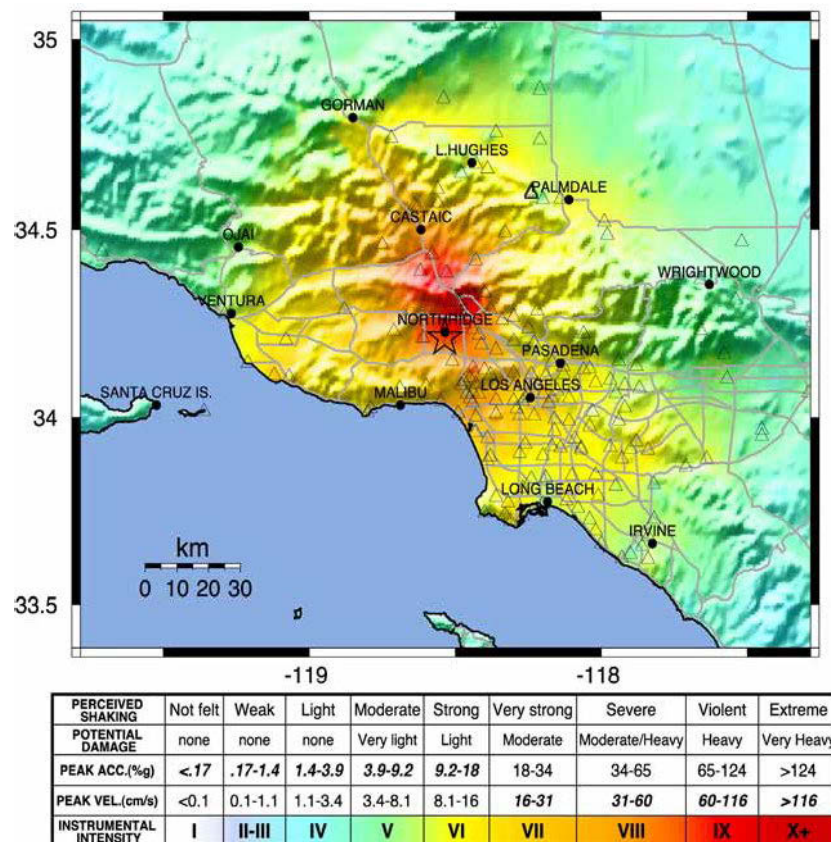


Figure 4-1 – ShakeMap instrumental intensity map

ShakeMap was first developed in the years following the 1994 M6.7 Northridge earthquake under the TriNet Project, a joint effort by the U.S. Geological Survey (USGS), California Institute of Technology (Caltech), and the California Geological Survey (CGS). The development of that system was completed in 2002, providing ShakeMap products for the entire state.

4.1 Generating ShakeMaps

ShakeMaps are generated from ground shaking data collected through the California Integrated Seismic Network (CISN) (<http://www.cisn.org/>). Currently, there are hundreds of seismic instruments installed throughout the state, operated by various organizations under the CISN collaborative. These organizations include the California Geological Survey, Caltech Seismological Laboratory, Berkeley Seismological Laboratory, USGS Menlo Park, USGS Pasadena, the California Governor's Office of Emergency Services, University of California, Santa Barbara, University of California, San Diego, University of Nevada, Reno, University of Washington, California Department of Water Resources, Lawrence Livermore National Lab, and Pacific Gas and Electric. In total, these organizations operate and maintain over 1900 sensors

statewide, providing post earthquake measurements to three primary processing centers for use in ShakeMap generation, as shown in Figure 4-2.

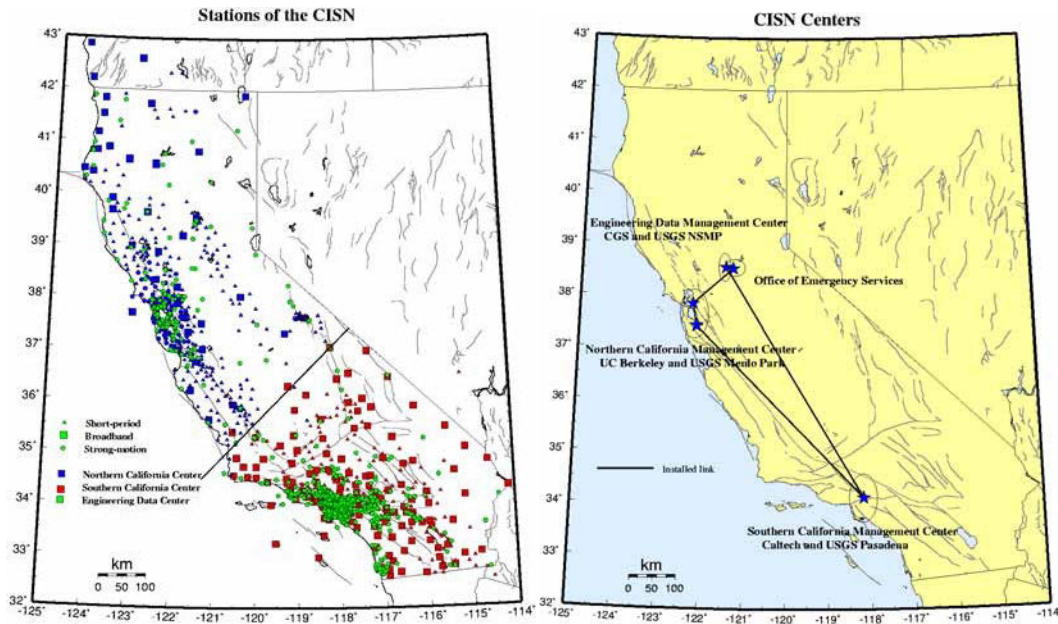


Figure 4-2 – CISM instrument locations and processing centers.

4.2 Benefits of ShakeMap

Prior to the availability of ShakeMaps, epicenter location and magnitude were the only available information immediately following an earthquake. With that single point on a map, post-earthquake response protocols called for inspections to focus at the epicenter and work away from there until no further damage was observed. However, the ShakeMap created years after the 1994 M6.7 Northridge earthquake illustrated that strong ground shaking did not occur uniformly around the epicenter, as shown in Figure 4-3. Use of ShakeMaps for response provides better information on the distribution of shaking, thereby focusing inspections on the areas most impacted.



Figure 4-3 – Ground shaking is not distributed uniformly around the epicenter.

BRIDGE FRAGILITY

The fragility method used in ShakeCast is based upon work originally published by Basöz and Mander (Basöz and Mander 1999) and is currently implemented in the Hazards U.S. (HAZUS) software of the Federal Emergency Management Agency (FEMA 2009).

5.1 Fragility Curves

Fragility curves typically take the form of a log-normal distribution and are plotted with the probability of exceeding a limit state on the vertical axis and the ground motion parameter on the horizontal axis. (The HAZUS method uses the *1.0 second peak spectral acceleration* ground motion parameter.) Multiple curves are used to define the multiple limit/damage states as shown in the example in Figure 5-1.

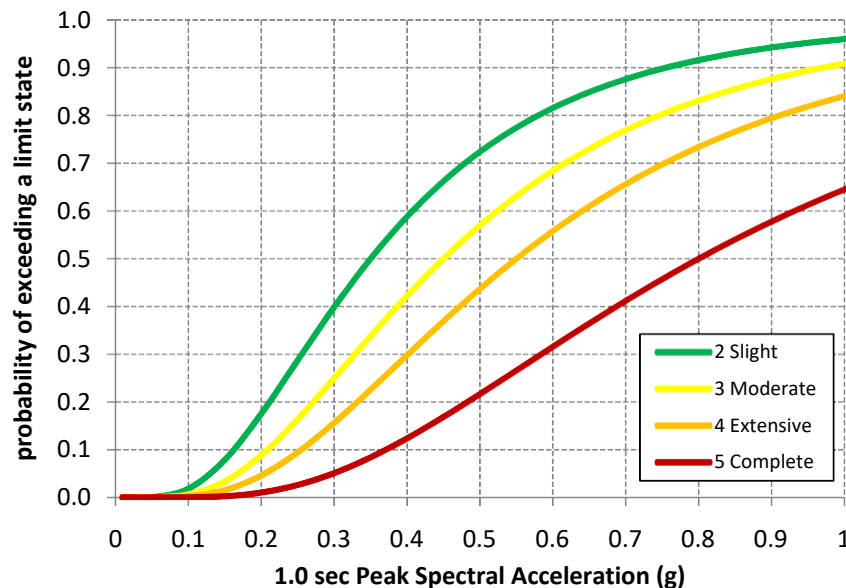


Figure 5-1 – Fragility curves of different damage states for a bridge example.

Take an example where, say, the 1.0 second peak spectral acceleration at the site was determined to be 0.5g. Examining the chart above, one would determine that is a 22% probability that the bridge is in a “complete” damage state, a 43% probability that the bridge is in an “extensive” damage state, a 57% probability that the bridge is in a “moderate” damage state, and a 72% probability that the bridge is in a “slight” damage state. It is important to note here that the bridge could actually be in any one of the four damage states based upon these probability functions.

5.2 Implementation in ShakeCast

In ShakeCast the HAZUS fragility method is further simplified in order to assign a single damage state to each facility in the inventory based upon the ground motion metric. In lieu of storing complete fragility curves, ShakeCast stores the parameter corresponding to the *50% probability of exceedance* value as shown in Figure 5-2.

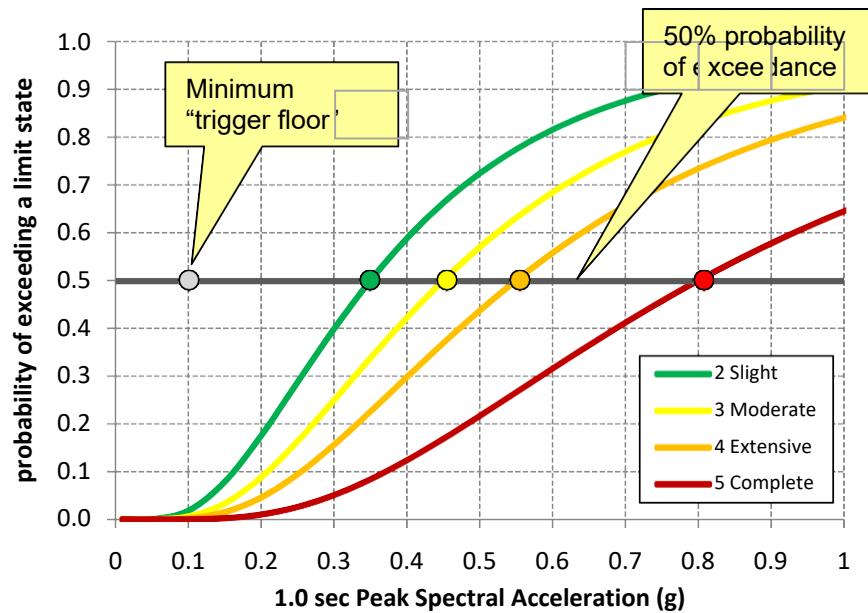


Figure 5-2 – Fragility curves of different damage states for a bridge example.

A trigger “floor” value of 0.1g (1.0 second peak spectral acceleration) is set in ShakeCast as the minimum value required for any facility to be reported in a ShakeCast analysis result.

The curve corresponding to “slight” damage cannot be easily calculated within ShakeCast, and, as such, that value is not stored in the system. Including the trigger floor value, four threshold values are stored in the system and are used to determine four damage states.

Fragility parameters for any facility in the ShakeCast system can be viewed by using the “search” function on the website as shown in Figure 5-3.

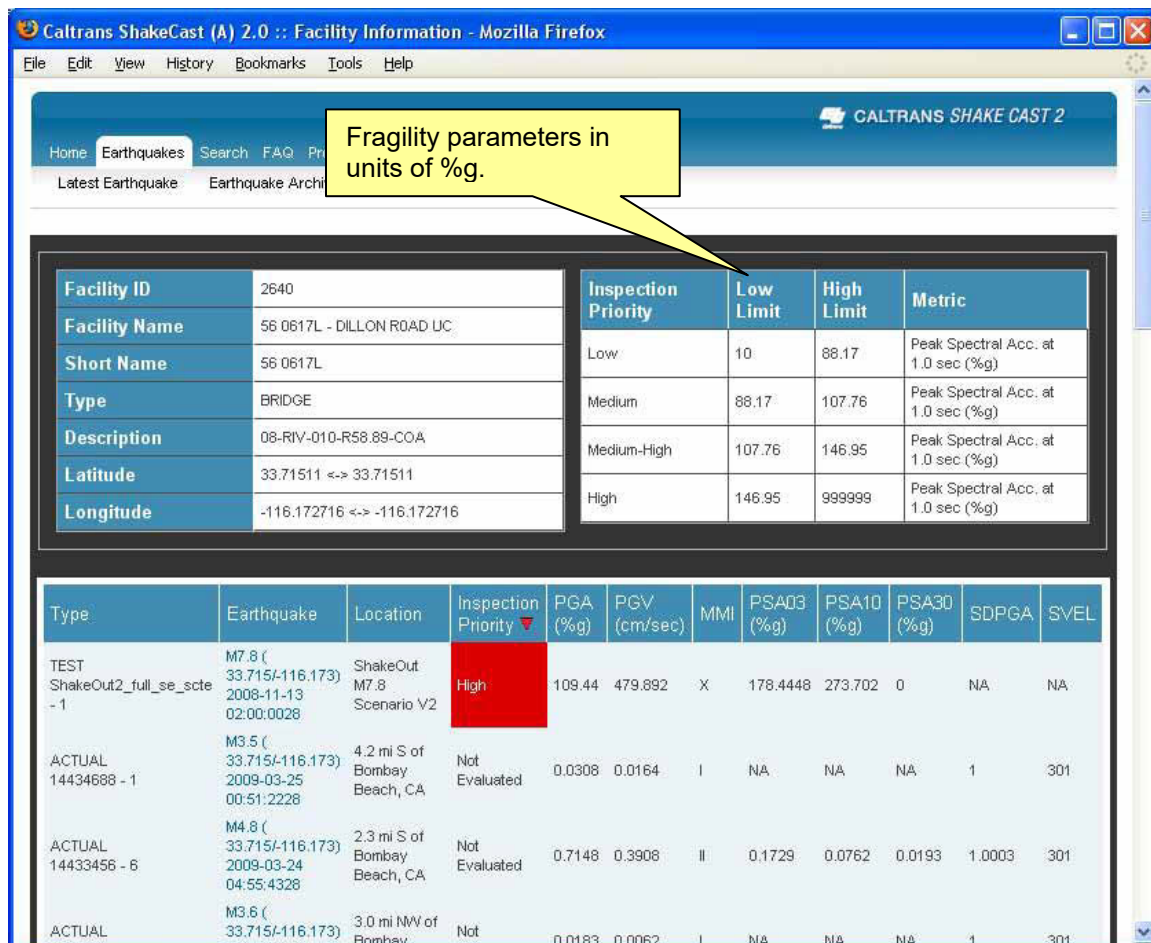


Figure 5-3 – Facility fragility information

5.3 Inspection Prioritization Terminology

Although the HAZUS method results in a prediction of “damage,” the ShakeCast system does not use the term “damage” or related phrases anywhere in the system, including in email notifications, on the website, and in other ShakeCast derived products. These terms were intentionally removed from the system so as to avoid any misinterpretation of ShakeCast results as being reports of actual observed damage.

In lieu of damage terms, a series of *inspection priority* terms and standard colors have been adopted. These terms, derived from HAZUS damage state terms, are shown in Figure 5-4. Note that the ShakeCast inspection priority “medium” includes both HAZUS states ds3 and ds2. Also, the ShakeCast inspection priority “low” does not directly correspond to a specific HAZUS damage state.

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)			

Figure 5-4 – Inspection priority terminology

5.4 Exceedance Ratio

In order for ShakeCast to compile a single list of bridges in rank ordered inspection priority, bridge inspection priority calculation results must be normalized.

For example, consider the case where two bridges are being analyzed and prioritized for inspection following an earthquake as shown in Figure 5-5. The bridges are located in close proximity to each other and both are exposed to the same ground motion.

Bridge		"A"	"B"
Fragility Parameters (1sec PSA)	High	1.34	1.56
	Medium-High	1.12	1.33
	Medium	0.72	0.87
	Low	0.10	0.10
Measured 1sec PSA during Earthquake		1.06	1.06
Inspection Priority Determined		Medium	Medium
Exceedance Ratio		0.85	0.41

Figure 5-5 – Example of calculating exceedance ratios for two bridges

In this example both bridges are determined to have a “medium” priority for inspection. However, the relative prioritization between the two can be difficult to determine since each bridge has unique fragilities. Note that Bridge “A”, in this case, is much closer to being categorized as “medium-high” since the 1 second peak spectral acceleration value is just below the threshold for medium-high. By contrast, a significantly higher 1 second peak spectral acceleration value would be required to push Bridge “B” to a “medium-high” category.

The *exceedance ratio* quantifies the relative priority of different bridges within the same inspection priority state. In the example presented, the exceedance ratio for Bridge “A” can be determined by:

$$exceedance\ ratio_{Bridge\ "A"} = \frac{1.06 - 0.72}{1.12 - 0.72} = 0.85$$

And, for Bridge “B”:

$$exceedance\ ratio_{Bridge\ "B"} = \frac{1.06 - 0.87}{1.33 - 0.87} = 0.41$$

In this example, Bridge “A” would be considered a higher priority for inspection since the 1 second peak spectral acceleration *exceeds* the threshold by a greater amount than for Bridge “B”.

ADMINISTERING THE SHAKECAST SYSTEM

ShakeCast currently operates on three servers located at the Transportation Laboratory in Sacramento, California. The system was set up with redundant processing, storage, and power to be used over the course of the research project.

6.1 System Hardware

Three servers were configured identically with ShakeCast software. The hardware used are server-class Dell PowerEdge 2850 rack mounted servers with dual 3.6 Xeon processors, 4GB RAM, and 146 GB 15k RAID 5 storage arrays. Each server is connected to an independent APC 1500 backup power supply. All hardware are housed together in a single rack, as shown in Figure 6-1.



Figure 6-1 – ShakeCast servers

6.2 System Software

The ShakeCast system operates on an open-source stack of technologies installed in a Windows 2003 Server environment. The technologies include the *Apache* web server, *MySQL* database, and *PHP* scripting language. This suite is collectively referred to as a “WAMP stack.” Additional information on WAMP version, installation, and configuration can be found in the documentation in the Appendices.

6.3 Administrative Interface

The majority of ShakeCast administrative functions can be accessed via a web interface, as shown in Figure 6-2. In general, the interface allows the system administrator to:

- Set up and manage user group accounts.
- Set up earthquake notification preferences.
- Create default notification profiles.
- Manage processed earthquake events.
- Set up and manage facility inventories and fragilities.
- Manage the ShakeCast server and database settings.

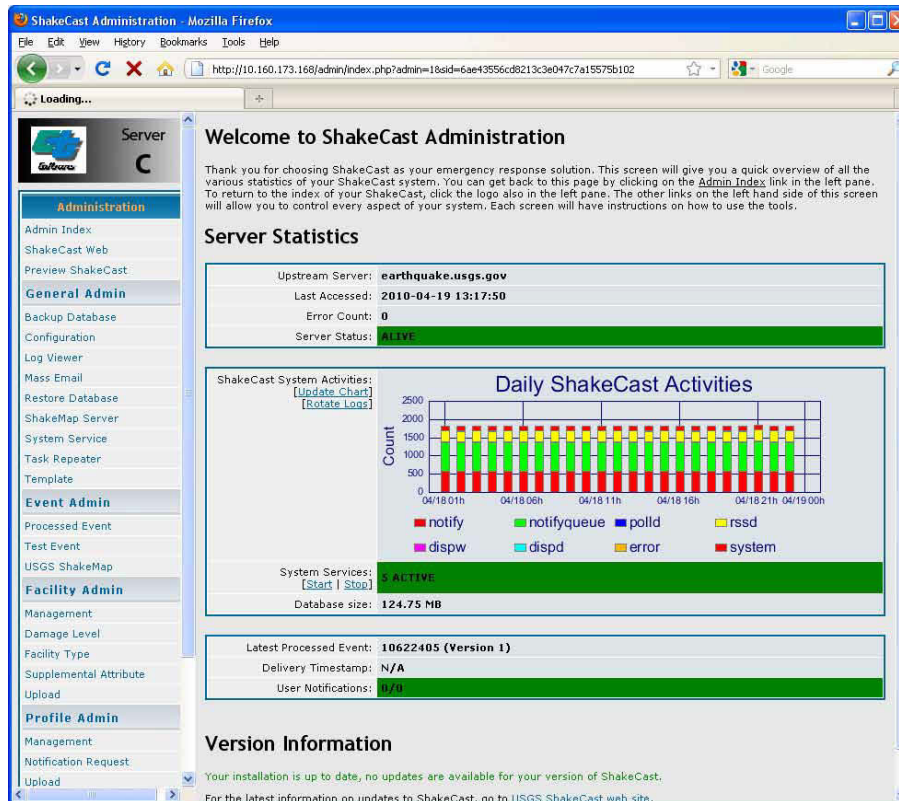


Figure 6-2 – ShakeCast administrative web interface

A number of new features implemented over the course of the project proved to be particularly useful for system administrators. The “Task Repeater” function made it possible for ShakeCast to send a daily status email messages to the administrator to let him/her know that the ShakeCast server was operating properly and in communications with upstream USGS servers. The “Log Viewer” feature allowed the administrator to view log entries of ShakeCast activities for troubleshooting. And, the primary administrative interface provided a good summary of the overall operational status of the ShakeCast system. Having these administrative tools within a web browser interface proved to be a valuable feature of the system.

Detailed information on the administrative interface can be found in the documentation in the Appendices.

6.4 Bridge Fragility Management

Section 4 presented the methodology used in ShakeCast to implement bridge fragility for inspection prioritization. Recall that ShakeCast stores the parameters corresponding to the 50% probability of exceedance value for HAZUS damage states 3, 4, and 5. In order to determine the unique fragility parameters for each bridge in the state’s inventory, a number of calculations must be performed. The calculations are performed once, and the resulting fragility parameters are entered into the ShakeCast system for use thereafter.

Early in the project an Excel spreadsheet was set up to automate the calculation of fragilities for over 12,700 state facilities. However, the number of calculations quickly overwhelmed the application, resulting in long processing times, and a file size approaching 200 MB. The data was subsequently migrated to a FileMakerPro 8 database application where the fragility calculations and bridge data could be more easily managed.

The FileMakerPro database combines information from a number of sources of bridge information, including:

- Structure Maintenance Automated Report Transmittal System (SMART) and the National Bridge Inventory (NBI)
- Traffic Analysis Surveillance and Analysis System (TASAS)
- 2004 Earthquake Engineering (EE) Vulnerability Spreadsheet
- HAZUS-MH MR4 (FEMA 2009)

The data are imported into tables in the FileMakerPro database as shown in entity relationship diagram in Figure 6-3.

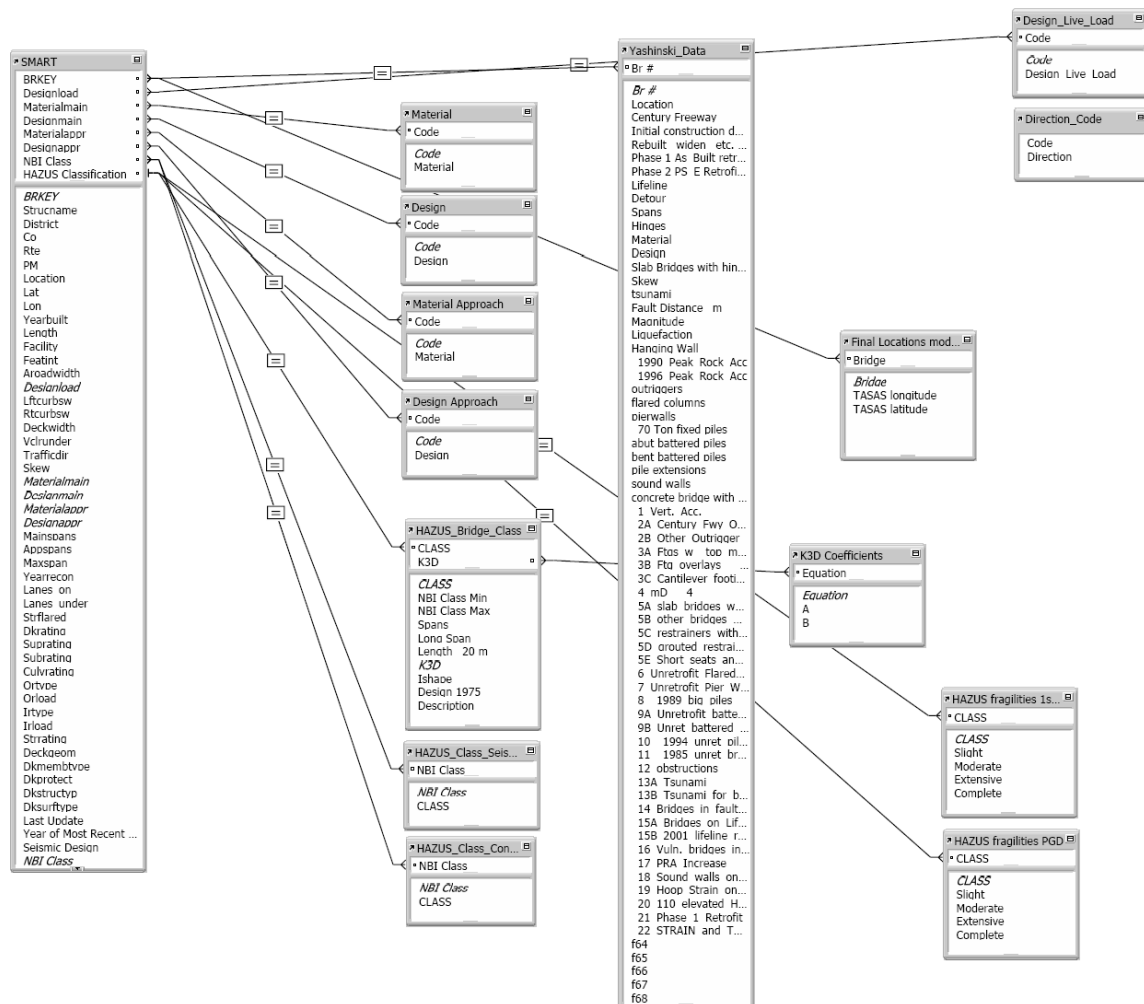


Figure 6-3 – Structure of FileMakerPro database

Fragility calculations are performed using bridge design data from SMART, seismic retrofit information from EE, and reference tables from HAZUS. Bridge location information is obtained from TASAS, as that system provides the most accurate location information. The resulting fragility parameters can be reviewed using the FileMakerPro interface, as shown in Figure 6-4, prior to exporting in a CSV format for use in ShakeCast.

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
Struoname	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
Feast	ROUTE 215
Aroadwidth	12.5
Designload	6
Design_Live_Load	HS 20+Mod
Lftcurbsw	0
Rtcurbsw	1.5
Deckwidth	14.4
Volrounder	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
lotype	1
lload	28.8
Strrating	7
Deckgeom	6
Dkmenbtype	0
Dkprotect	0
Dkstruotyp	1
Dksurftype	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	0
HAZUS Classification (If Single Span)		Phase 2 PS_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	33.9483000	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

Figure 6-4 – Reviewing bridge data in the FileMakerPro database

SHAKECAST FEATURES FOR END-USERS

ShakeCast delivers post-earthquake and inspection prioritization information to users in several different formats, including:

- Email notifications
- The ShakeCast Website
- Google Earth KML files
- ArcGIS shape files
- Excel spreadsheets

7.1 Email Notifications

Email notifications are the initial method for delivery of ShakeCast information following an earthquake. For many users, email notifications provide a sufficient amount of detail about the event and the impacts to state facilities and may be the only ShakeCast product that is used. Email messages are generated by the ShakeCast server and are sent to the Caltrans Lotus Domino email servers for distribution to ShakeCast subscribers. Emails can be sent to addresses with the Caltrans domain (dot.ca.gov) or sent to non-Caltrans email addresses, such as personal email accounts, cell phone email addresses, etc.

ShakeCast will typically generate email notifications within one or two minutes from receipt of ShakeMap data from the USGS. The USGS typically generates ShakeMap data within 5 minutes of the event occurrence. However, there have been a number of events over the course of the project where longer ShakeMap generation times were observed. This has resulted in longer times for users to receive ShakeCast email notifications.

ShakeCast sends four types of emails to users: NEW EVENT, UPDATED EVENT, CANCELLED EVENT, and BRIDGE ASSESSMENT. The type of message is noted in the subject line of email messages.

7.1.1 NEW EVENT Messages

NEW EVENT messages are sent to users for all earthquakes impacting California with magnitudes greater than 4.0, as reported by the USGS using the sensor array from the California Integrated Seismic Network (CISN). These messages are sent even though there may be no impacts to state facilities.

NEW EVENT messages contain the following key features:

- General description of the contents of message in the header with links to CISN and the ShakeCast administrator.
- A graphic image of the ShakeMap showing the extent of strong shaking.
- A summary of the event with date, time, magnitude, epicenter, and location.
- Other resources, including a links to the Caltrans-ShakeCast website, ShakeCast product downloads, and Google Earth KML files for the state bridge inventory.

These features are shown in an example email in Figure 7-1.

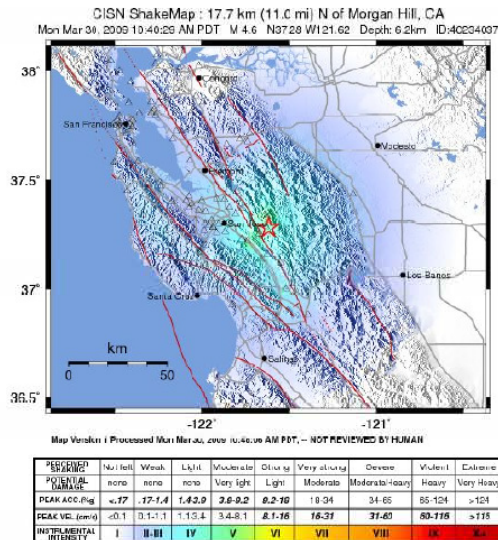


Caltrans ShakeCast Server (C) <Loren.Turner@dot.ca.gov>
03/30/2009 10:52 AM

To: Caltrans-ShakeCastAdmin@dot.ca.gov
cc:
Subject: NEW EVENT: 4.6, 17.7 km (11.0 mi) N of Morgan Hill, CA (40234037 Version 1)

Caltrans ShakeCast Preliminary Earthquake Notification

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](#). A "BRIDGE ASSESSMENT" followup email will be sent if ShakeCast determines any significant impacts to bridges. Questions about ShakeCast or this email report can be directed to Loren Turner at (916) 227-7174 or by [email](#).



Event Summary

Name: (Unnamed Event) , Version 1
Magnitude: 4.6
ID: 40234037-1
Location: 17.7 km (11.0 mi) N of Morgan Hill, CA
Latitude: 37.2845
Longitude: -121.6157
Time: 2009-03-30 10:40:20 CMT

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.

ShakeCast Server

Generated: [NULL]
Reported by: Server ID 1000
DNS: 10.160.173.166

Template Modified: 09-03-08 by L.Turner

Figure 7-1 – ShakeCast NEW EVENT message and contents.

7.1.2 UPDATED EVENT Messages

UPDATED EVENT email messages are sent if the USGS makes a significant change to the ShakeMap data. A change is considered significant if any ShakeMap metric (e.g. peak spectral acceleration, peak ground acceleration, peak ground velocity, etc.) for subsequent revisions exceed 10% of the originally reported value. This threshold minimizes the number of updated messages sent to users that have little to no impact on response protocols. The message will have a subject line containing "UPDATED EVENT." The content of these messages are similar to the NEW EVENT messages. These features are shown in an example email in Figure 7-2.

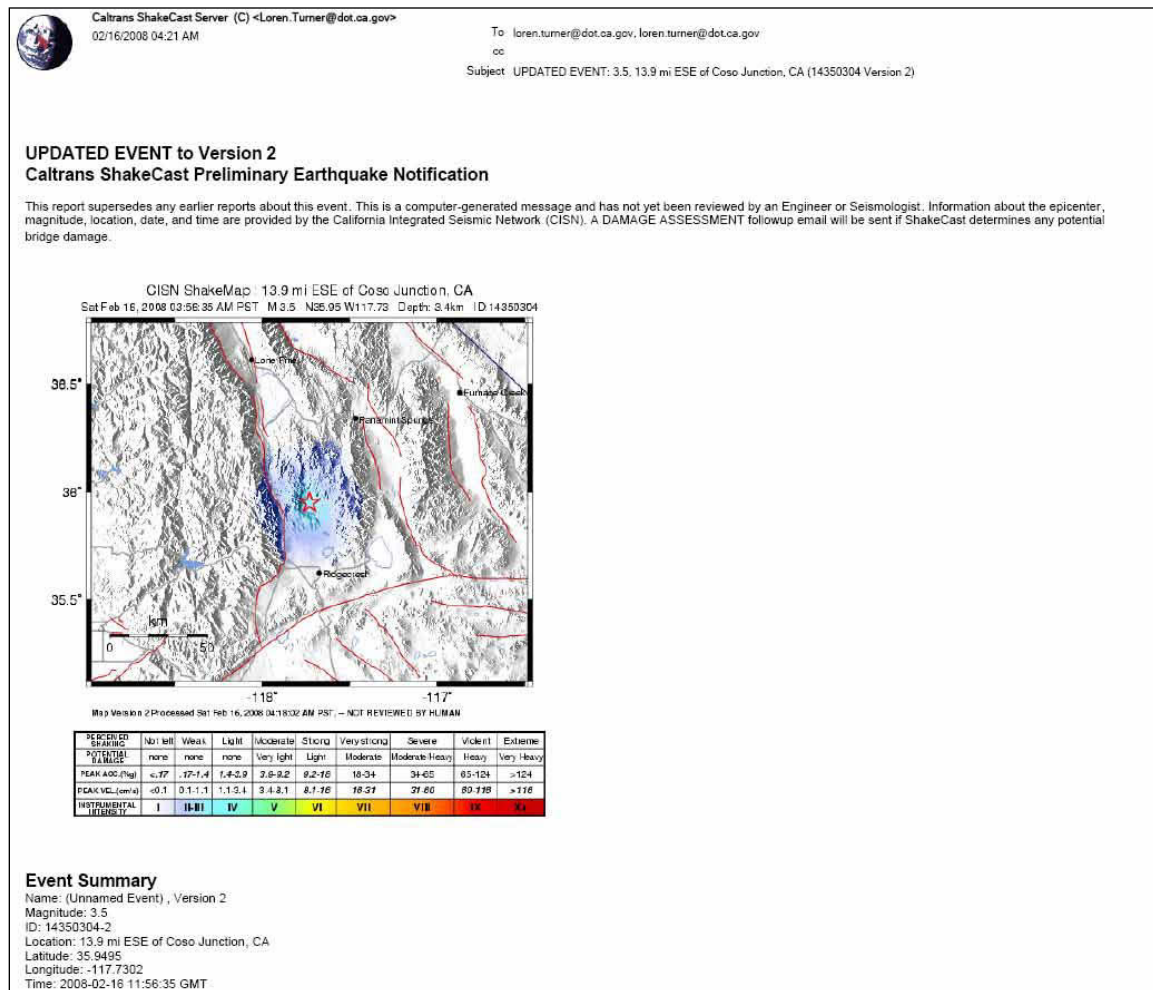


Figure 7-2 – ShakeCast UPDATED EVENT message and contents.

7.1.3 CANCELLED EVENT Messages

CANCELLED EVENT email messages are sent if the USGS retracts or cancels a ShakeMap. The message will have a subject line containing "CANCELLED EVENT" with minimal content in the message as shown in Figure 7-3.

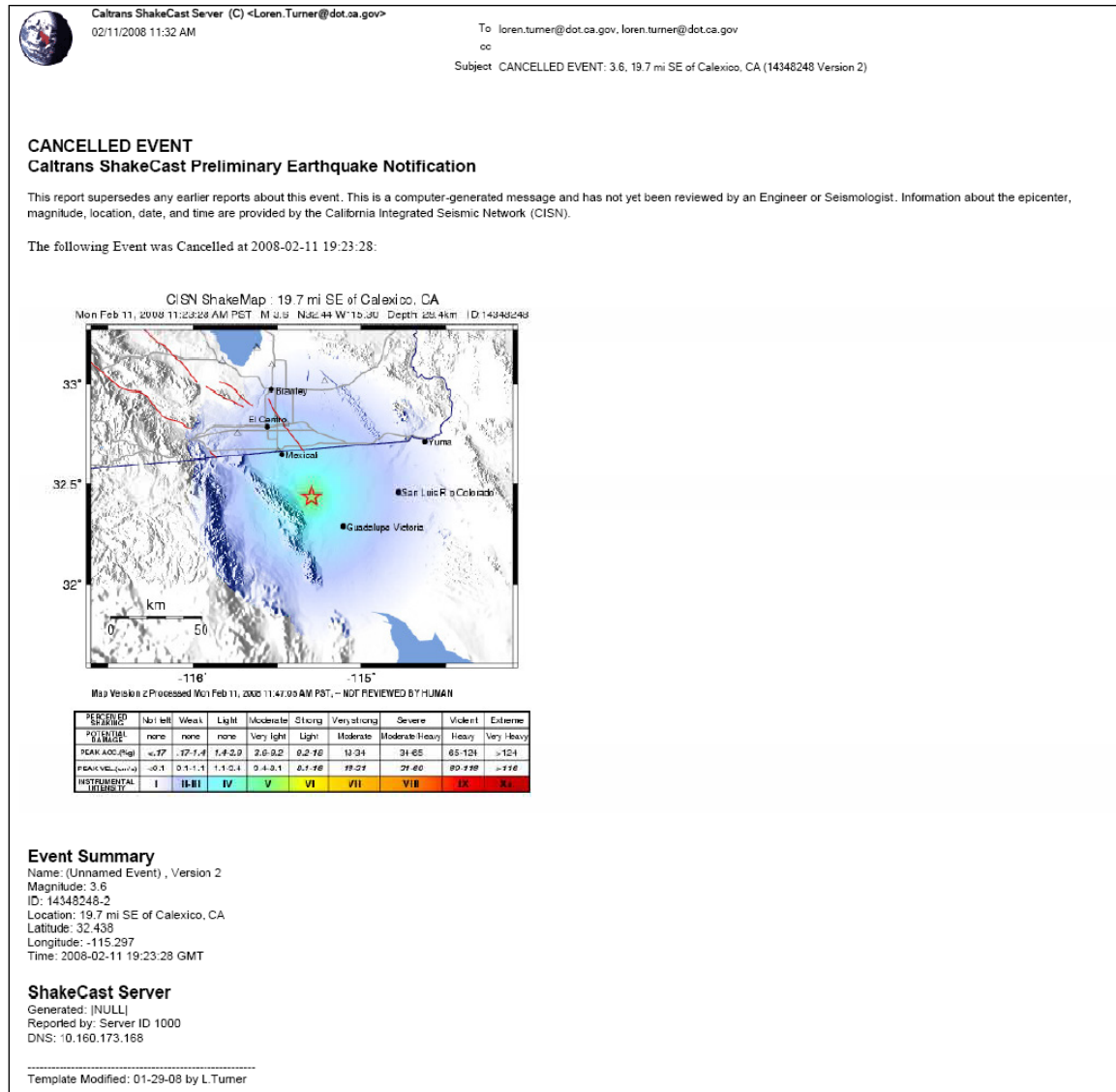


Figure 7-3 – ShakeCast CANCELLED EVENT message and contents.

7.1.4 BRIDGE ASSESSMENT Messages

BRIDGE ASSESSMENT emails are sent if the earthquake generates a peak spectral acceleration greater than 0.10g at any bridge location within the shaking zone. This email includes the list of bridges and priority for inspection.

BRIDGE ASSESSMENT messages contain the following key features:

- General description of the contents of message in the header with links to CISM, FEMA, Structure Maintenance & Investigations response protocols, and the ShakeCast administrator.
- A graphic image of the ShakeMap showing the extent of strong shaking.
- A summary of the event with date, time, magnitude, epicenter, and location.
- Other resources, including links to the Caltrans-ShakeCast website, ShakeCast product downloads, and Google Earth KML files for the state bridge inventory.
- The complete list of bridges analyzed and their relative inspection priority.

These features are shown in an example email in Figures 7-4 and 7-5.

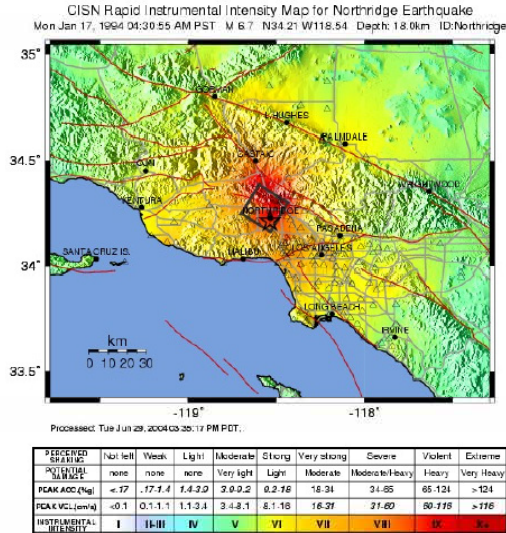


Caltrans ShakeCast Server (C) <Loren.Turner@dot.ca.gov>
03/23/2009 02:53 PM

To: Caltrans-ShakeCastAdmin@dot.ca.gov
cc:
Subject: BRIDGE ASSESSMENT: 6.7, Northridge (Northridge_sote 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](#).



Event Summary

Name: (Unnamed Event) , Version 1
Magnitude: 6.7
ID: Northridge_sote-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.

Figure 7-4 – ShakeCast BRIDGE ASSESSMENT message and contents.

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	1.886
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
53 1962F - S14 TRUCK-S5 TRUCK CONNECTOR	53 1962F	07-LA-014-R24.81-LA	Medium-High	115.578	0.062
53 2212F - W118-S405 CONNECTOR OC	53 2212F	07-LA-118-R9.83-LA	Medium-High	140.0625	0.046
53 2809L - BUTTE CANYON	53 2809L	07-LA-005-R50.80	Medium-High	111.1475	0.041
53 1220 - CHATSWORTH DRIVE UC	53 1220	07-LA-005-39.92-LA	Medium-High	122.517	0.035
52 0301 - STOW STREET OC	52 0301	07-VEN-118-R29.32-SIMV	Medium-High	64.5698	0.017
53 1130 - BRAND BLVD UC	53 1130	07-LA-005-39.98-LA	Medium-High	122.517	0.017
53 1132 - RINALDI STREET UC	53 1132	07-LA-005-40.46-LA	Medium-High	122.517	0.010
53 1115 - ROXFORD STREET UC	53 1115	07-LA-005-42.65-LA	Medium	120.8961	0.946
53 2502 - LIMEKILN CANYON	53 2502	07-LA-118-4.54-LA	Medium	103.3412	0.821
53 2634 - ALISO CREEK CULVERT	53 2634	07-LA-118-R6.38-LA	Medium	115.8198	0.795
53 1500 - DEVONSHIRE STREET UC	53 1500	07-LA-405-46.24-LA	Medium	140.0625	0.766
53 2213F - W118-S405 CONNECTOR	53 2213F	07-LA-118-R10.08-LA	Medium	140.0625	0.766
53 1985F - S5-E210 CONNECTOR SEPARATION	53 1985F	07-LA-005-R44.01-LA	Medium	129.9639	0.751
53 2342L - SHARP AVENUE UC	53 2342L	07-LA-118-R11.31-LA	Medium	111.3769	0.745
53 1783 - PICO LYONS OC	53 1783	07-LA-005-R50.33	Medium	111.1475	0.720
53 0848 - SIERRA HIGHWAY SEPARATION	53 0848	07-LA-005-C45.49-LA	Medium	115.578	0.710
53 0848G - N5TRK-N14 CONNECTOR OC	53 0848G	07-LA-005-C45.49-LA	Medium	115.578	0.710
53 2342R - SHARP AVENUE UC	53 2342R	07-LA-118-R11.32-LA	Medium	111.3769	0.710
53 0996R - WELDON CANYON ROAD UC	53 0996R	07-LA-005-C45.86	Medium	115.578	0.706
53 1965K - SAN FERNANDO ROAD OC	53 1965K	07-LA-005-R45.25-LA	Medium	115.578	0.706
53 1984R - WEST SYLMAR OH	53 1984R	07-LA-005-R44.87	Medium	115.578	0.694
53 1178 - SHERMAN WAY UC	53 1178	07-LA-405-42.36-LA	Medium	70.5283	0.658
53 1959 - S5-S5TRUCK UC	53 1959	07-LA-005-R45.88	Medium	112.4042	0.620
53 2809R - BUTTE CANYON	53 2809R	07-LA-005-R50.80	Medium	111.1475	0.619
53 2928 - ROUTE 5/126 SEPARATION	53 2928	07-LA-005-R53.33-SCTA	Medium	102.3536	0.593
52 0324 - COCHRAN STREET OC	52 0324	07-VEN-118-R29.96-SIMV	Medium	59.159	0.578
53 1129 - CHAMBERLAIN STREET PUC	53 1129	07-LA-005-39.48-LA	Medium	111.3769	0.569
53 2196 - EAST CANYON CHANNEL	53 2196	07-LA-118-R11.4-LA	Medium	111.3769	0.569

Figure 7-5 – ShakeCast BRIDGE ASSESSMENT message and contents (continued)

7.2 Navigating the ShakeCast Website

The ShakeCast website is hosted on the same ShakeCast server that carries out the analysis. The types of information on the website are similar to the information communicated in email notifications, but is provided in an enhanced and interactive web-based environment.

7.2.1 Home Page

The primary ShakeCast notification emails contain a direct link to the ShakeCast website. The link, titled "Caltrans ShakeCast Website," can be found in the section of the notification email under "Downloads & Resources" as shown in Figure 7-6.

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](#).

Figure 7-6 – Link to ShakeCast website in emails

When the hyperlink is clicked, the user is directed to the Caltrans ShakeCast home page, as shown in Figure 7-7.

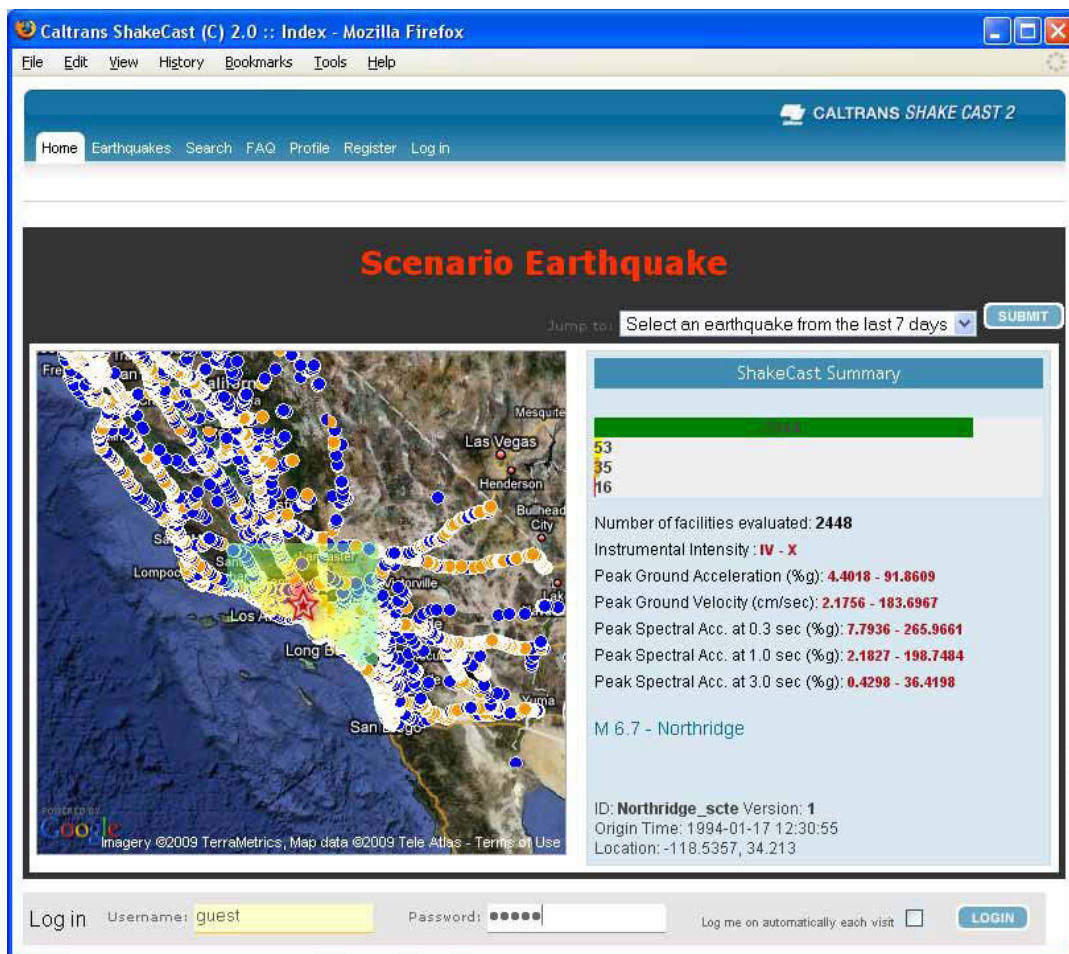


Figure 7-7 – ShakeCast home page

This page displays:

- An interactive map, centered on the event with the ShakeMap overlay.
- A summary of key earthquake parameters.
- A summary of the number of state facilities impacted and their breakdown by inspection priority.
- User login

The interactive map supports standard Google Maps controls. Double-clicking with the left mouse button within the map zooms into specific areas, while double-clicking with the right mouse button zooms out. Click-drag with the mouse allows the user to pan within the map, as shown in Figure 7-8.

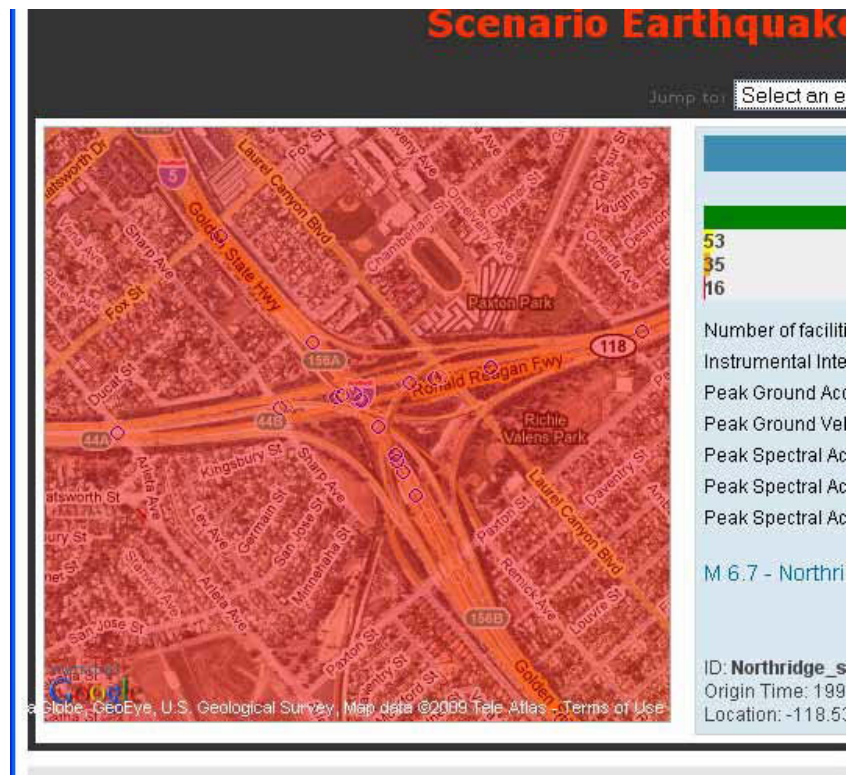


Figure 7-8 – Interactive map on the home page

Key earthquake parameters are displayed in the lower right corner of the page, as shown in Figure 7-9. The name of the earthquake is hyperlinked to an event page that will require the user to login.

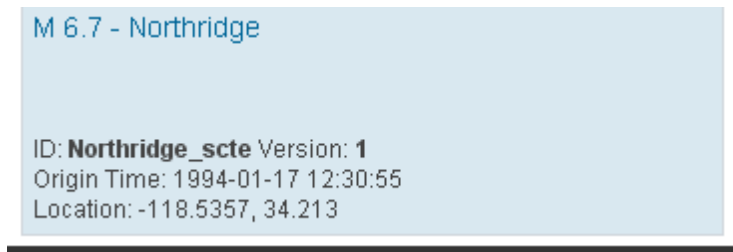


Figure 7-9 – Earthquake details

The analysis results, with impacts to state bridges, are presented in a bar chart on the right side panel, as shown in Figure 7-10. The total number of structures where 1 sec peak spectral accelerations exceeded 10% g is shown below the bar chart. The detailed breakdown by inspection priority is shown by green, yellow, orange, and red bars.

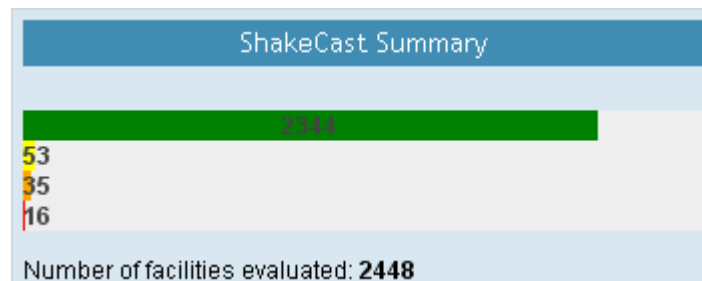


Figure 7-10 – Summary of impact to facilities

In the upper right area of the window there's a pull-down menu that allows the user to view other recent earthquakes, as shown in Figure 7-11. This is particularly useful in major events where significant aftershocks may result in multiple analyses.

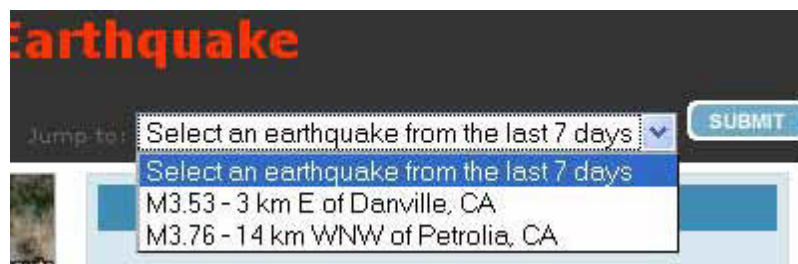


Figure 7-11 – Quick link to other recent events

At the bottom of the screen is the user login section, as shown in Figure 7-12. For Caltrans users a default guest account was established using the following login parameters:

Username: *guest*
Password: *guest*

A screenshot of a user login section. It features a light gray background with a white border. On the left, the text "Log in" is displayed. To its right are two input fields: "Username:" followed by a text box containing "guest", and "Password:" followed by an empty text box. Further right is a checkbox labeled "Log me on automatically each visit". To the right of the checkbox is a blue button with the text "LOGIN" in white capital letters.

Figure 7-12 – User login fields

After a successful login, the user is permitted to navigate throughout the site using the navigation tabs at the top of the screen, as shown in Figure 7-13.

A screenshot of a site navigation bar. It has a blue gradient background. On the right side, there is a logo consisting of a stylized 'C' and the text "CALTRANS SHAKE CAST 2". On the left side, there is a horizontal list of navigation tabs: "Home", "Earthquakes", "Search", "FAQ", "Profile", and "Log out [guest]". The "Home" tab is highlighted with a white background and a blue border.

Figure 7-13 – Site navigation tabs

7.2.2 Earthquakes Page

By default, following login, the user is redirected to the “Earthquakes” tab, as shown in Figure 7-14. The most recent event will be displayed along with a table of facility inspection priorities.

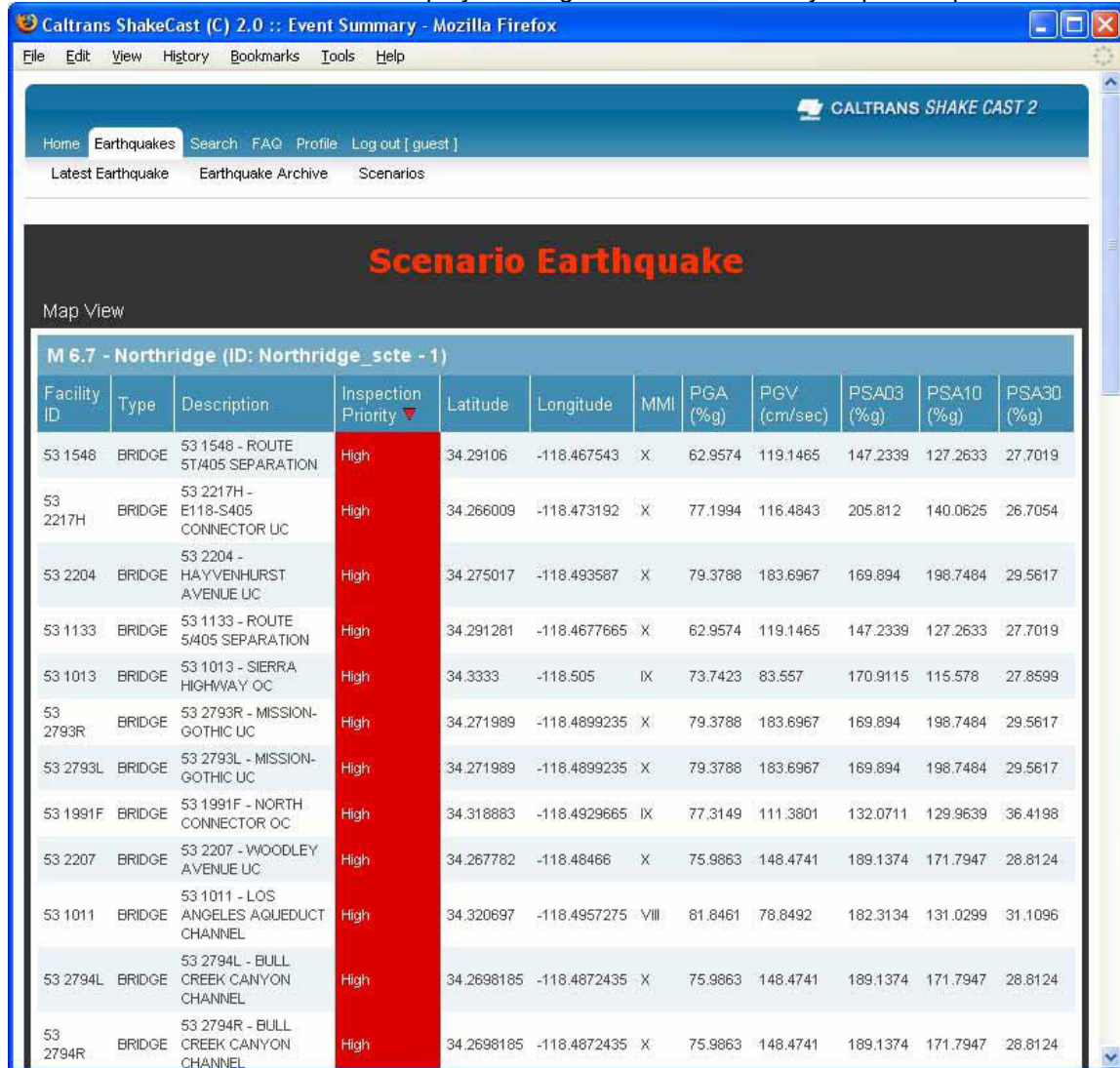


Figure 7-14 – Earthquakes page view

The “Earthquakes” tab expands a second tier of tabs and presents three tables of earthquakes that the ShakeCast system has analyzed, as shown in Figure 7-15. Users can browse through the most recent earthquake event in the “Latest Earthquake” table as shown in Figure 7-15, previous earthquakes in the “Earthquake Archive,” and scenario and planning events in the “Scenarios” tab as shown in Figure 7-16.

No. Facility Evaluated	Magnitude	Earthquake	Location	Event ID	Last Update
4157	4.7	1.4 mi NNE of Hawthorne, CA (Version 5)	33.9372, -118.3447	CI 10410337	Mon May 18, 2009 3:50 pm
4163	5	1.7 mi NNE of Hawthorne, CA (Version 2)	33.9397, -118.3378	CI 10410337	Mon May 18, 2009 4:11 am
4163	5	1.7 mi NNE of Hawthorne, CA (Version 1)	33.9397, -118.3378	CI 10410337	Mon May 18, 2009 3:48 am

All times are GMT

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Figure 7-15 – Latest earthquakes

No. Facility Evaluated	Magnitude	Earthquake	Location	Event ID	Last Update
6865	7.8	ShakeOut M7.8 Scenario V2 (Version 1)	33.35, -115.71	US ShakeOut2_full_se_scte	Thu Nov 13, 2008 5:42 pm
3686	6.7	Chino Hills Fault Scenario (Version 4)	33.9, -117.6	CI Chino_Hills6.7_se	Fri Sep 05, 2008 2:58 pm
3963	6.7	Northridge (Version 2)	34.213, -118.5357	CI Northridge_scte	Thu Sep 04, 2008 5:33 am

All times are GMT

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Figure 7-16 – Scenario earthquakes

When the user clicks on the name of any event in these tables, they are presented with the event and the table of facility inspection priorities, as shown in Figure 7-17.

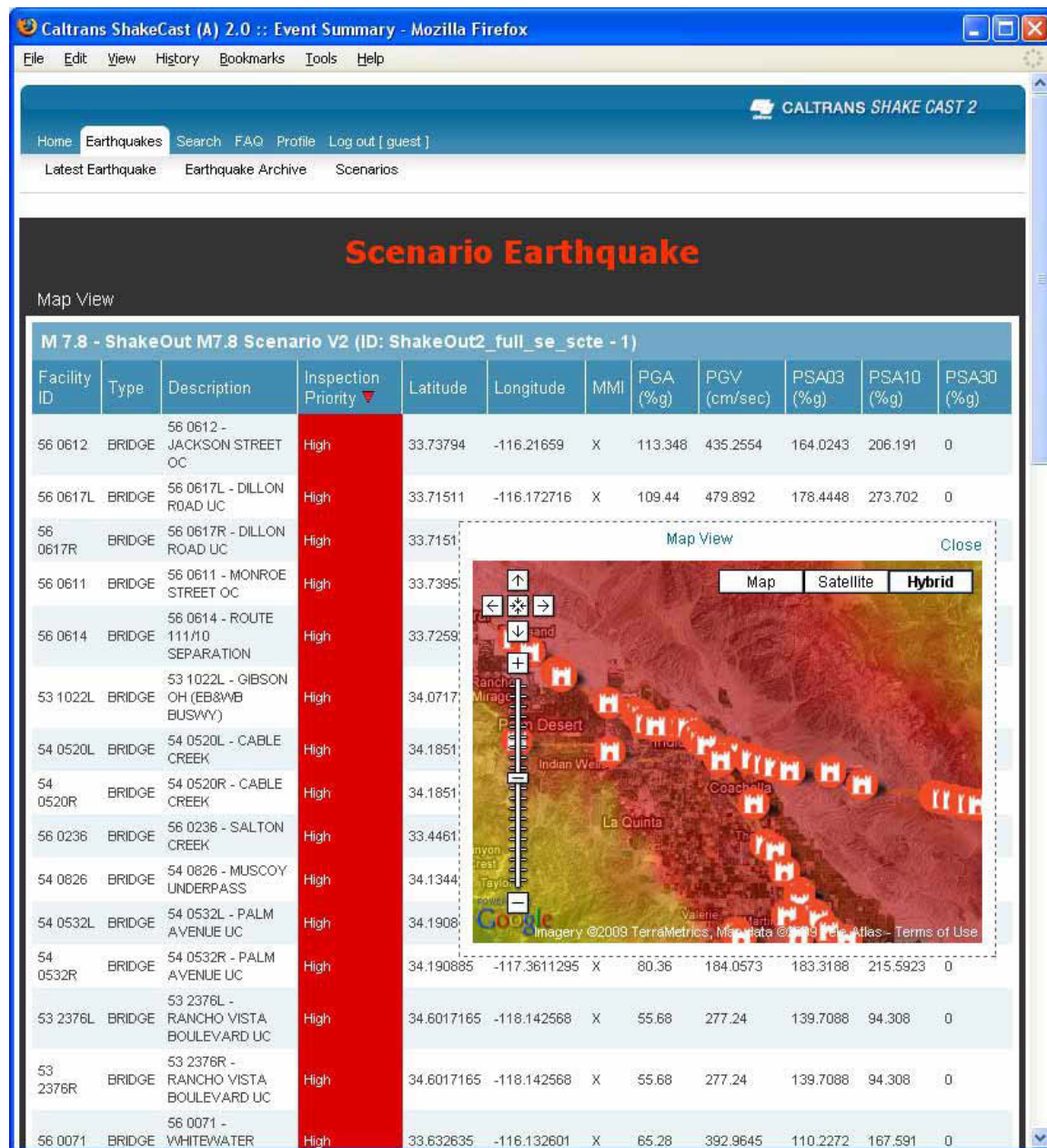


Figure 7-17 – Table view of event

Clicking on any of the rows in the table will bring up a floating map display, centered on the facility that was selected. This view allows the user to see the facility in the context of the event and adjacent facilities.

In the upper left corner of the table is a “Map View” link. When clicked, the user is presented with a map view of the event, as shown in Figure 7-18. The map view lists the structures to the right of the map, color coded to the inspection priority.

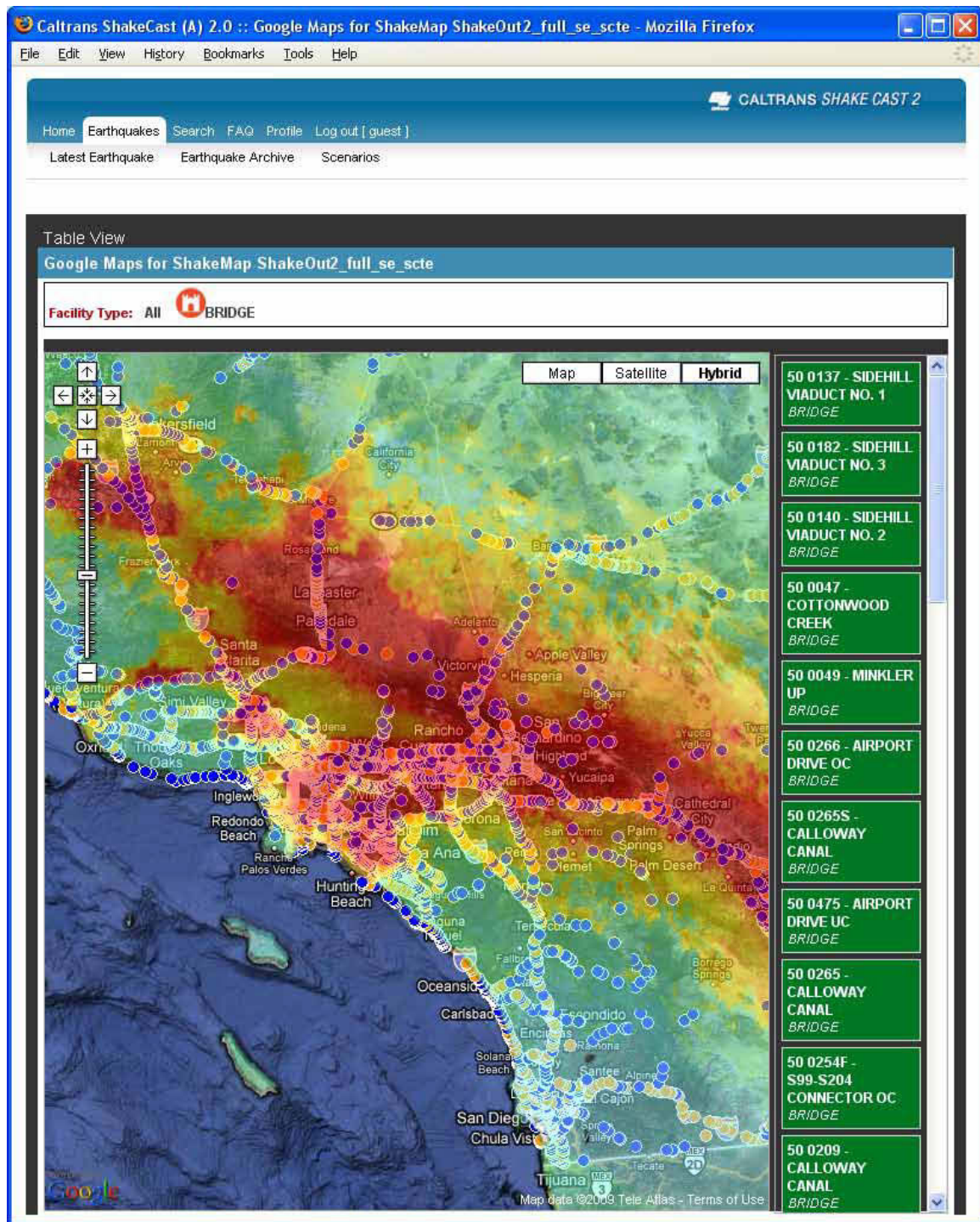


Figure 7-18 – Map view of event

As the user zooms in to locations on the map, additional detail is provided. Notably, the bridge icons will be symbolized by color coded icons corresponding to inspection priority, as shown in Figure 7-19. Clicking on any of the icons will bring up information about the facility and the ground motions at that location.

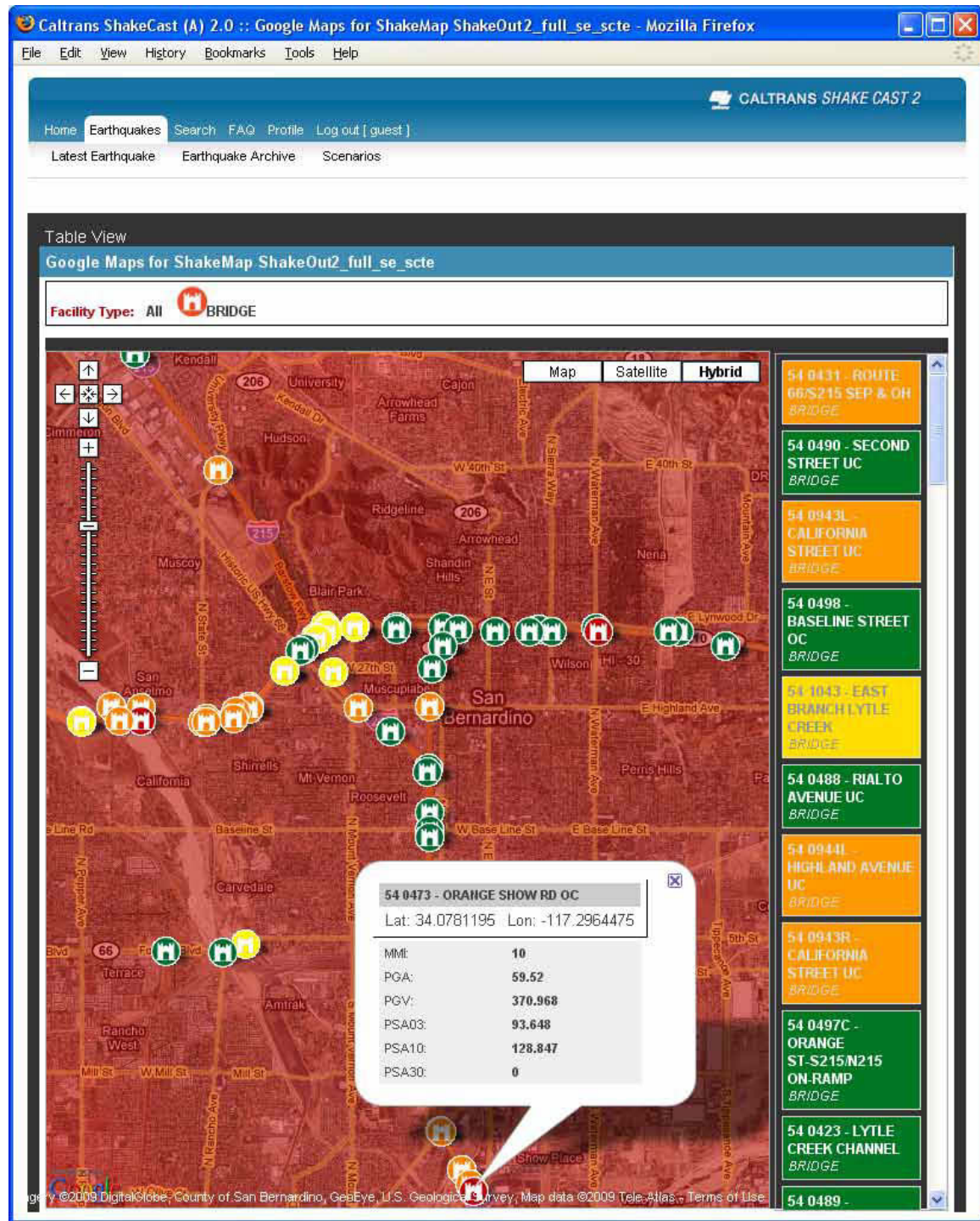
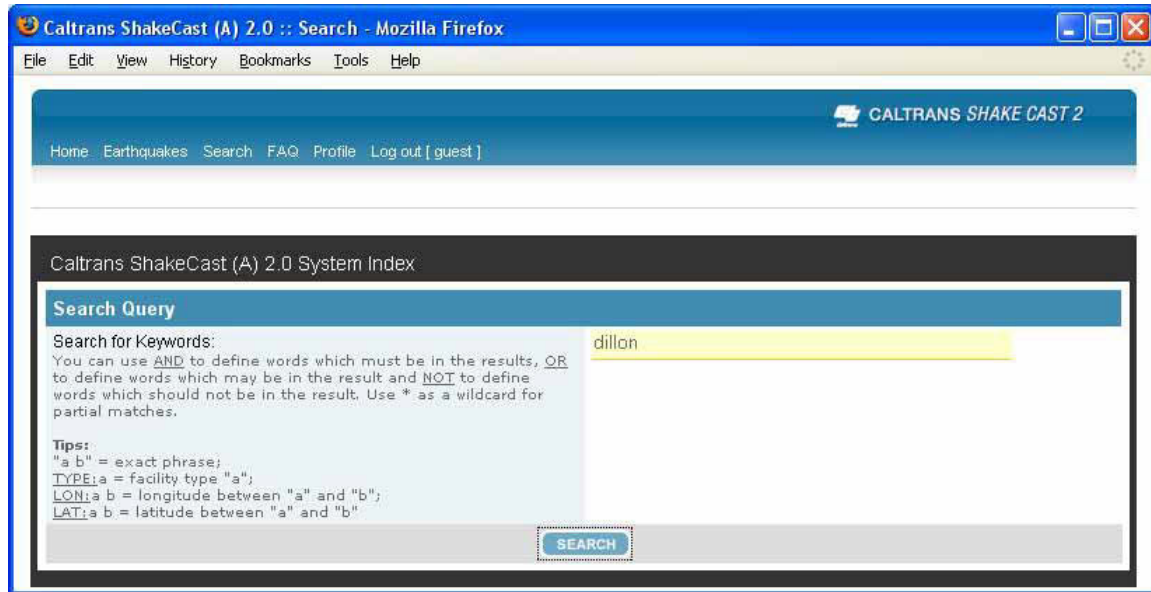


Figure 7-19 – Map view of event

7.2.3 Search Page

In the top navigation bar there is a “Search” function that can be used to view detailed information about any facility within the system. The user is prompted to enter any part of a facility name, as shown in Figure 7-20.



Caltrans ShakeCast (A) 2.0 :: Search - Mozilla Firefox

File Edit View History Bookmarks Tools Help

CALTRANS SHAKE CAST 2

Home Earthquakes Search FAQ Profile Log out [guest]

Caltrans ShakeCast (A) 2.0 System Index

Search Query

Search for Keywords:
You can use **AND** to define words which must be in the results, **OR** to define words which may be in the result and **NOT** to define words which should not be in the result. Use * as a wildcard for partial matches.

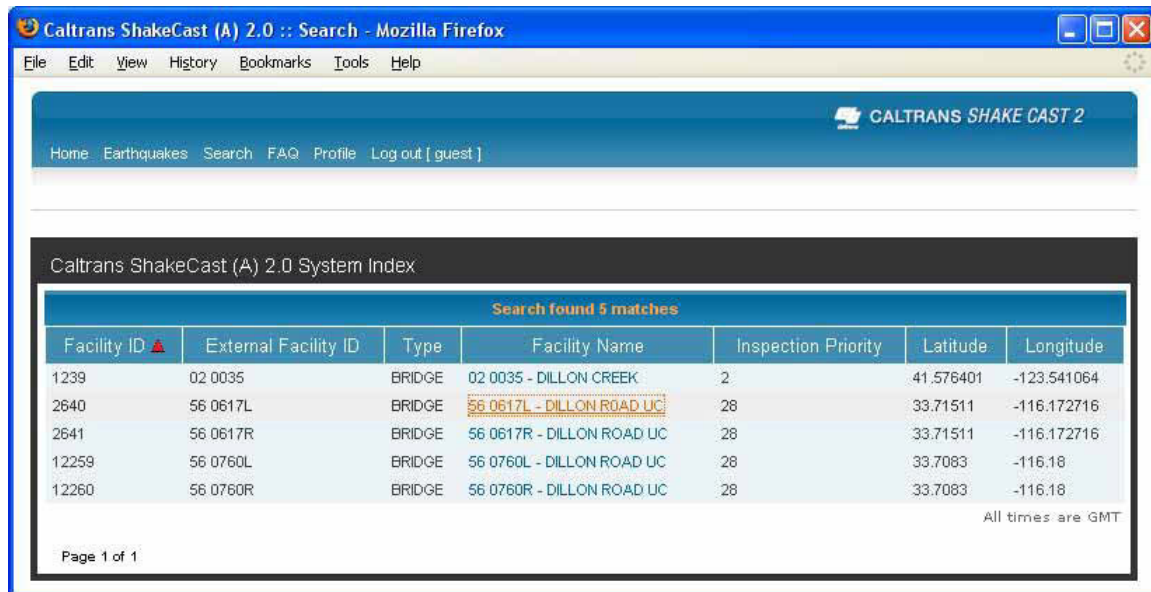
Tips:
"a b" = exact phrase;
TYPE:a = facility type "a";
LON:a b = longitude between "a" and "b";
LAT:a b = latitude between "a" and "b"

dillon

SEARCH

Figure 7-20 – Search function

After clicking the “search” button, the user is presented with the search results, as shown in Figure 7-21.



Caltrans ShakeCast (A) 2.0 :: Search - Mozilla Firefox

File Edit View History Bookmarks Tools Help

CALTRANS SHAKE CAST 2

Home Earthquakes Search FAQ Profile Log out [guest]

Caltrans ShakeCast (A) 2.0 System Index

Search found 5 matches

Facility ID ▲	External Facility ID	Type	Facility Name	Inspection Priority	Latitude	Longitude
1239	02 0035	BRIDGE	02 0035 - DILLON CREEK	2	41.576401	-123.541064
2640	56 0617L	BRIDGE	56 0617L - DILLON ROAD UC	28	33.71511	-116.172716
2641	56 0617R	BRIDGE	56 0617R - DILLON ROAD UC	28	33.71511	-116.172716
12259	56 0760L	BRIDGE	56 0760L - DILLON ROAD UC	28	33.7083	-116.18
12260	56 0760R	BRIDGE	56 0760R - DILLON ROAD UC	28	33.7083	-116.18

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All times are GMT

Figure 7-21 – Search results

Clicking on any one of the search results will bring up a screen with details of the specific facility, as shown in Figure 7-22. The screen presents general information about the facility (e.g. name,

location, etc.) in addition to the fragility limits unique to the facility. In the lower portion of the screen is a table showing all events that impacted the specific facility.

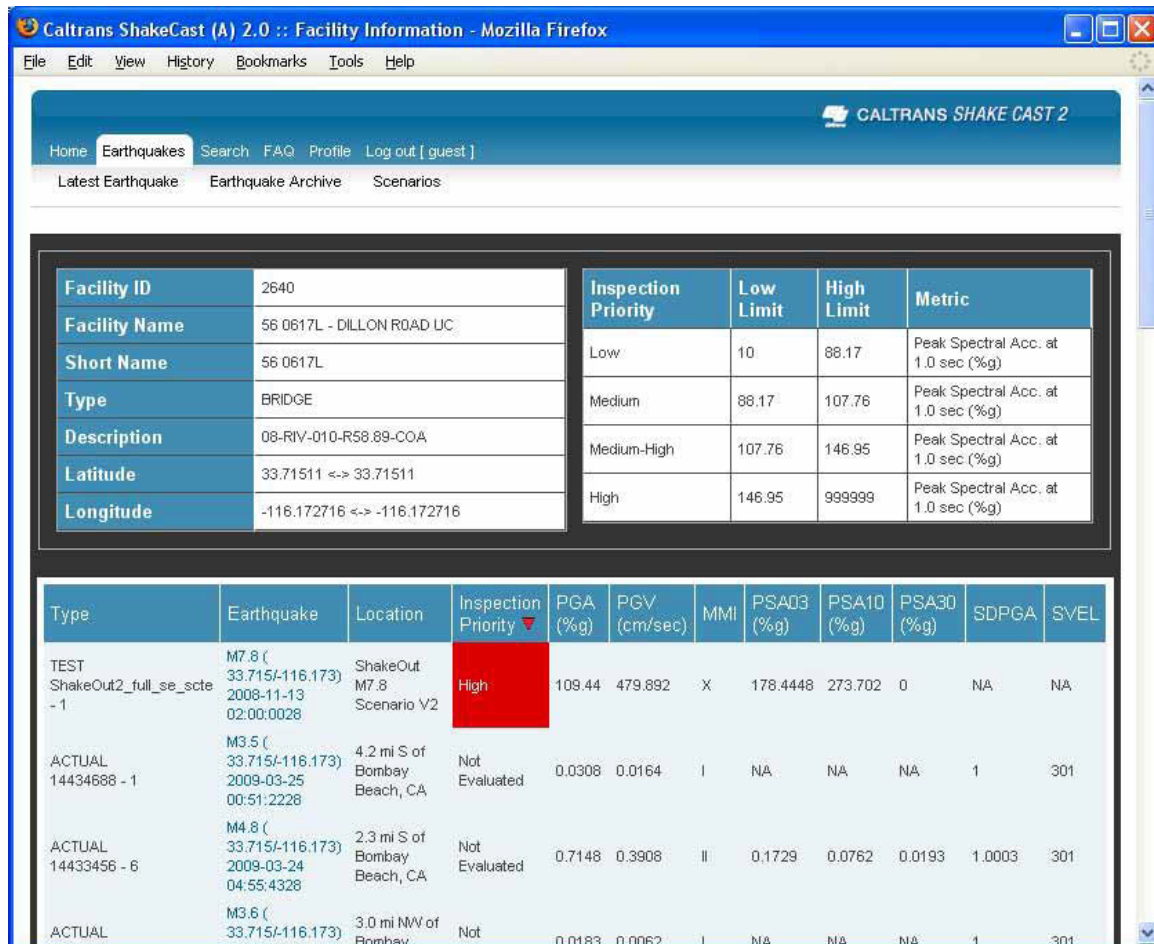


Figure 7-22 – Facility information

7.3 Using Google Earth KML Files

Google Earth is a desktop application that provides a powerful and interactive map-based interface to quickly combine ShakeCast and other relevant data sets. ShakeCast produces a Google Earth file as one of the standard output products. The file combines the ShakeMap along with the results of the facility analyses.

7.3.1 Obtaining Google Earth Software

To use the Google Earth file, you will need to have the Google Earth software installed on your computer. The software can be obtained on the web (<http://earth.google.com/download-earth.html>). Correspondence with Google's Enterprise Online group indicates that use of the free viewer did not present a licensing issue for Caltrans users, as shown in Figure 7-23.

From: "Google Earth Sales" <ge_sales@google.com>
 To: "Loren Turner" <loren_turner@dot.ca.gov>
 Date: 05/09/2007 04:56 PM
 Subject: Re: Google Earth software follow-up

Hi Loren,
 The people with whom you share the KML links with don't need to subscribe to the Google Earth Pro version to be able to view the data. The users preparing and sending the KML files do need to subscribe. Please review the end-users licensing agreement using this link:
<http://earth.google.com/support/bin/answer.py?answer=25095&query=license&topic=&type>

Thank you,

Carolina Hahn-Rodriguez
 Enterprise Online Sales
 Original Message Follows:

 From: Loren Turner <loren_turner@dot.ca.gov>
 Subject: Re: Google Earth software follow-up
 Date: Wed, 9 May 2007 15:29:07 -0700

Hi Carolina -
 Thank you for getting back to me on this. So, if I understand correctly, there is no licensing issue with having 100 Caltrans users downloading and using the free version of Google Earth for this earthquake response application?

thanks again,

Loren Turner

 Loren L. Turner, P.E.
 Senior Transportation Engineer
 Caltrans, Division of Research & Innovation, GeoResearch Group
 5900 Folsom Blvd. MS-5, Sacramento, CA 95819
 (916) 227-7174 Office (916) 227-6974 Fax

From: "Google Earth Sales" <ge_sales@google.com>
 To: "Loren Turner" <loren_turner@dot.ca.gov>
 Date: 05/09/2007 03:21 PM
 Subject: Re: Google Earth software follow-up

Hi Loren,
 You can share that information with users who downloaded the Free version; they will not need to subscribe to the Pro version.

Thank you,
 Carolina Hahn-Rodriguez
 Enterprise Online Sales
 Original Message Follows:

 From: Loren Turner <loren_turner@dot.ca.gov>
 Subject: Re: Google Earth software follow-up
 Date: Wed, 9 May 2007 11:41:45 -0700

Hi Carolina -
 I am inquiring into the use of Google Earth Free edition for up to 100 users here at Caltrans in support of a research and development effort associated with post-earthquake response.

Following an earthquake, Caltrans bridge inspection teams deploy to the impacted area to inspect bridges for potential damage. Time is critical and focusing the inspection resources on the most likely damaged areas can save lives and reduce traffic down time. We're currently working with the USGS to get the earthquake data in spatial data sets. We have systems to automatically analyze bridge performance against measured ground motions. That analysis is then summarized and communicated to our bridge response teams.

We've figured out how to transform the data into KML files, and have been testing this using our current GE Pro licenses on a very limited basis. However, we're at a stage in the project where we'd like to have 100 responders use the Free version to quickly view that data. Is this something that we can do? Are any formal licensing agreements necessary for this? We appreciate your consideration of this request and support of our emergency response efforts.

Please feel free to call me to discuss further.

Best Regards,

Loren Turner

 Loren L. Turner, P.E.
 Senior Transportation Engineer
 Caltrans, Division of Research & Innovation, GeoResearch Group
 5900 Folsom Blvd. MS-5, Sacramento, CA 95819
 (916) 227-7174 Office (916) 227-6974 Fax

Figure 7-23 – Correspondence with Google on licensing

7.3.2 Getting the ShakeCast-generated *kml* File

Users can obtain the Google Earth file (with the file extension, *kml*) from the ShakeCast products website. A link, titled “Caltrans ShakeCast Products,” can be found in the section of the notification email under “Downloads & Resources” as shown in Figure 7-24.

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](#).

Figure 7-24 – Link to ShakeCast products website in emails

When the hyperlink is clicked, the user is directed to the Caltrans ShakeCast Products webpage, as shown in Figure 7-25.

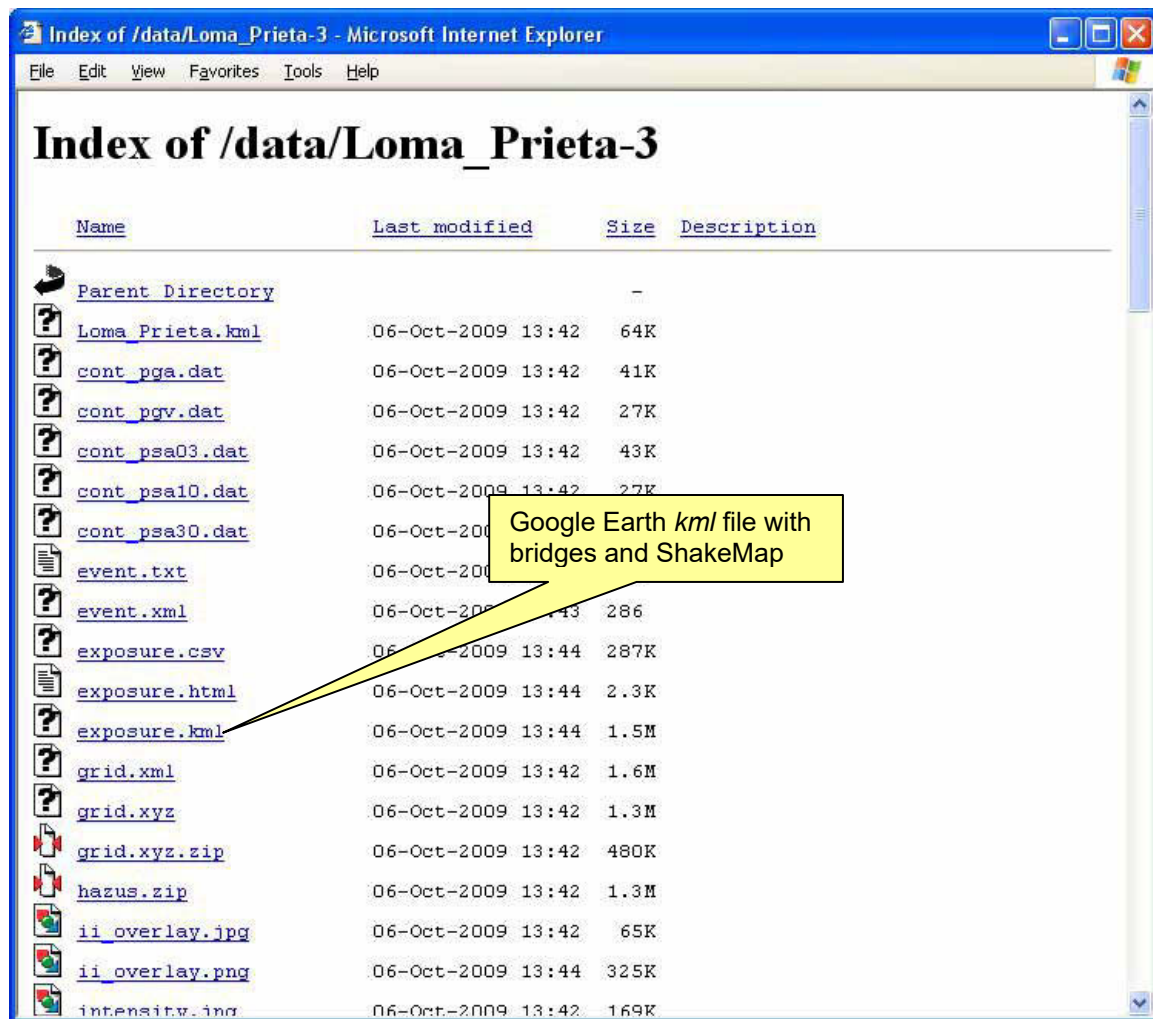


Figure 7-25 – Caltrans ShakeCast Products webpage

The page contains a list of all available ShakeCast files for the specific event, including various ShakeMap image files, and the core data files used in the ShakeCast analysis routines. For Google Earth users, the file, *exposure.kml*, is the file you will want to download. Depending upon

which internet browser you are using, the download procedure varies. For users of Internet Explorer, it is recommended that you right-click the name of the file, then use the “Save Target As...” option to save the file, as shown in Figure 7-26.

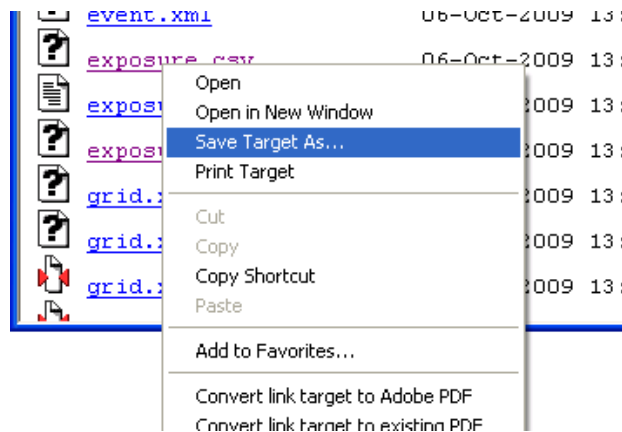


Figure 7-26 – Downloading the Google Earth exposure.kml file

When prompted to save the file, be sure to check that the filename extension is *kml* as shown in Figure 7-27. Internet Explorer typically recognizes the file as an *xml* file type by default, so the file extension may need to be changed.

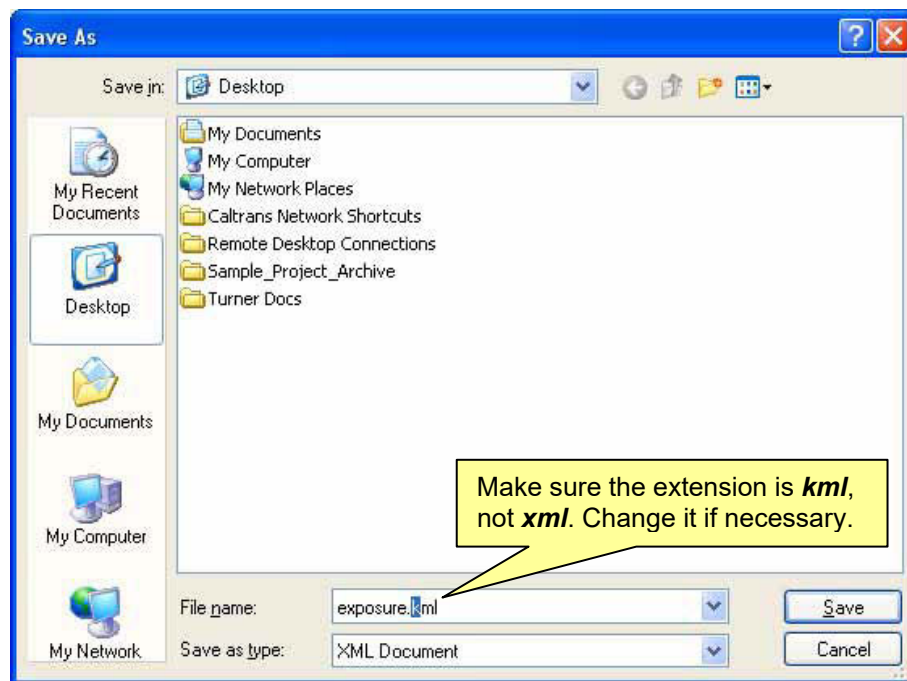


Figure 7-27 – Downloading the Google Earth exposure.kml file

7.3.3 Working with the ShakeCast *kml* File

Once downloaded, open the *kml* file in the Google Earth application. The view should zoom and center the map view automatically on the specific event as shown in Figure 7-28. You should see the ShakeMap overlay, facility icons and labels, and the earthquake epicenter as shown in Figure 7-29.

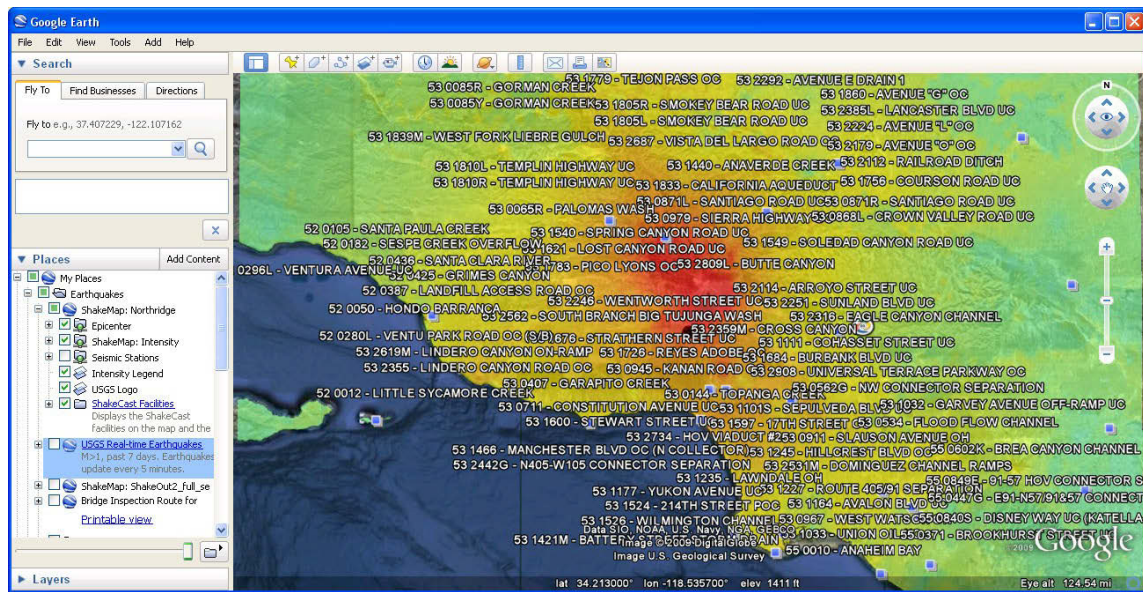


Figure 7-28 – Downloading the Google Earth exposure.kml file

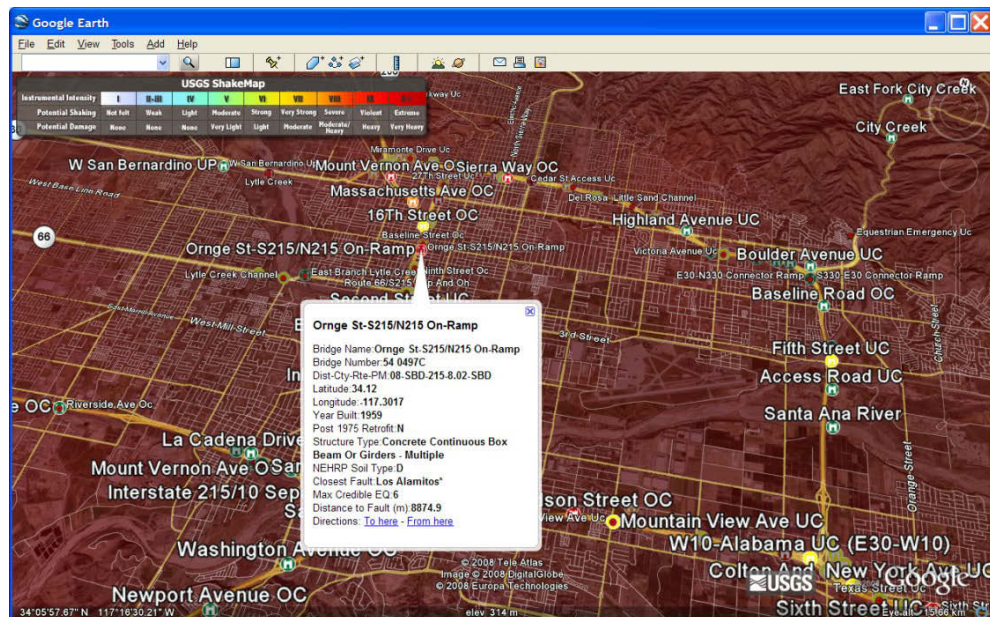


Figure 7-29 – Viewing facility information in Google Earth

Other features may be added to the map that could help responders better understand the extent and impact of the event. For example, Google Earth provides near real-time traffic speed information as a default layer, as shown in Figure 7-30. Traffic incidents coupled with “high priority” facility inspection prioritization in the same area may be an indicator of potential problems in that area.

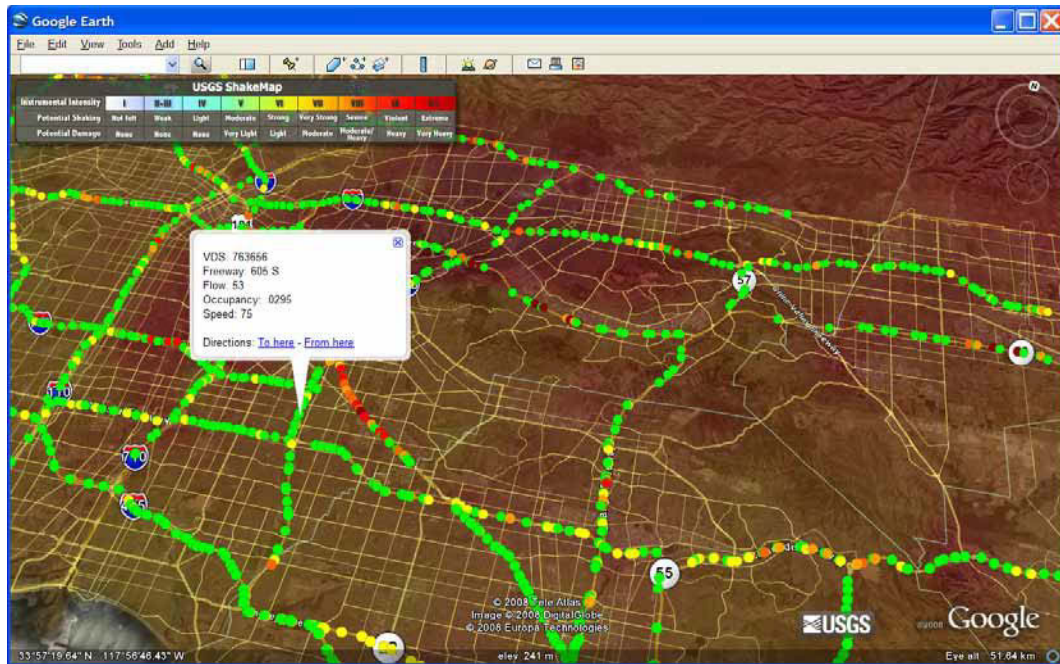


Figure 7-30 – Viewing traffic information in Google Earth

Caltrans maintains a network of Closed-Circuit Television (CCTV) cameras that are available as Google Earth files with streaming real time video feeds. This information may also be useful, if available, after an earthquake, as shown in Figure 7-31.

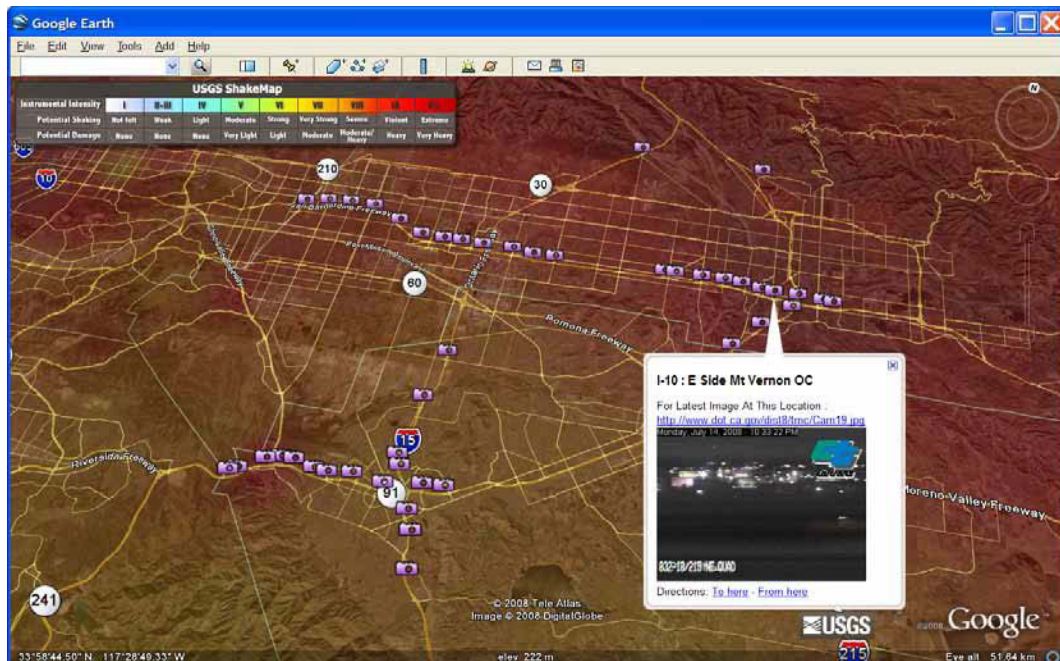


Figure 7-31 – Viewing CCTV video streams in Google Earth

7.4 Using ArcGIS Shape Files

Some users may want to use the ShakeCast information to produce printable maps and other map based products. The USGS packages the ShakeMap data into shape files which can, in turn, be used in ArcGIS and other standard GIS applications. The results of the facility assessments are not provided in a shapefile; however, the CSV file described in the next section can be used in ArcGIS to produce this map layer. Alternatively, users can import facility datasets into their GIS application from the “shakecast.xml” document. It is similar to exposure.csv and is in an XML format. Detailed instruction on importing an XML workspace is available on the ESRI web site (<http://webhelp.esri.com/arcgisserver/9.3/java/index.htm>).

7.4.1 Getting the ShakeMap GIS Files

Users can obtain the shapefiles from the ShakeCast products website. A link, titled “Caltrans ShakeCast Products,” can be found in the section of the notification email under “Downloads & Resources” as shown in Figure 7-32.

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](#).

Figure 7-32 – Link to ShakeCast products website in emails

When the hyperlink is clicked, the user is directed to the Caltrans ShakeCast Products webpage, as shown in Figure 7-33.

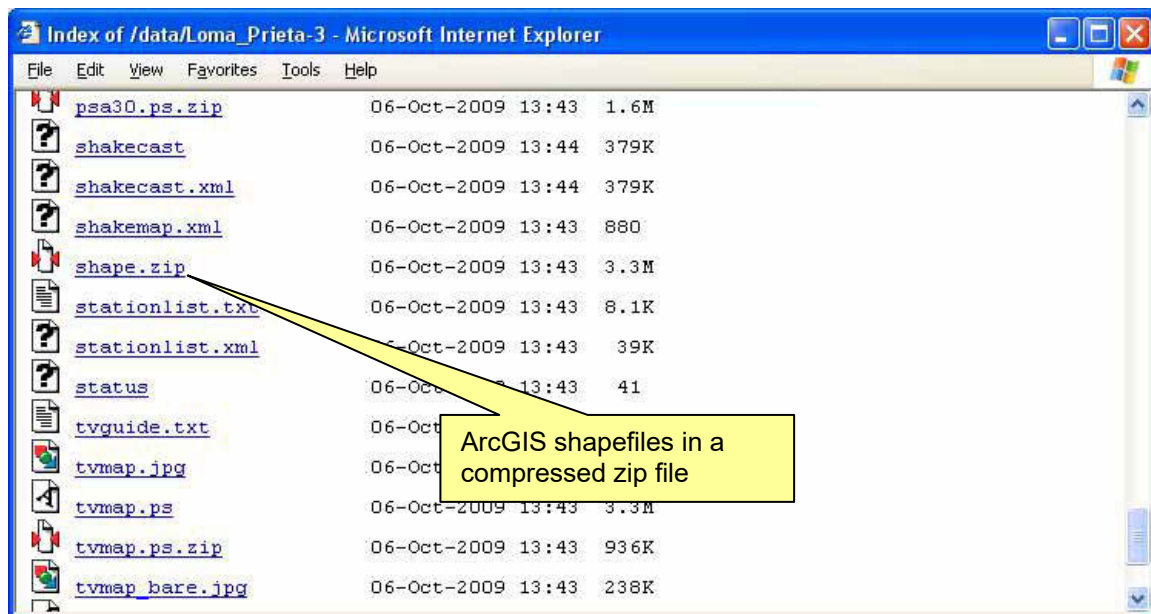


Figure 7-33 – Caltrans ShakeCast Products webpage

The page contains a list of all available ShakeCast files for the specific event, including various ShakeMap image files, and the core data files used in the ShakeCast analysis routines. For GIS users, the file, *shape.zip*, is the file you will want to download, containing a collection of ShakeMap related shape files. Depending upon which internet browser you are using, the download procedure varies. For users of Internet Explorer, it is recommended that you right-click

the name of the file, then use the “Save Target As...” option to save the file, as shown in Figure 7-34.

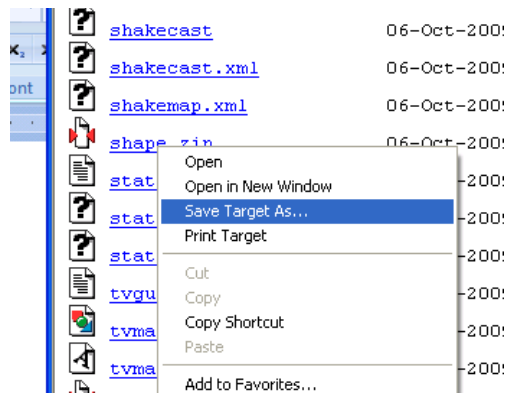


Figure 7-34 – Downloading the shape files

7.4.2 Working with ShakeMap GIS Files

Once downloaded, unzip the *shape.zip* file and add the various shape files to your GIS map project as shown in Figure 7-35. For users who wish to access the full list of ShakeMap metrics beyond the standard PGA, PGV, and PSA datasets, the “grid.xml” file contains all available metrics and can be imported in the same manner described above.

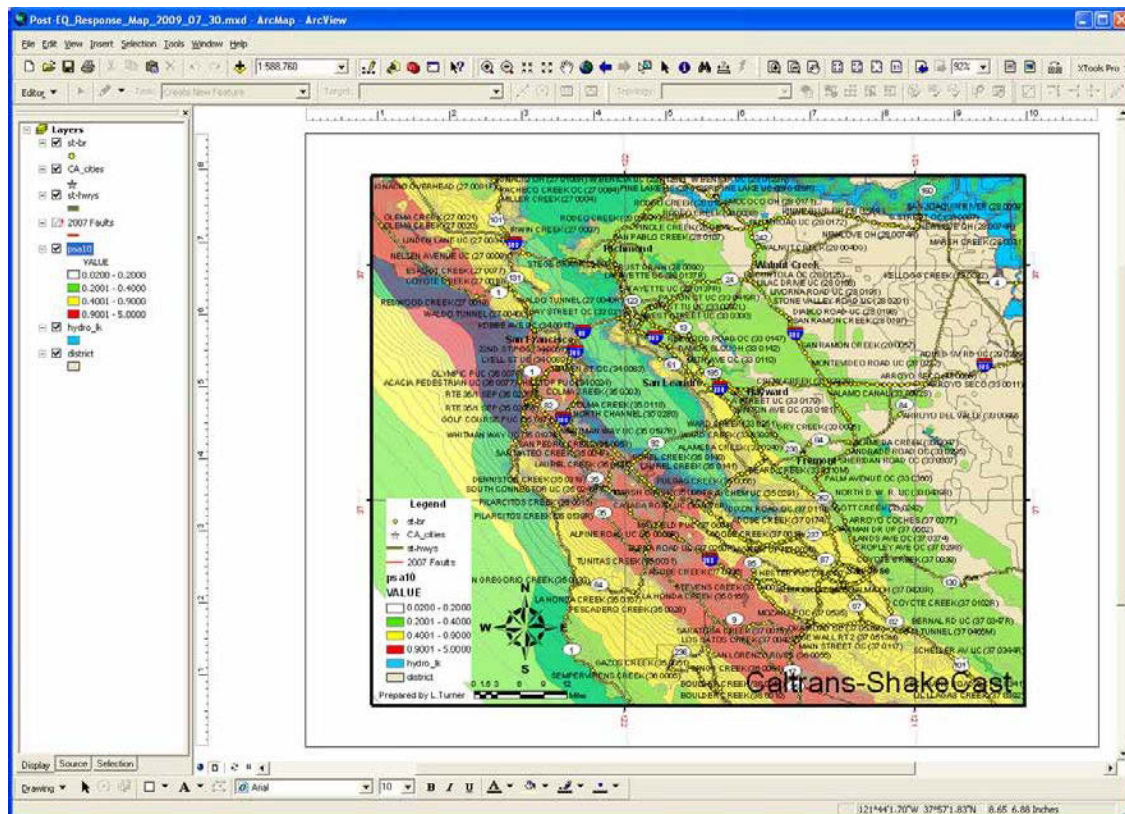


Figure 7-35 – Using ShakeMap GIS files in ArcGIS

7.5 Using the CSV File in Excel

The results of the ShakeCast facility analysis is provided to users in an Excel-compatible comma-separated value (csv) file.

7.5.1 Getting the CSV File

Users can obtain the csv file from the ShakeCast products website. A link, titled “Caltrans ShakeCast Products,” can be found in the section of the notification email under “Downloads & Resources” as shown in Figure 7-36.

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](#).

Figure 7-36 – Link to ShakeCast products website in emails

When the hyperlink is clicked, the user is directed to the Caltrans ShakeCast Products webpage, as shown in Figure 7-37.

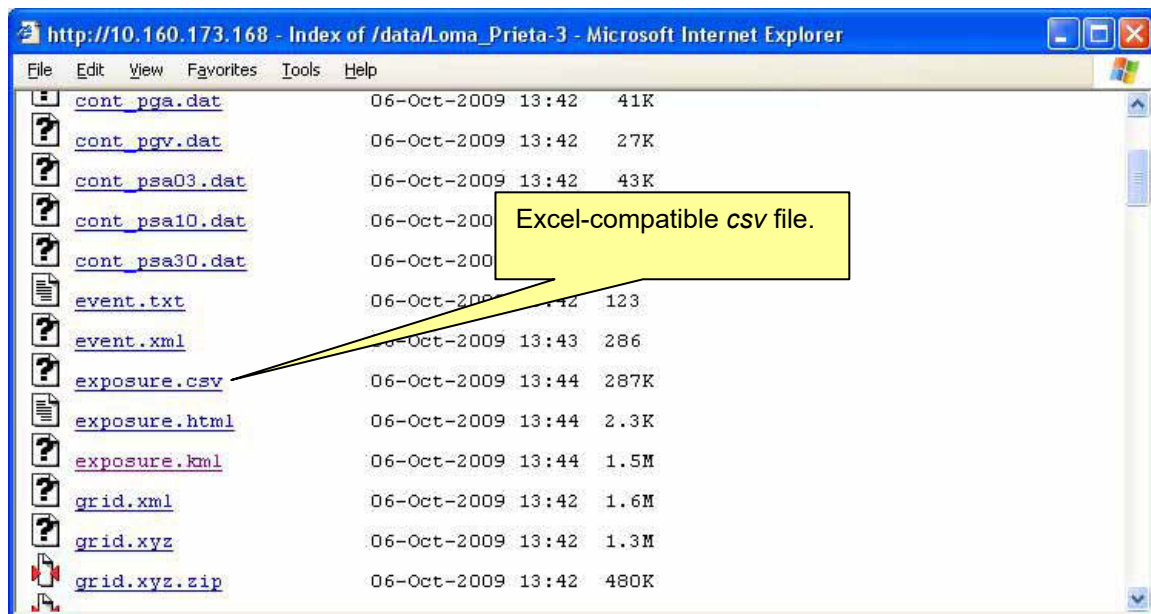


Figure 7-37 – Caltrans ShakeCast Products webpage

The page contains a list of all available ShakeCast files for the specific event, including various ShakeMap image files, and the core data files used in the ShakeCast analysis routines. The *exposure.csv* file is the file you will want to download. Depending upon which internet browser you are using, the download procedure varies. For users of Internet Explorer, it is recommended that you right-click the name of the file, then use the “Save Target As...” option to save the file, as shown in Figure 7-38.

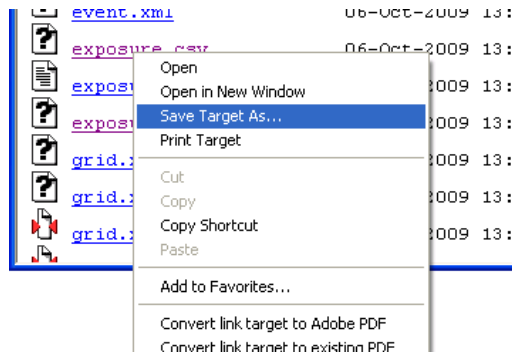


Figure 7-38 – Downloading the shape files

7.5.2 Working with the csv File in Excel

Once downloaded, open the file in Microsoft Excel as shown in Figure 7-39.

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

Figure 7-39 – Downloading the shape files

CASE STUDIES OF SHAKECAST USAGE

Over the course of project, there were two events, one actual event and one exercise event, where ShakeCast notifications proved to be an effective response tool. Additionally, these events provided a good opportunity to identify several issues with the configuration of the ShakeCast system.

8.1 Chino Hills 5.4 Earthquake and Grier St. POC

At 6:42 PM on Jul 29, 2008, a magnitude 5.4 earthquake occurred near Chino Hills in southern California as shown in Figure 8-1. The Caltrans-ShakeCast system processed the event and distributed multiple notifications to subscribers, including several "NEW EVENT" messages and corresponding "BRIDGE ASSESSMENT" messages.

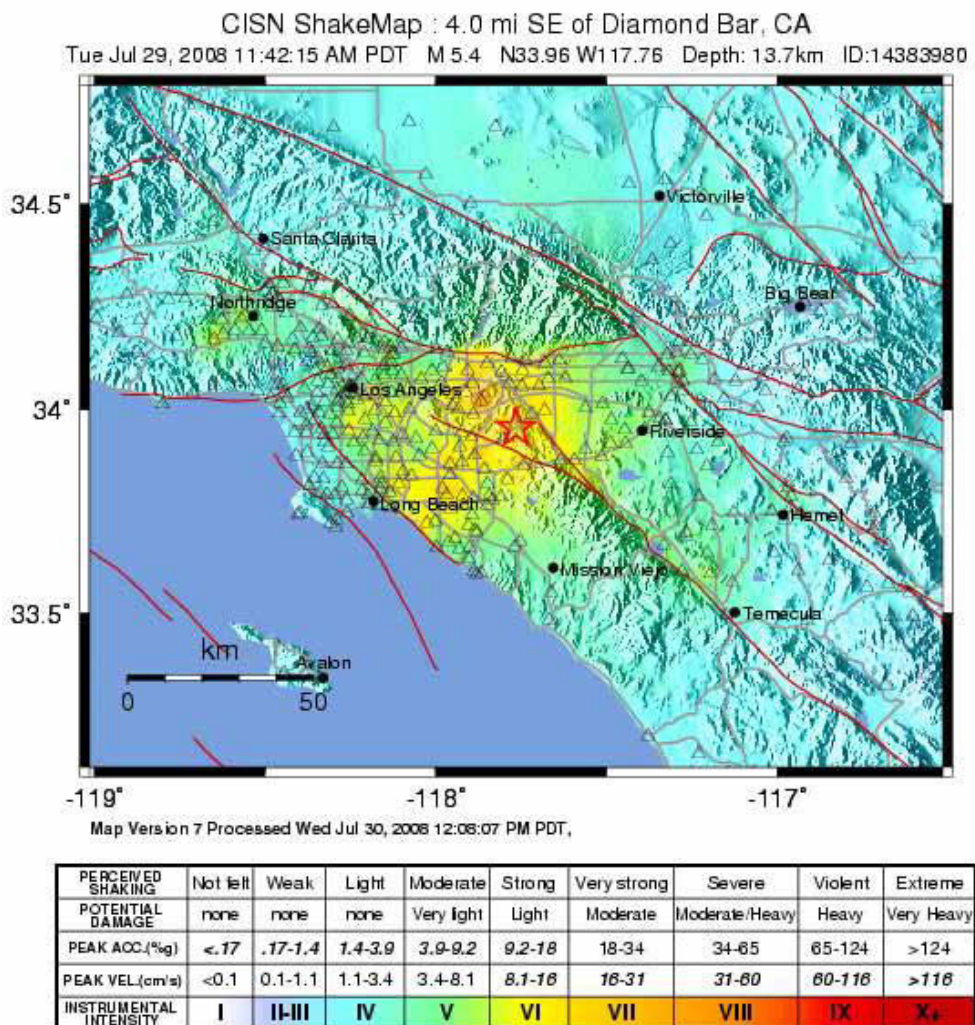


Figure 8-1 – ShakeMap from Chino Hills Earthquake

8.1.1 Timeline of Events

A chronology of ShakeCast actions is shown in the table below.

Date/Time	Activity
7/29/08 11:42 AM	Chino Hills earthquake occurs.
7/29/08 11:54 AM	USGS reports a magnitude 5.8 event and publishes an initial ShakeMap v2.
7/29/08 11:54 AM	ShakeCast retrieves the v2 ShakeMap data from USGS and sends a "NEW EVENT" message to Caltrans subscribers.
7/29/08 11:54 AM	ShakeCast analyzes bridge inventory and sends a "BRIDGE ASSESSMENT" message to Caltrans subscribers.
7/29/08 12:08 PM	The USGS issues a v3 ShakeMap. ShakeCast analyzes bridge inventory and sends a revised "BRIDGE ASSESSMENT" message to Caltrans subscribers.
7/29/08 12:59 PM	The USGS issues a v4 ShakeMap and revises the event to magnitude 5.4. ShakeCast analyzes bridge inventory and sends a revised "BRIDGE ASSESSMENT" message to Caltrans subscribers.
7/29/08 2:09 PM	The USGS issues a v5 ShakeMap. ShakeCast analyzes bridge inventory and sends a revised "BRIDGE ASSESSMENT" message to Caltrans subscribers.
7/30/08 12:09 PM	The USGS issues a final v7 ShakeMap. ShakeCast analyzes bridge inventory and sends a revised "BRIDGE ASSESSMENT" message to Caltrans subscribers.

There were a number of factors that impacted the delivery of ShakeCast notifications for this event, including a slight delay in the distribution of the ShakeMap data and the repeated processing of subsequent ShakeMap versions.

The initial "NEW EVENT" ShakeCast message was sent 12 minutes after the event occurred, 7 minutes later than the USGS's ShakeMap performance goal. The USGS reported that an issue with a network switch at USGS offices was the cause of the delay in making the ShakeMap available to downstream ShakeCast servers. In the end, however, the overall impact to response was negligible.

Multiple "NEW EVENT" and "BRIDGE ASSESSMENT" notifications were sent to responders in the hours following the event, as the ShakeMap was updated multiple times. It is typical for an event of this magnitude to be updated in the hours and days following the earthquake, as USGS scientists review and update the ShakeMap to reflect additional seismological data obtained after the initial ShakeMap was created. Caltrans-ShakeCast servers were initially set up to process all versions of ShakeMaps issued by the USGS. However, it became apparent that the multiple messages for the same event caused too much confusion with responders. The Caltrans-ShakeCast server configuration was modified the next day so that only significant changes would be sent to responders in subsequent notifications. That is, updated ShakeMaps would not be processed by ShakeCast unless there was a substantial change in ground motion metrics, in excess of 10%.

8.1.2 Analysis of Bridges

Of the bridges assessed by ShakeCast, only one bridge, Grier Street Pedestrian Overcrossing (POC), was reported to have damage from the earthquake (PEQIT 2008). Grier St. POC is an 8-span, prestressed concrete slab, simple support bridge structure, shown in Figure 8-2. It is located in the city of Pomona in Los Angeles county on State Route 71. Damage to the structure included concrete cracking and spalling at the top of two piers, transverse displacements of the deck slabs from 3" to 4" at the pier locations, and bending of steel dowels connecting the deck slabs to the piers.



Figure 8-2 – Observed damage to pier and displacement of deck slab at Grier St. POC.

The first “BRIDGE ASSESSMENT” message from ShakeCast identified 315 bridges that were subjected to 1.0 second peak spectral accelerations in excess of 10% g. All 315 facilities were considered “low” priority for inspection. Grier St. POC was listed as the 40th priority for inspection.

In the final analysis ShakeCast identified 468 bridges that were subjected to 1.0 second peak spectral accelerations in excess of 10% g. All 468 facilities were considered “low” priority for inspection, as shown in Figure 8-3 in the excerpt from the ShakeCast notification email sent to subscribers. Grier St. POC was listed as the 3rd 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; 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 2078 - VALLEY BLVD UC	53 2078	07-LA-071-R1.47-POM	Low	24.0541	0.433
53 2078K - VALLEY BLVD UC	53 2078K	07-LA-071-R1.47-POM	Low	24.0541	0.433
53 1158 - GRIER STREET POC	53 1158	07-LA-071-1.93-POM	Low	34.7183	0.339
53 2107 - TEMPLE AVENUE OC	53 2107	07-LA-057-6.17-POM	Low	22.1482	0.335
53 0346 - EAST SPADRA OH	53 0346	07-LA-071-1.2-POM	Low	34.7183	0.330
53 0345 - WEST POMONA OH	53 0345	07-LA-071-1.31-POM	Low	34.7183	0.312

Figure 8-3 – “BRIDGE ASSESSMENT” message sent after the 5.4 Chino Hills Earthquake

8.2 Golden Guardian Response Exercise

On November 13, 2008, Caltrans participated in the nation's largest state-sponsored emergency exercise coordinated through the State of California, Office of Homeland Security (CalEMA 2010). *Golden Guardian 2008 Operation ShakeOut (GG08)* was intended to test California's response, recovery and rebuilding capabilities during and after a major catastrophic earthquake.

Working with the United States Geological Survey, the Golden Guardian team developed a scenario based upon a M7.8 earthquake occurring along a 270 kilometer segment of the southern San Andreas fault, as shown in Figure 8-4. The scenario earthquake had a duration of 90 seconds, beginning at 10:00 AM (PST) on November 13, 2008. The extent of shaking ranged from the Salton Sea at the southern end, to the City of Lancaster at the northern end. Large areas of Los Angeles County were impacted in the scenario.

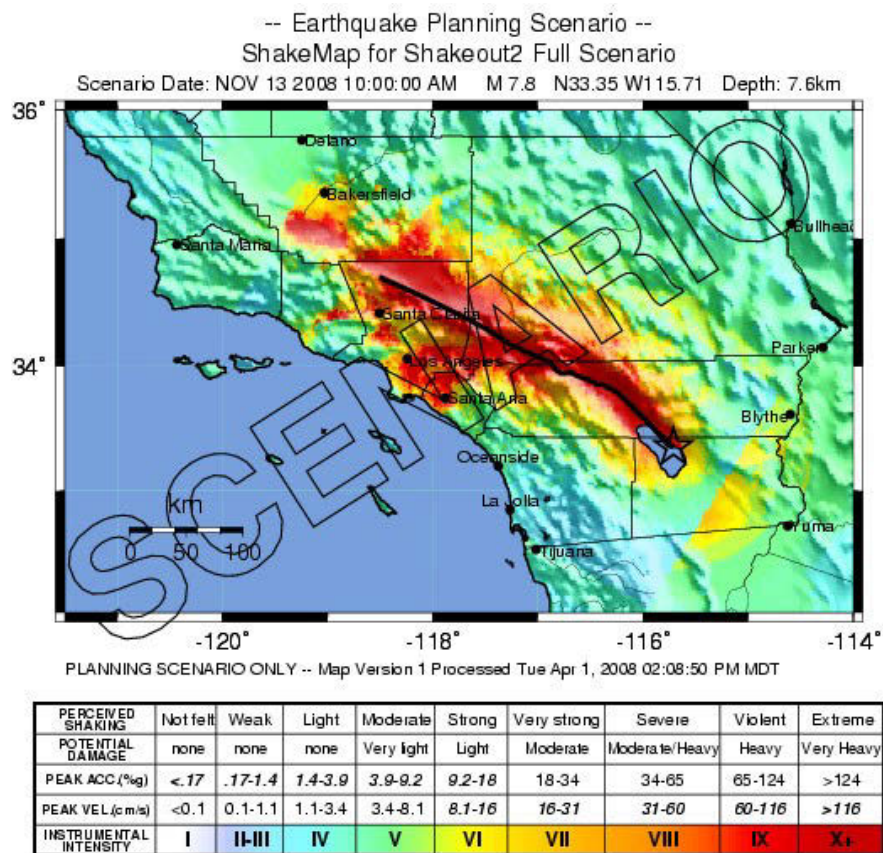


Figure 8-4 – Golden Guardian scenario event

ShakeCast played an important role in the exercise, providing the simulated notifications and various scenario products to Caltrans participants, including the ShakeMaps, Excel files, Google Earth KML files, and ArcView Shapefiles. At 10:00 AM on the day of the drill, Caltrans responders were sent two ShakeCast messages, a "NEW EVENT" message and a corresponding "BRIDGE ASSESSMENT" message, as shown in Figure 8-5. ShakeCast products were used by Caltrans responders as the basis for the response exercise, providing the extent of potential impacts to the highway infrastructure.

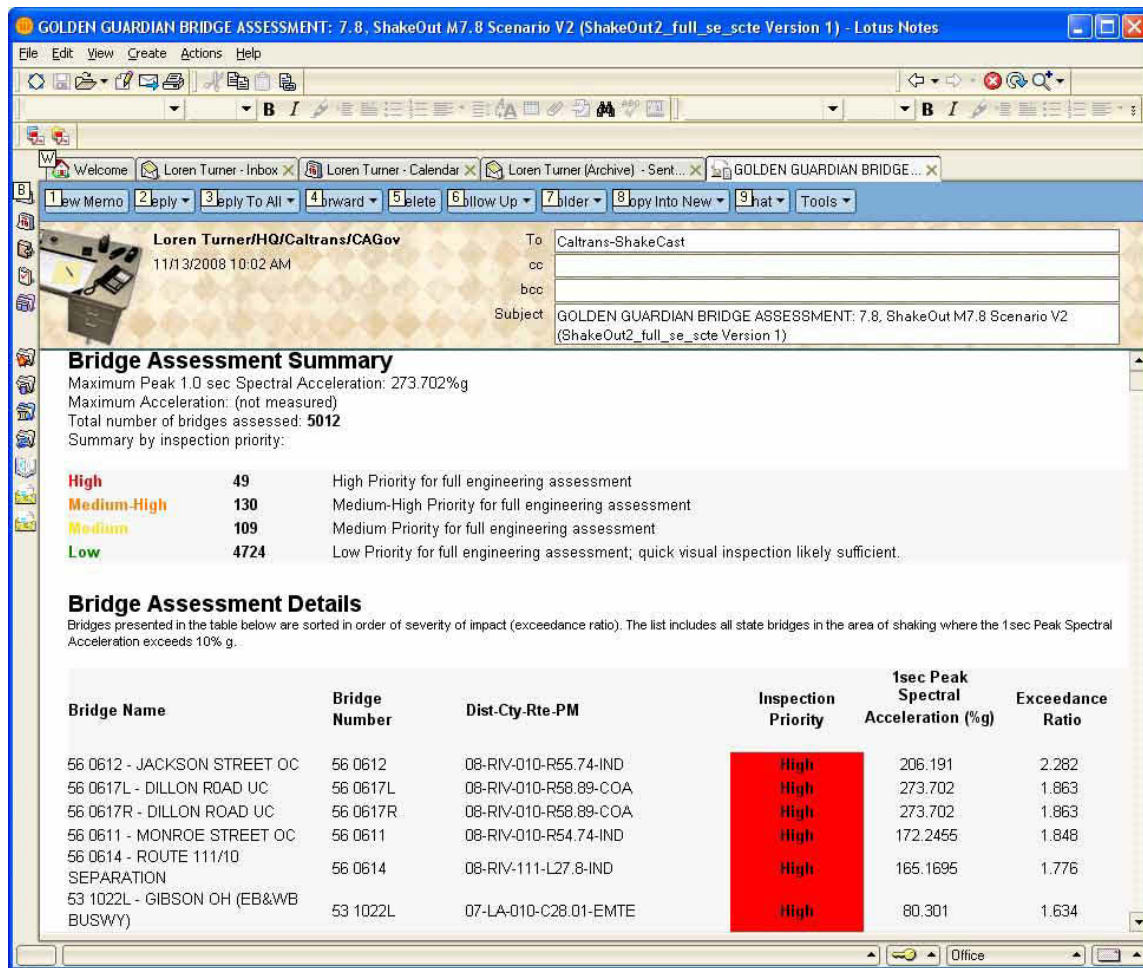


Figure 8-5 – “BRIDGE ASSESSMENT” notification for Golden Guardian scenario event

The ShakeCast analysis identified 5012 state bridges that would have been subjected to 10%g (1 second peak spectral accelerations) of which 288 would require immediate assessment. Of those bridges, 49 were identified *high*, 130 *medium-high*, and 109 *medium* priority for full engineering assessment. The general consensus amongst Caltrans engineers was that the number and breakdown of bridges identified by ShakeCast wouldn't be unreasonable, considering the magnitude and extent of the scenario event.

STATE OF DEPLOYMENT

The use of ShakeCast notifications within Caltrans has grown over the course of the project. The value of ShakeCast products were demonstrated in the 2008 Golden Guardian response exercise, and the reliability of ShakeCast's bridge inspection prioritization algorithms during the 2008 Chino Hills 5.4 earthquake helped to reinforce confidence in the tool. ShakeCast has become integral to Caltrans response protocols.

9.1 ShakeCast Subscribers

By the end of the project there were over 300 subscribers receiving ShakeCast notifications, including personnel throughout Caltrans from:

- Structure Maintenance & Investigations inspectors and managers.
- Earthquake Engineering staff and managers
- Members of the Post EQ Investigations Team
- Structures Construction inspectors and managers
- Geotechnical Services staff and managers
- District Traffic Management Center (TMC) managers and staff
- District Emergency Operations Center (EOC) managers
- Caltrans Upper Management, including the Director and some Deputy Directors

9.2 Integration into Response Protocols

The Office of Structure Maintenance & Investigations (SM&I) in Caltrans Division of Maintenance integrated the use of ShakeCast products into its published response protocols in 2008. SM&I is responsible for performing bridge inspections and engineering investigations following emergencies and serves as the lead responder to all emergencies involving existing State highway structures. The "Emergency Response Plan" (2008), shown in Figure 9-1, documents the use of ShakeCast in post-earthquake response.

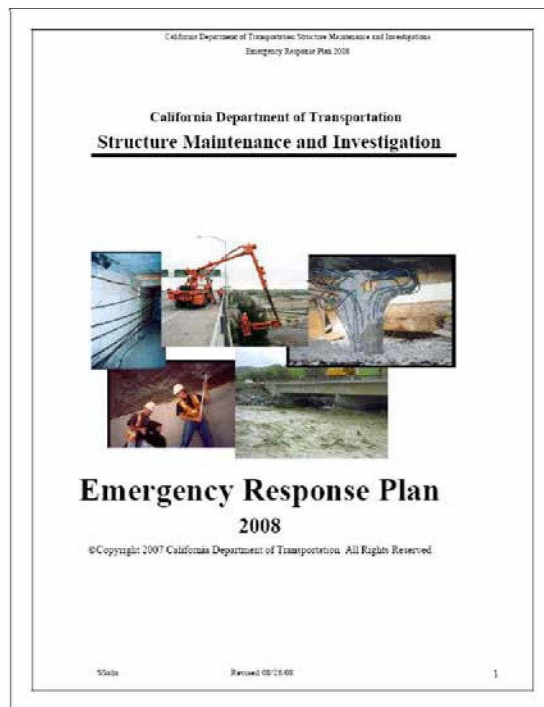


Figure 9-1 – "Emergency Response Plan," Structure Maintenance & Investigations

An excerpt from the “Emergency Response Plan” details the use of ShakeCast for moderate and major earthquakes as shown in Figure 9-2.

- Earthquake magnitude of 5.6 to 6.2 (moderate):*
- *Be prepared to activate SM&I DCC*
 - *Analyze the magnitude of the earthquake, identify the affected area using **ShakeCast** and from other sources*
 - *Analyze and determine inspection resources and depth of call out*
- Earthquake magnitude of 6.2 or greater (major):*
- *All SM&I employees should come directly to their respective office unless otherwise directed*
 - *Begin phone call out tree to the Senior level, (it will be determined if a full mobilization will be required once more information is gathered)*
 - *Analyze the magnitude of the earthquake, identify the affected area using **ShakeCast***
 - *Analyze and determine inspection resources and depth of call out*
 - *Map and Identify potential damaged bridges and create inspection routes*

Figure 9-2 – Use of ShakeCast in the SM&I “Emergency Response Plan”

SUMMARY

The overarching objective of this project was to improve Caltrans' effectiveness in post-earthquake response. That objective was met with the rollout of ShakeCast version 2, and validated through application in a real earthquake and in a major statewide exercise. Feedback from Caltrans users indicate that ShakeCast does provide a valuable source of information, and has quantifiable benefits with regards to the time reduced in identifying facilities most likely impacted by an earthquake.

10.1 Benefits

The primary benefits of ShakeCast, based upon user feedback collected over the course of the project, can be summarized as follows:

- *ShakeCast provides a more focused post-earthquake response.* The ShakeCast products provide responders a heightened level of situational awareness in the minutes and hours following an earthquake, previously unavailable. This information can influence critical decisions made in the aftermath of a major earthquake, in turn, saving lives.
- *ShakeCast allows for more effective use of limited staff resources.* Since ShakeCast analyzes each bridge independently based upon location-specific ground shaking measurements and estimates, the number of bridges requiring urgent assessment is significantly reduced. For example in the 2008 magnitude 7.8 Golden Guardian scenario, only 288 of the 5012 bridges in the region would require immediate assessment, a 94% reduction.
- *Caltrans management is better informed and can communicate the post earthquake bridge inspection situation.* ShakeCast quantifies the number of bridges in the affected area and provides a breakdown of inspection priorities (e.g. RED, ORANGE, YELLOW, GREEN) based upon distribution of ground motions and anticipated bridge performance. This simple aggregation of results allows Caltrans managers and public relations staff to communicate the scope of current inspection efforts to partner agencies, the Governor's office, and the media.
- *District Traffic Management Centers (TMC) and Emergency Operation Centers (EOC) are informed so they can more effectively coordinate with the California Highway Patrol (CHP).* These centers can use the preliminary ShakeCast information to coordinate with CHP and local fire, rescue, and law enforcement agencies in assessing the possible condition of emergency lifeline routes.
- *Running scenario events in ShakeCast helps prepare responders.* As a scenario planning and evaluation tool, ShakeCast can generate any number of possible earthquake situations and analyze the performance of the bridge inventory. Improvements to bridges (e.g. seismic strengthening) can be tested against past and scenario earthquakes to assess effectiveness of these types of improvements.

10.2 Attainment of Objectives, Lessons Learned

Several performance goals were established at the beginning of the task and documented in the Feasibility Study Report. These goals and an assessment of their attainment are summarized here.

- *Goal 1: Functional, user-friendly system, such that 90 percent of the users can register and set up notification preferences within the system with less than one day of training.* This goal

was achieved, however, the use of individual user accounts and personalized notification preferences were not implemented due to a latency issue with SMTP email services between the Caltrans ShakeCast servers and the Caltrans Lotus Notes server. As such, a single user (Caltrans-ShakeCast) was created on the ShakeCast system, and a Lotus Notes email group was established to forward the ShakeCast notifications to all subscribers. Adding new subscribers entailed contacting the ShakeCast project manager and system administrator. New subscribers were provided with a high-level document on ShakeCast in addition to documentation on the email notifications and other products that would be available to them. Most users reported that the written materials provided sufficient guidance in the use of ShakeCast, and that the time required to get acquainted with the ShakeCast products they intended to use was on the order of ½ to 2 hours. More work is needed to investigate restoring user-managed notification preferences without the latency issue.

- *Goal 2: Operate robustly in a production environment with less than 5 percent downtime over a 12-month period.* Over the course of this project, the ShakeCast servers operated robustly without any unintended downtime. Planned service interruptions were brief and well within the 5% performance goal established, which is the equivalent of 18 full days. Servers were periodically restarted to support system software patches and configuration changes. Additional administrative features were integrated into ShakeCast to provide daily notifications via email to the administrators on the operational status of the system. Although, the server did not have any failures during the project, this feature mitigated some of the risks of prolonged downtimes in the event of a system failures. Other alternatives will need to be explored for future operational requirements.
- *Goal 3: Simple to set up and administer, such that 90 percent of the system administrators can install, administer, and maintain the system with less than three days of training.* By the conclusion of the project, ShakeCast was delivered as a complete installation package, including the WAMP stack, and made available on the USGS website (<http://earthquake.usgs.gov/research/software/shakecast/shakecast.php>). On a Windows platform, the installer uses a wizard type interface to keep the installation process simple. For more advanced users, the script and database files are made available, and the user can setup a ShakeCast instance on a number of platforms including Linux and Solaris systems. The USGS also delivered a deployable ShakeCast instance on a USB flash drive, thereby demonstrating the portability and modular nature of ShakeCast. Although, a significant effort was made to insure that installation and configuration of ShakeCast would be as simple as possible, the system was not installed at Caltrans outside of the three servers setup at the beginning of the project. The project manager was required to repeat the installation process during code upgrades and other deployment testing activities, and found that the process was not difficult with some training and materials. The performance goal of three days of training is anticipated to be more than adequate.
- *Goal 4: Deliver time-critical bridge inspection data within 10 minutes following a significant earthquake event.* In the 5.4 Chino Hills earthquake in July 2008, the “BRIDGE ASSESSMENT” message was delivered 12 minutes following the event, as described in an earlier section of this report. A technical issue with the USGS systems caused the delay in the distribution of ShakeMap data. However, Caltrans ShakeCast servers processed and delivered notifications to responders in less than a minute after obtaining the data. The USGS has since identified the issues with their upstream systems and have implemented new processes to avoid similar situations in the future.
- *Goal 5: Demonstrated to reduce the number of bridges required to be inspected following an event. Typical reduction in required bridge inspections is expected to be better than 50 percent.* The Golden Guardian exercise in 2008 clearly demonstrated a reduction in the number of bridges in an affected region requiring immediate assessment. In this case only 288 of the 5012 bridges in the region would require immediate assessment, a 94% reduction.

10.3 Further Research Needs

The technology behind ShakeCast continues to evolve and mature, and subsequent work is needed to continue Caltrans partnership with the USGS to provide more tailored bridge and roadway status information to emergency responders. ShakeCast version 1 now provides Caltrans with basic situational awareness within minutes of a damaging earthquake. However, over the course of this project and use of ShakeCast in real and scenario events, a number of additional development needs have been identified.

It is strongly recommended that a “Phase 2” task for ShakeCast be pursued to develop, deploy and support an enhanced version. The enhanced version should add behind-the-scenes capabilities and flexibility to accommodate a broader range of facility and user-group information that will enable dissemination of more informative, more accurate, and better tailored messages based on feedback from Caltrans user groups.

This follow-up task should include modification and supplementing of ShakeCast software features for Caltrans-specific bridge and roadway inspection protocols, as follows:

- Implement polygon/polyline facility location delineation method.
- Implement landslide hazard analysis function.
- Implement liquefaction hazard analysis function.
- Develop and implement method to present results for various facility groupings.
- Implement a user-defined HTML facility attribute.
- Automatic generation of large-scale printable map as a standard ShakeCast product.
- Implement full statistical interpretation of fragility curves.
- Implement a component-based fragility analysis framework.

In addition, the work should deliver:

- Troubleshooting support and implementation of interface enhancements.
- A recommendation for IT server deployment at Caltrans.

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Information Technology Project Request

**Feasibility Study Report
Executive Approval Transmittal**



Department Name

Transportation

Project Title maximum of 75 characters

Test Deployment of ShakeCast for Post Earthquake Bridge Inspection

Project Acron m	Department Priori	Agency Priority
Shakecast		

APPROVAL SIGNATURES

I am submitting the attached Feasibility Study Report (FSR) in support of our request for the Department of Finance's approval to undertake this project

I certify that the FSR was prepared in accordance with State Administrative Manual Sections 4920-4930.1 and that the proposed project is consistent with our information technology strategy as expressed in our current Agency Information Management Strategy (AIMS).

I have reviewed and agree with the information in the attached Feasibility Study Report.

Chief Information Officer  Printed name: Ann Barsotti	Date Signed 9/12/05
Chief Information Security Officer  Printed name: Patricia G. Kuhar	Date Signed 9/19/05
Budget Officer  Printed name: Norma Ortega	Date Signed 9/21/05
Department Director  Printed name: Will Kempton	Date Signed 10/25/05

Information Technology (IT) Project Summary Fact Sheet

ShakeCast

- Purpose**
- Caltrans proposes to improve bridge inspection response after an earthquake occurs by deploying a new response system called *ShakeCast*, (ShakeMap Broadcast).
 - *ShakeCast* will automate analysis of real-time earthquake ground shaking data against Caltrans bridge design data and deliver bridge inspection priority lists by pager or email to key response personnel.
 - Caltrans emergency response, and public safety, will be improved from having this information within minutes following an earthquake to more effectively focus inspection efforts.

- Project Strategy**
- Caltrans partnered with leading seismologists at the United States Geological Survey (USGS) to develop this post-earthquake response technology.
 - USGS has developed the software-based system, *ShakeCast*, which performs automated earthquake and bridge performance analysis to produce maps and facility inspection priority lists. This system combines geological and GIS data.
 - USGS will modify *ShakeCast* software for specific application to Caltrans' bridge inspection response following a major earthquake. This deployment will be tested at two Caltrans Transportation Management Center (TMC) to demonstrate the system effectiveness.

- Costs**
- USGS will be under contract with Caltrans to customize and test deploy the *ShakeCast* software, with one-time project costs totaling \$317,000, funded by the existing Division of Research and Innovation (DRI) budget. This project will be federally funded.

- Schedule**
- Project Start: September 2005
 - Project Completion: Jun 2008

3.0 BUSINESS CASE

3.1 BUSINESS PROGRAM BACKGROUND

Following a major earthquake, one of Caltrans' most critical tasks is to assess the condition of all potentially impacted bridges and roadway corridors in the state highway system. Timely response is important to ensure public safety, guide emergency vehicle traffic, and re-establish critical lifeline routes.

The primary method to assess damage is for trained personnel from the Division of Maintenance and Structures to complete thorough site inspections of state bridges. However, inspectors in the past had difficulties setting priorities because they lacked precise information about where the worst shaking and, most likely, the greatest damage had taken place. Absent such data, they were forced to locate the quake's epicenter, find the closest fault, and develop a list of bridges within a specified buffer zone surrounding that fault or the epicenter. Maintenance crews were then dispersed widely within that region to perform initial reconnaissance.

That can take precious time. Moreover, shaking levels can vary dramatically within the buffer zone. An earthquake rarely ruptures over a fault's entire length. Furthermore, ground shaking at the same distance from a rupture zone varies by nearly tenfold due to a variety of seismological and geotechnical effects. Buffer zones large enough to account for all areas that could be shaken strongly will also include wide swaths of undamaged zones, which can lead to misdirected resources.

Research through test deployment of advanced technologies is needed to explore how response time and resources can be reduced when responding to earthquakes.

3.2 BUSINESS PROBLEM OR OPPORTUNITY

Caltrans currently does not have the tools in place to adequately compile and analyze earthquake-related information, such as ground shaking measurements, that are available within minutes immediately following an earthquake. In conjunction with Caltrans' existing bridge and highway inventory maps, this information could be used within the first critical hour following an earthquake to direct inspection crews and emergency response staff to bridges and other infrastructures that experienced the most severe shaking.

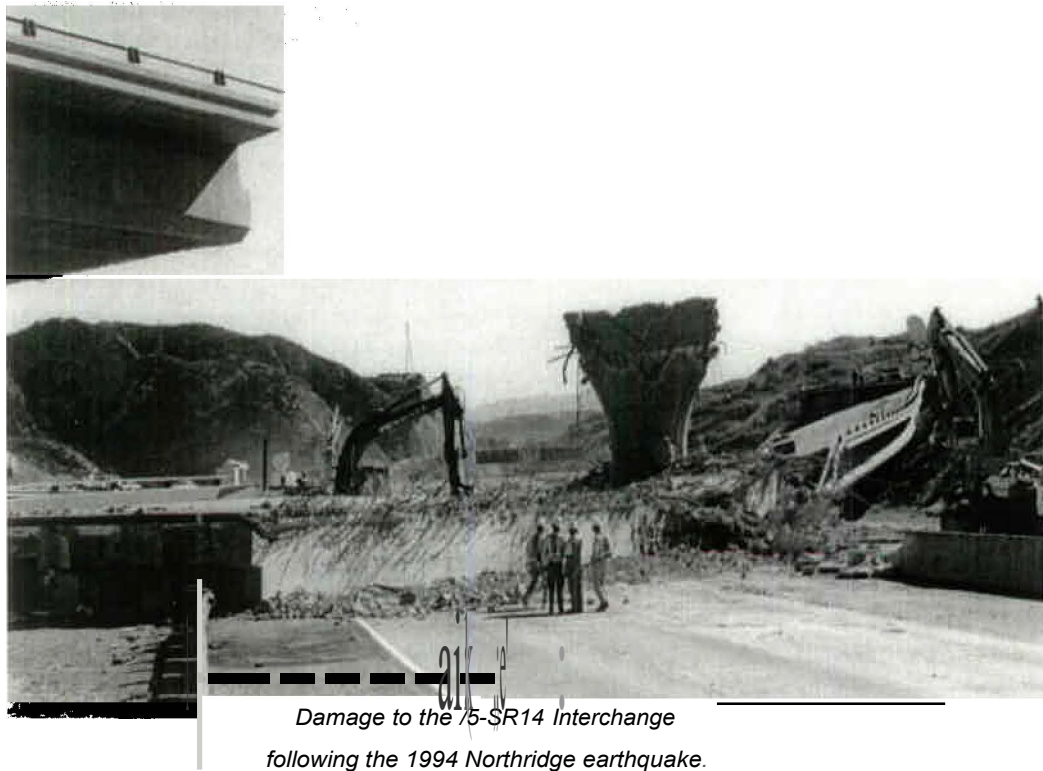
Caltrans has been working with the United States Geological Survey (USGS) over the past few years to help guide the development of a post-earthquake response technology called *ShakeCast*. *ShakeCast* is a software-based system currently under development by the USGS. When completed, the software will provide automated earthquake and bridge performance analysis and produce maps and bridge inspection priority lists.

ShakeCast is built upon *ShakeMap*. *ShakeMap* is a USGS system that takes ground motion data from a network of sensors throughout California and combines it with geological data to create ground shaking intensity maps. These maps provide a level of detail that far surpasses general epicenter/magnitude information typically used. Delivery of *ShakeMaps* in a GIS format facilitates automated analyses using existing Caltrans bridge and highway inventory data to produce priority inspection lists. Once implemented, these tools could drastically reduce Caltrans' response time following an earthquake by focusing inspection efforts in the most critically shaken areas.

3.3 BUSINESS OBJECTIVES

The objective of this project is to improve Caltrans' ability to respond following a major earthquake by prioritizing bridge inspections and providing fire, police, and other agencies with information on potential route closures at the earliest possible time. This project proposes to achieve these objectives through further development, integration of Caltrans-specific features, and test deployment of *ShakeCast*, a system that will automate the retrieval of *ShakeMaps* to analyze earthquake shaking levels against Caltrans bridges and infrastructure, and deliver bridge inspection priority lists by pager and e-mail. Caltrans could greatly benefit from this type of information, as the state of the transportation network following a major earthquake is critical to its operations and the operations of the other agencies.

This research has the potential to save lives. Getting inspectors to the bridges that are quickly identified as having the greatest potential of damage (based on the geology, the design characteristics, and actual ground shaking measurements) can reduce the incidence of injury and death to travelers attempting to use potentially damaged structures. Having the best possible information on potential route closures from damaged structures assists medial and emergency response personnel in getting to critical areas in the shortest possible time.



3.4 BUSINESS FUNCTIONAL REQUIREMENTS

In order for this research work to have been successful, the following criteria must be met at the completion of the project:

- ShakeCast is developed into a functional, user-friendly system, such that 90 percent of the users can register and set up notification preferences within the system with less than one day of training.
- ShakeCast is demonstrated to function robustly in a production environment with less than 5 percent downtime over a 12-month period.
- ShakeCast is demonstrated to be fairly simple to set up and administer, such that 90 percent of the system administrators can install, administer, and maintain the system with less than three day of training.
- ShakeCast is demonstrated to deliver time-critical bridge inspection data within 10 minutes following a significant earthquake event (**M>4**).
- ShakeCast is demonstrated to reduce the number of bridges required to be inspected following an event. Typical reduction in required bridge inspections is expected to be better than 50 percent.

4.0 BASELINE ANALYSIS

4.1 CURRENT METHOD

Preliminary earthquake response within Caltrans is currently based upon very limited earthquake information. Bridge inspections initiated immediately after earthquakes are performed using that same limited set of information. Often times, bridge inspection priorities are driven by those locations that receive the most television and radio media attention.

Caltrans staff currently use a handful of mechanisms to determine when and where an earthquake recently occurred. In the minutes following a major earthquake, managers, emergency responders, and other critical users need to be notified about the occurrence of the event in order to begin considering the impact on their facilities and the transportation network. Current tools are:

- The California Geological Survey (CGS) paging system
- The California Integrated Seismic Network (CISN) paging system
- The Caltech USGS Broadcast of Earthquakes/Rapid Earthquake Data Integration (CUBE/REDI) system
- Media (e.g., television and radio)

Pager-based notification services have been available for a number of years. The California Geological Survey (CGS), California Department of Conservation, has operated a pager-only service, reporting key earthquake information such as time, date, location, magnitude, epicenter, and peak accelerations. However, this service is only available to a very small group of responders within Caltrans who have been issued special pagers to receive these messages. More recently, the USGS, through the California Integrated Seismic Network (CISN), has been offering a web-based paging service to anyone with a pager, cell phone, personal digital assistant (PDA) devices, Blackberry, or other device capable of receiving text e-mail messages. Unfortunately, to date the mechanism for subscribing to this service has been confusing with different USGS regional offices handling different messaging services for Northern and Southern California. Furthermore, message formats have taken on different formats and content based upon regional offices. CISN has recently undertaken an effort to consolidate the various messaging services; however, the subscription process and the overall end user experience remains to be integrated seamlessly.

The *Caltech USGS Broadcast of Earthquakes/Rapid Earthquake Data Integration* (CUBE/REDI) system is a computerized network that monitors seismic activity and transmits data describing the location, magnitude, and duration of earthquakes to subscribing members within minutes of occurrence. It was initiated by the California Institute of Technology and USGS-Pasadena in 1991 and by the University of California, Berkeley and USGS-Menlo Park in Northern California in 1993. The combined CUBE/REDI system provides for almost "real time" monitoring of earthquakes in most of California to a limited number of subscribers. The system receives messages through a paging network and displays earthquake epicenter and magnitude information on a map running within client software. A few Traffic Management Centers (TMC) in the state are currently connected to the CUBE/REDI system. Receiving the earthquake data requires running a standalone application on a 286 or better PC with a DOS operating system. A RS-232 serial data cable connects the PC to a Verizon pager.

Conventional media tools are also used in response situations. Often times, it's the traffic helicopters from the major television news broadcasts that are the first on site. Phone calls to maintenance, police, and fire stations, and radio reports can also be valuable.

ShakeMaps are generated by the USGS and posted on their website, typically within 15 minutes following an earthquake. These maps usually come in a variety of formats, including image files (e.g. JPG, TIF) as well as GIS files (i.e. ArcView shapefiles). These maps provide ground shaking estimates using actual sensor measurements and are displayed as contours of shaking intensity on a map. This information is much more useful than a single point representing the epicenter of an earthquake. However, processing ShakeMaps within Caltrans currently takes an hour or more to generate bridge inspection priority lists.

4.2 TECHNICAL ENVIRONMENT

The expected operational life of the developed system will be the duration of the research project, September 1, 2005, through June 31, 2008. The system will be test-deployed in close partnership with the USGS. The client side application will be implemented by Caltrans staff. The server side application will be implemented by USGS staff at the Pasadena, California, and Boulder, Colorado, facilities. Method of alert notifications and recipient lists for post-earthquake data on potential bridge damage will be coordinated with Caltrans' Structures Maintenance staff and management. Maintenance of the system over the course of the project will be provided by staff from the Division of Research and Innovation and supplemented by staff from the USGS. At the conclusion of the project, a report will be produced documenting the performance of the system over the course of the project. Research performance metrics will be used (qualitative and quantitative). Documented benefits will be used to make the business case (i.e. a Feasibility Study Report) for continued deployment support of the system with funding and resources within the operational programs. Ongoing support and enhancements to the software will be performed by USGS.

4.3 EXISTING INFRASTRUCTURE

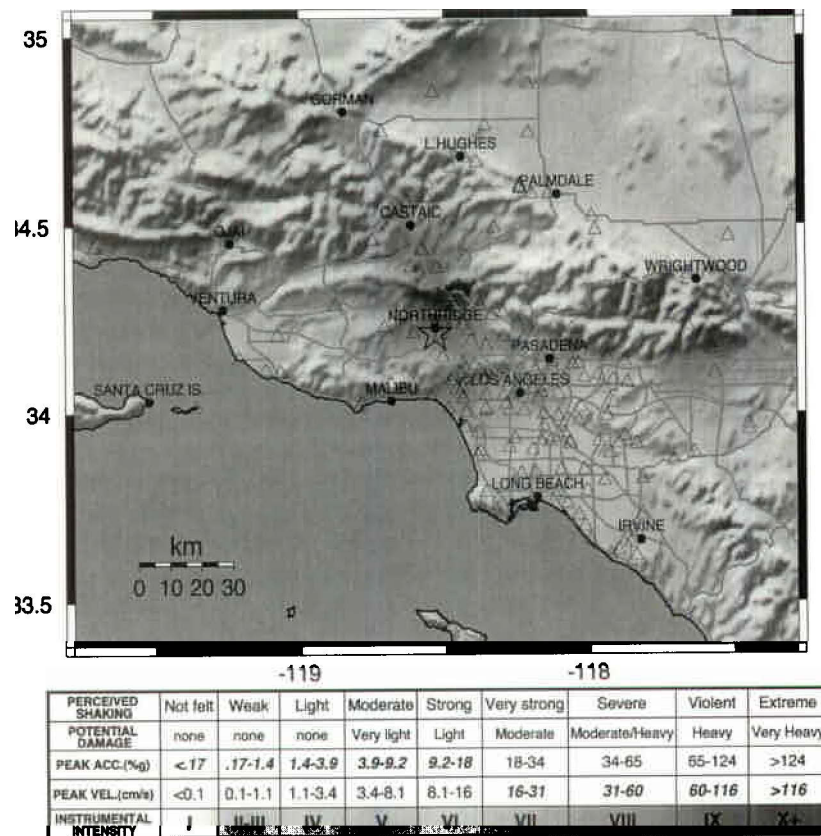
The ShakeCast system will utilize the existing Caltrans statewide network and internet to connect to remote servers at USGS facilities in Boulder, Colorado, and Pasadena, California. Communications with remote servers outside the Caltrans firewall will be initiated by client servers within Caltrans, and do not require a breach in Caltrans' network firewall.

5.0 PROPOSED SOLUTION

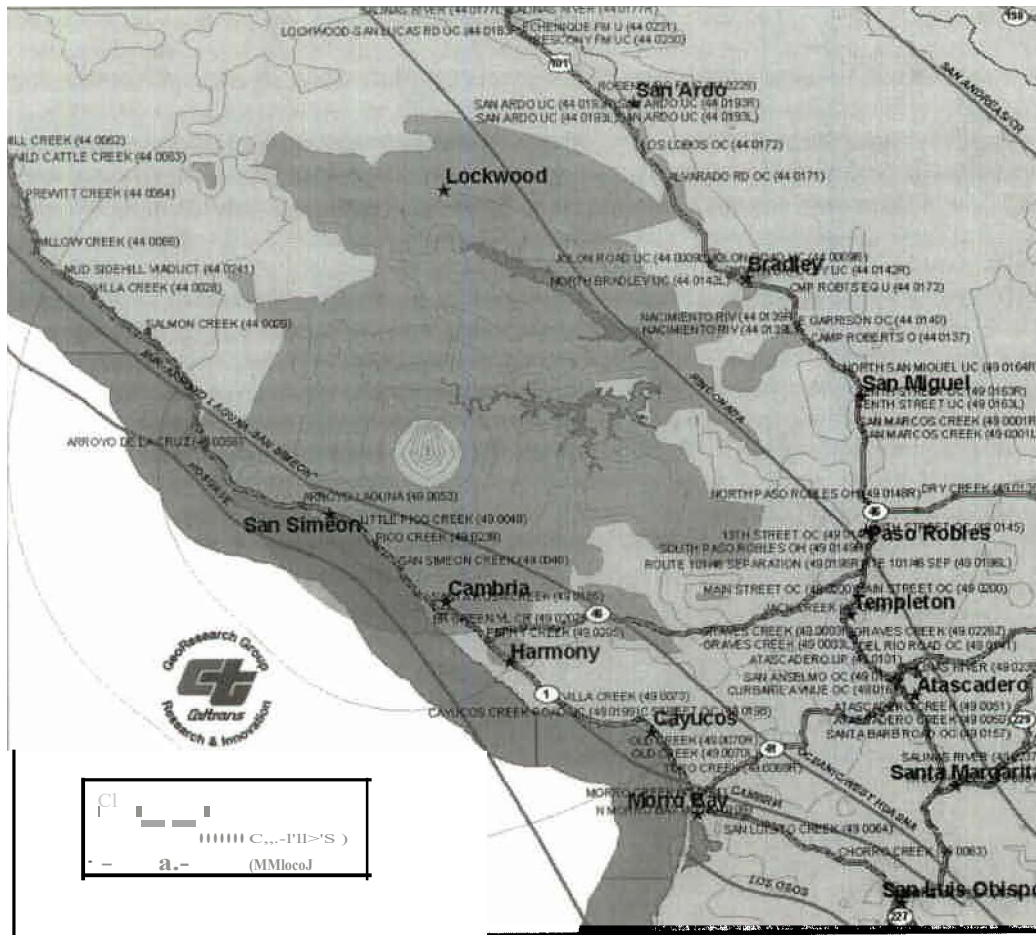
5.1 SOLUTION DESCRIPTION

The contractor will modify and supplement *ShakeCast* software for specific application to Caltrans' bridge inspection response immediately following a major earthquake. Test deployment at two TMCs will demonstrate the effectiveness of an automated analysis system.

ShakeCast, short for "ShakeMap Broadcast," allows agencies such as Caltrans to automatically and reliably receive desired maps of shaking intensity and trigger post-processing tools to initiate an established response protocol. *ShakeCast* is built from *ShakeMap*. *ShakeMap* is a system for automatically generating maps of ground motion and intensity in the minutes immediately following an earthquake. The figure below shows an example of an Instrumental Intensity ShakeMap for the 1994 Northridge earthquake.



The 2003 San Simeon earthquake provided an opportunity for Caltrans to test the technologies and processes, and demonstrate the usefulness of this type of information in a response situation. For this event a preliminary bridge inspection list was generated from the analysis and was e-mailed following 90 minutes of manual data processing. Automation via *ShakeCast* would reduce the time to generate the same information to approximately ten minutes.



ShakeMap was originally developed under the TriNet project in Southern California, which began in the years following the 1994, magnitude 6.7 Northridge earthquake. Ongoing development of ShakeMap is under the auspices of the USGS Advanced National Seismic System (ANSS). Under this program, ShakeMap now runs in Southern and Northern California, as well as the Seattle and Salt Lake City areas. It will be available in other seismically active regions of the country if sufficient numbers of real-time strong motion stations are installed as outlined in the ANSS strategic plan.

Currently, ShakeMap products are automatically distributed to the California Office of Emergency Services (OES), state agencies, and utility providers to enable them to determine the extent of damaging shaking in their districts. In addition, a number of media news organizations and private companies, including several engineering and financial institutions, also receive the automatic electronic delivery of ShakeMap.

5.2 RATIONALE FOR SELECTION

The USGS is uniquely qualified to perform the work under this contract. The USGS owns and maintains much of the statewide real-time ground sensor network to measure ground motions due to earthquakes. Furthermore, the USGS has developed the technology and infrastructure to compile shaking data within minutes following an earthquake, develop ShakeMap products, and deliver those products to end-user agencies such as Caltrans. ShakeCast, as an extension to ShakeMap, could only be developed by the USGS or under the direction of the USGS. Much of the planned ShakeCast development is being

done under federal funds. Features specific to Caltrans will be developed under this contract.

5.3 OTHER ALTERNATIVES CONSIDERED

Two distinct alternatives were considered to this contract. The first alternative would be to not fund this work with the USGS and wait for the USGS to fully develop ShakeCast on their own terms without Caltrans funding. However, it is possible that the USGS would not develop and implement the features that are of importance to Caltrans. If they did eventually develop the requested features, it would likely take years before this work would be done, as the USGS has a different mission and purpose (i.e. scientific pursuits and research) in contrast to Caltrans (i.e. stewardship of the transportation infrastructure).

A second alternative considered was to independently develop and implement features into ShakeCast through contracting with outside software developers. However, the costs and effort in taking on such an endeavor did not make any sense. An outside consultant would be required to reverse-engineer the prototype product developed to date. Even with close coordination with the USGS, this would require a considerable effort and cost. Since much of the functionality of ShakeCast is built from the existing ShakeMap system (e.g. server communications, data exchange, protocol, etc.), an independent development of ShakeCast would essentially require a ground-up development of a statewide sensor network and data processing system, paralleling USGS efforts to date.

6.0 PROJECT MANAGEMENT PLAN

6.1 PROJECT MANAGER QUALIFICATIONS

The successful execution of the project will require a project manager that has extensive knowledge and project experience in geotechnologies, research methods, ground deformation sensing methods, GIS and internet technologies, data management, bridge design and performance factors, TMC operations, statewide emergency response protocols, and multi-agency partnering efforts.

Mr. Loren Turner, the designated project manager, exceeds in his qualifications to manage this project effectively. He is currently the Chief of the Geotechnology Applications Branch in the Division of Research and Innovation and brings 12 years of professional experience in the California Department of Transportation in structural, geotechnical, and earthquake engineering and research. His experience includes designing and directing the construction of state highway facilities, planning and conducting large-scale testing of bridge foundations, and managing and guiding geotechnology research product development and deployment. He has been acknowledged within the professional community for leadership in web-based geotechnical information management systems, GPS deformation monitoring, and post-earthquake analysis technologies. He has also been recognized by the National Academy of Engineering's Frontiers of Engineering Program as one of a select group of emerging engineering leaders from industry, academe, and government labs in pioneering technical work and leading edge research.

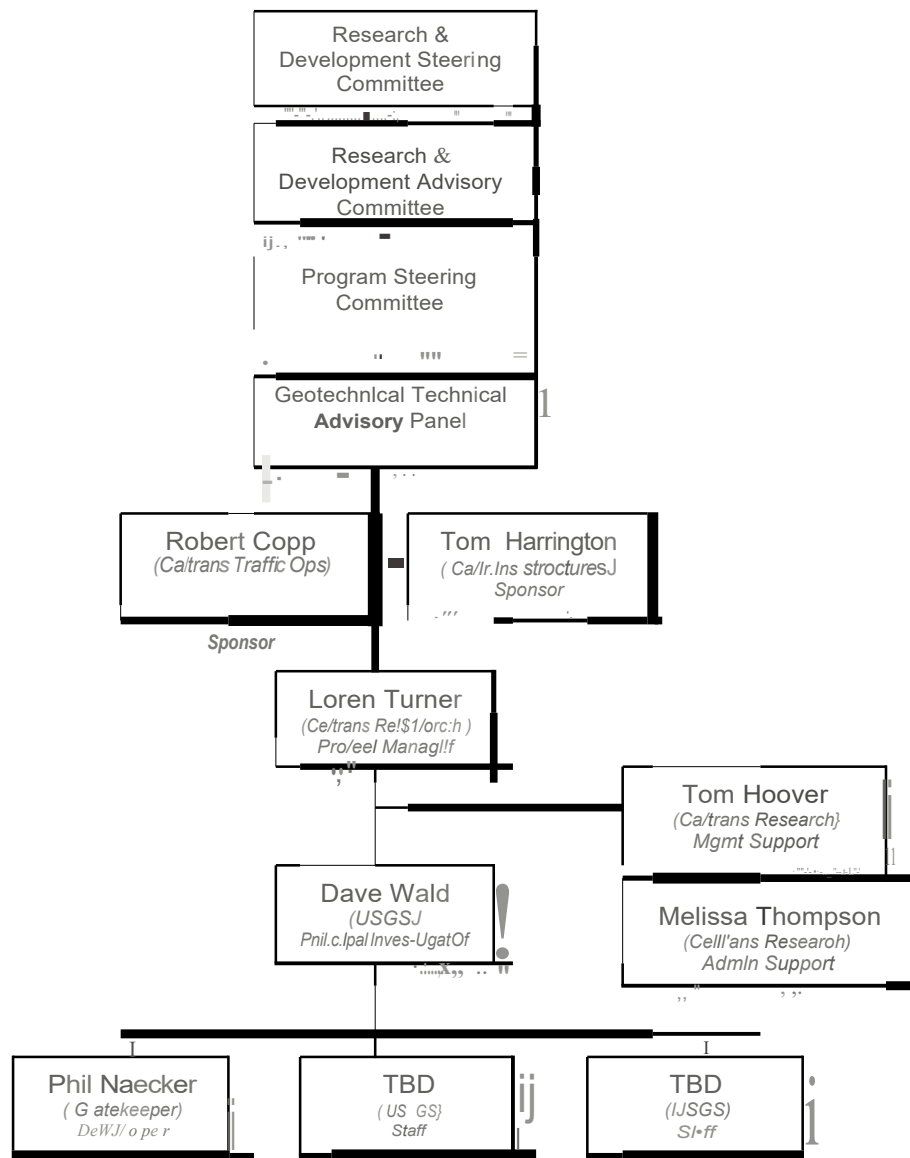
Mr. Turner has the project management experience and training to effectively execute a contract of this type and complexity and carry the deliverables from research to deployment. As an example, he is currently managing a \$1.2 million contract with CGS to develop landslide hazard mitigation maps and tools. His involvement in a multi-agency effort to develop geotechnical data exchange standards demonstrates his abilities to interact in diverse teams, develop systems requirements, and direct the work of contractors. Furthermore, his focus on geotechnologies over the past five years has given him the expertise needed to deploy information technologies into Caltrans practice where significant gains can be realized.

6.2 PROJECT MANAGEMENT METHODOLOGY

Management of the project will be generally based upon the concepts and guidelines described in the *Project Management Methodology* from Section 2.0 of the Statewide Information Management Manual (**SIMM**). In addition, the guidelines and protocols set forth by the Caltrans Division of Procurement and Contracts will be used extensively.

6.3 PROJECT ORGANIZATION

Loren Turner will manage the project with the support from Division of Research and Innovation administrative staff and management, including Tom Hoover and Melissa Thompson. David Wald from the USGS, Department of the Interior, will be the Principal Investigator and will involve his staff. Phil Naecker of GateKeeper Systems will carry out the development activities and tasks. Project sponsors include Robert Copp of Caltrans Traffic Operations and Tom Harrington of Caltrans Structures Maintenance and Investigations. Organizational charts are below.



6.4 PROJECT PRIORITIES

Managing the project requires the balancing of three factors: resources, schedule, and scope. These three factors are interrelated; a change in one of them causes the others to change as well. Project stakeholders need to agree on the importance of each of these factors before the project begins, as future project management decisions will be guided by these priorities. The project trade-off matrix below shows the relative importance of each factor:

Schedule	Scope	Resources
Improved (can be adjusted)	Constrained (factor cannot be changed)	Accepted (somewhat flexible to the project circumstances)

The project scope is considered the most important factor, as the pursuit of a quality research deliverable is critical to the success of the project. Although resources have been allocated to this project already, there is some flexibility within the research process to request and obtain additional research resources. The schedule for the project could be changed to meet unique conditions encountered in the process. The nature of research projects is such that discovery can lead to change in a positive way. As such, a change in schedule would not be seen as detrimental if the benefits from the change lead to a higher quality product.

6.5 PROJECT PLAN

6.5.1 PROJECT SCOPE

Through an interagency agreement, the USGS will deliver an advanced post-earthquake bridge inspection prioritization tool. An enhanced version of *ShakeCast* will be test-deployed at two TMCs on the same servers as *CISN Display*. *ShakeCast* will automatically retrieve measured earthquake data and ShakeMaps in near real-time, analyze shaking levels against Caltrans bridge inventory, and generate preliminary bridge inspection priority lists. *ShakeCast* will have functions to store complex bridge performance data and user-defined threshold levels based on ShakeMap parameters. In addition, *ShakeCast* will feature web-based GIS maps and information over the Caltrans intranet, as well as customized e-mail and pager messages specific to bridge damage assessment.

6.5.2 PROJECT ASSUMPTIONS

This project assumes that the USGS remains committed to supporting the further development of *ShakeCast* and *ShakeMap* technologies for applications within Caltrans. Partnering and in-kind contributions from the USGS are critical to the successful execution of the project.

The project also assumes that research management and sponsors continue to **view** this as a high priority. Continued funding through the research program is essential.

6.5.3 PROJECT PHASING

The phasing for the research project is as follows:

1. Conduct a needs assessment with Caltrans to enhance current web page navigation in *ShakeCast*. Develop a detailed specification for a revised web interface, including story board, mockups, and explanation of new features.
2. Revise front-end web interface to *ShakeCast* to facilitate system administrators, establishing accounts, maintaining system, and setting fragility parameters.
 - 2.1. Implement recommendations from needs assessment.

- 2.2. Integrate server verification tools to allow validation of communications with USGS servers. Validation should be automated when identifying a new upstream, downstream, poll, or query server.
- 2.3. Integrate tool to view error logging and error checking.
- 2.4. Revise pages to set up ShakeCast server, combining all settings in one page (e.g. sets rver passwords in same screen when setting other server parameters.)
- 2.5. Apply global fragility parameters to groups of facilities in a single interface. For example, the facility table for Caltrans bridges will likely be expanded into classes of bridge (i.e. Type A, Type B, etc.). The interface needs to allow the system administrator to apply a single set of fragility parameters to a type of bridge.
3. Revise front-end web interface to *ShakeCast* to facilitate Users setting up accounts and maintaining notification preferences.
 - 3.1. Implement recommendations from needs assessment.
 - 3.2. "Event," "Product," "Shaking," and "Damage" notifications selectable by region. Incorporate map interface to select by district or county.
4. Develop and implement user types ("Administrator" and "User") to access ShakeCast server, with password management.
 - 4.1. Administrators have access to all ShakeCast features.
 - 4.2. Users should only be permitted to update contact information (phone, e-mail, address) and notification settings (facility, region, etc.).
 - 4.3. New users should be permitted to access the server and set up an account.
5. Develop a web-enabled map interface (ArcIMS or similar companion product) to ShakeCast for graphical map display of analyzed post-earthquake output data.
 - 5.1. Application runs on the same ShakeCast server.
 - 5.2. Provides graphical map output via internet.
 - 5.3. Displays facilities and their potential damage status based upon the ShakeCast analysis and defined fragilities (e.g. facilities are color coded red/yellow/green).
 - 5.4. Displays facility inspection priority lists, with attributes for each facility. Sort table in ascending or descending order by any column attribute.
6. Create training and support materials to assist in deployment of *ShakeCast* within Caltrans, and evaluate system performance through test deployments.
 - 6.1. Create an informational brochure describing the application of ShakeCast within Caltrans.
 - 6.2. Provide electronic files (text, html, and images) to assemble a web-based version of the informational brochure. Caltrans will implement the web site on its intranet.
 - 6.3. Develop a user's guide tailored to the Caltrans application.
 - 6.4. Provide technical support via phone and e-mail over the duration of the contract for installation, setup, and usage.
 - 6.5. Provide onsite deployment support for two locations in California. This includes installation of software and training for site staff.
7. Provide support for a redundant ShakeCast upstream server at the USGS, Golden Colorado facility. Implement dedicated, high-priority, robust communications to insure that earthquake data is reliably transmitted to Caltrans in the shortest possible time frame.

Upon completion of the research project contract with the USGS, the system will be evaluated for its effectiveness in mitigating delays during post-earthquake response

situations. The evaluation will be used to develop a FSR, if required, to fully implement the system into Caltrans practices.

6.5.4 ROLES AND RESPONSIBILITIES

Project Manager:

- Implement project policies and procedures.
- Acquire reserves required to perform work.
- Maintain staff technical proficiency and productivity, and provide training where required.
- Establish and maintain quality in project.
- Identify and procure tools to be used on the project
- Develop draft project plan.
- Define project success criteria.
- Document project constraints.
- Conduct cost/benefit analysis.
- Develop detailed project plan, tailoring methodology to reflect project needs.
- Ensure that management, users, affected state organizations, and contractors agree to project commitments.
- Ensure that project plan is approved and baselined.
- Assign resources to project and assign work packages
- Approve project quality
- Regularly review project status, comparing budgeted to actual values.
- Ensure that project plan is updated and signed off as needed.
- Review the results of quality assurance (QA) reviews.
- Participate in change board to approve system changes.
- Obtain management and user approval of design, test, and approaches.
- Review project risks and establish mitigation procedures.
- Develop an action plan for any product that does not pass acceptance test.
- Obtain user and management approval of tested system.
- Close-out open action items.
- Assist DGS in contract close-out.
- Celebrate success.
- Develop post-implementation report.
- Conduct lessons learned session.

Contractor/PI:

- Carry out the work and terms described in the contract document.
- Adhere to schedule and Caltrans contracting statutes.

Sponsors:

- Review deliverables.
- Provide feedback throughout project as requested.
- Represent the project in management meetings.

Research Management:

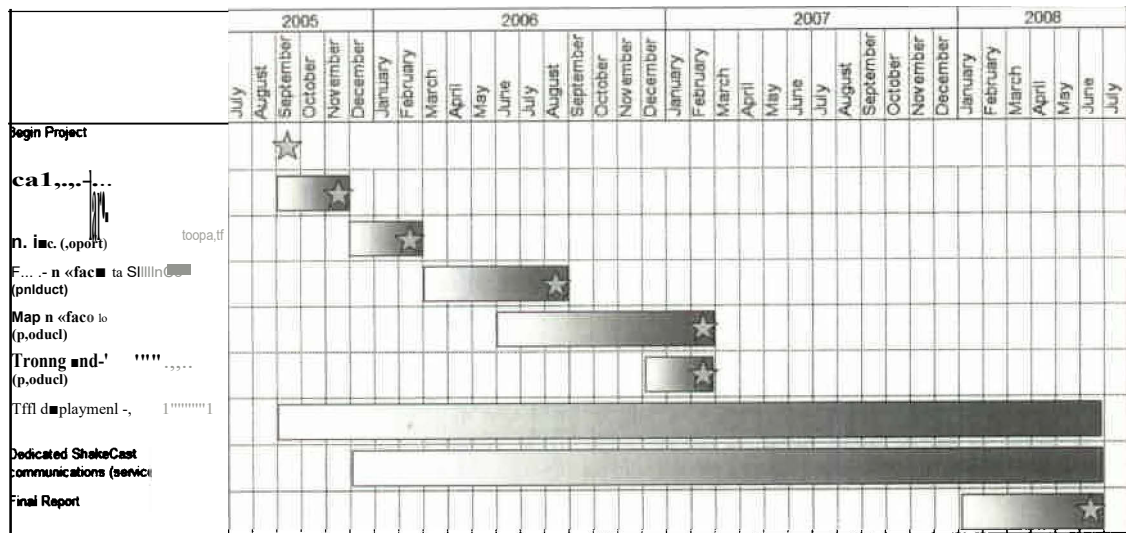
- Provide administrative support for the project manager.
- Insure funding and provide **TRAMS** accounting support.
- Report progress to the FHWA.

6.5.5 PROJECT SCHEDULE

Significant project milestones/deliverables are as follows:

- Caltrans needs assessment (report)
- Specification for a revised web interface (report)
- Front-end interface to ShakeCast (product)
- Map interface to ShakeCast (product)
- Training and support materials (product)
- Test deployment support(service)
- Dedicated ShakeCast communications (service)

The timeline for the deliverables and activities are as follows:



Note: yellow star indicates the start of the project and/or a specific deliverable.

6.6 PROJECT MONITORING

Project monitoring will be performed in accordance with Caltrans Division of Procurement & Contracts (DPAC) guidelines. This includes monitoring:

- The contractor's compliance with contract provisions.
- All expenditures charged by the contractor.
- When applicable, invoices or billing statements are used to identify payment per percentage and/or dollar amounts set for it in DBE or DVBE contracting goals required by the state or federal governments.
- Contractor for use of subcontractors and suppliers.
- The quality of the Contractor's work.
- If performance is unsatisfactory and bonds were required, notify the bonding company of any noted poor performance. If termination of the contract results, the bonding company must be notified as well.
- If insurance is required, see that it is in effect at all times during the life of the contract. If the insurance expires during the term of this agreement, a new certificate must be received by the state at least ten days prior to the expiration of this insurance.

The project will be monitored according to Federal Highway Administration (FHWA) standards, including completion of quarterly status reports to the Division of Research

and Innovation and FHWA management. Also, the ShakeCast Project will be monitored according to Caltrans' Information Technology standards, including completion of monthly status reports to the Project Management Office (PMO).

6.7 PROJECT QUALITY

Project quality assurance processes within the project will be generally based upon the concepts and guidelines described in the *Project Management Methodology* from Section 200 of the Statewide Information Management Manual (**SIMM**), Section 3.7.

A comprehensive test strategy consisting of a series of different tests that will fully evaluate the ShakeCast system will be undertaken. The primary purpose of these tests is to uncover the system's limitations and measure its full capabilities. A list of the various planned tests and a brief explanation follows below.

- The system tests will focus on the behavior of the ShakeCast system. User scenarios will be executed against the system as well as screen mapping and error message testing. Overall, the system tests will test the integrated system and verify that it meets the requirements defined in the requirements document.
- Performance test will be conducted to ensure that the ShakeCast system's response times meet the user expectations and do not exceed the specified performance criteria. During these tests, response times will be measured under heavy stress and/or volume.
- Security tests will determine how secure the new ShakeCast system is. The tests will verify that unauthorized user access to confidential data is prevented.
- The ShakeCast system will be subjected to high input conditions and a high volume of data during the peak times. The system will be stress tested using 20 users.
- Recovery tests will force the system to fail in a various ways (e.g. power outage) and verify the recovery is properly performed.
- Tests will be conducted to check the accuracy of the user documentation. These tests will ensure that no features are missing, and that contents can be easily understood.
- Caltrans staff will beta test the new ShakeCast system and will report any defects they find. This will subject the system to tests that could not be performed in our test environment.
- Once the ShakeCast system is ready for test deployment, the Caltrans staff will perform user acceptance testing. The purpose of these tests is to confirm that the system is developed according to the specified user requirements and is ready for test deployment use.

6.8 CHANGE MANAGEMENT

The change management process within the project will be generally based upon the concepts and guidelines described in the *Project Management Methodology* from Section 200 of the Statewide Information Management Manual (**SIMM**), Section 5.5.

Change management is a process that provides a mechanism to identify and handle change. In order to maintain the balance between requirements on one hand and the cosUschedule on the other, the project team will use a change management process. This process allows for change during the project's life cycle, but always puts the change in the context of the latest documented agreement (project plan) between the team and management and, in the case of the contractors, as contractually agreed to.

The change management process consists of a series of steps that allows change to be identified, evaluated, priced, and tracked through closure. The goal is to implement and use a process that fits the project.

- Step 1 - The proposed change is described which clearly identifies whether the change is system, organizational, or procedural in nature. Any reference material that will assist the reviewers will be identified and attached. A discussion of why the change is being proposed, including a cost-benefit analysis, if needed. If the change is not implemented, how will it adversely affect the customer and the state organization? Attach any supporting documentation that helps to clarify the proposed change. When complete, the change management document is submitted to the project manager.
- Step 2 - All change requests will be reviewed on a regular basis by the project manager (PM), who will review the initial request and determine whether to proceed, reject, or defer the request. The PM will make an initial assessment of the cost, schedule, and resources needed to implement the proposed change.
- Step 3 -- With executive PM approval, the appropriate processes will be followed to update contracts and baseline documents.

6.9 AUTHORIZATION REQUIRED

This project has been approved through a process implemented within Caltrans Division of Research and Innovation. The process requires support from a broad group of stakeholders, the Research and Deployment Steering Committee (RDSC), the Program Steering Committees (PSC's), and the Technical Advisory Panels (TAP's).

The California Department of Transportation supports research on a wide variety of topics to improve transportation efficiency and effectiveness in California. Caltrans' research project selection process emphasizes customer participation throughout the research process and effective deployment and customer ownership of the research products.

The RDSC, consisting of four deputy directors and six district directors, sets Caltrans' research priorities. All research proposals and projects included in the research program are first approved by the RDSC.

Research projects are selected and programmed annually, using an integrated Request For Proposals (RFP) process. A short turn-around (quarterly) process is provided to respond to projects that require approval outside the annual cycle.

The PSC's develop program-level research priorities. The eight PSC's include Caltrans' division chiefs, district directors and external partners, and have the following functional goals:

- Adopt agendas for multi-year integrated research programs
- Develop program-level research priorities
- Develop program-level ranking of proposals
- Support the deployment of research products

The TAP's provide technical expertise essential to a quality research program. The TAP's make recommendations to the PSC's and include technical experts from Caltrans' divisions, districts and external agencies. The TAP's have the following functional goals:

- Suggest, review and rank problems for inclusion in an RFP
- Develop problem statements, state-of-research summaries, and agendas for tri-annual research
- Review and rank proposals

- Identify deployment opportunities

7.0 RISK MANAGEMENT PLAN

The Risk Management approach for the project will be generally based upon the concepts and guidelines described in the *Project Management Methodology* from Section 200 of the Statewide Information Management Manual (SIMM), Section 3.10.

There are two primary risks for this research project:

- *The project team does not deliver an adequate or comprehensive evaluation at the conclusion of the research project of the effectiveness, robustness, and scientific integrity of the ShakeCast technology and system.* The research project is intended to demonstrate the effectiveness of a customized ShakeCast system, tailored to Caltrans needs. An effective evaluation of the system is needed in order to make a clear business case to fully integrate such a system into Caltrans' emergency response protocols and redirect resources to adequately support the system beyond the scope of the research effort.
- *Ca/trans management redirects research resources and priorities prior to the completion on the project.* The project depends upon the full support of research management and the sponsors. Continued funding through the research program through completion of the project is essential to its success.

8.0 QUESTIONS AND ANSWERS

1. **Question:** The EAW shows that the following is being procured in 06/07: \$30,000 for hardware and \$15,000 for software licenses. Please explain what each is being used for. If the hardware expenditure is for servers, please explain who is going to maintain them. Please include any arrangements with GIS.

Answer: Three servers are being procured under this project at an estimated cost of \$10,000 each. Two will be test deployed at TMCs, while the third will be maintained in Sacramento in the offices of the Division of Research & Innovation. The servers will each independently retrieve near real-time information over the internet through dedicated communications with USGS servers. ArcIMS software licenses for the servers will be installed at an estimated cost of \$15,000. ArcIMS licensing will be managed and coordinated through the HQ-GIS unit. Over the course of the research project, updates to the ShakeCast software will be performed by the USGS. Servers will be maintained by staff in the Division of Research & Innovation in close coordination with TMC support personnel.

2. **Question:** Section 2.2 refers to "server verification tools." Please give an explanation of what these tools are.

Answer: Section 2.2 states the following:

"Integrate server verification tools to allow validation of communications with USGS servers. Validation should be automated when identifying a new upstream, downstream, poll, or query server."

In an early alpha version of the ShakeCast software, there was a section of the administrative Interface that required the user to identify how they particular server was interfacing with the USGS server. This particular interface was not intuitive and left the user wondering whether

their server was "upstream" or "downstream", etc. Section 2.2 is requiring that the USGS change this part of the setup process such that the user can more easily identify the appropriate choice for their specific application. Furthermore, we are asking that the setup routine to run a preliminary check between the agency's server and the USGS server to validate that the correct choice was in fact selected.

3. **Question:** Section 2.5 discusses an "interface." Please explain what system, or database this interface connects to.

Answer: Section 2.5 states the following:

"Apply global fragility parameters to groups of facilities in a single interface. For example, the facility table for Ca/trans bridges will likely be expanded into classes of bridge (i.e. Type A, Type B, etc.). The interface needs to allow the system administrator to apply a single set of fragility parameters to a type of bridge."

The ShakeCast system stores information about bridges and other facilities in a MySQL database. That information is used to compare measured earthquake shaking levels against bridge performance data in order to create the inspection priority lists immediately following an earthquake. The "interface" that is referred to in the FSR is the tool by which the system administrator configures the system. Section 2, in general, refers to necessary improvements in the front-end interface for both users and administrators, the front-end being the web interface to the ShakeCast system. Section 2.5 refers to a feature that will see a lot of use. For example, a bridge inspection team may wish to set damage thresholds for all bridges in their District. Under the prototype ShakeCast system, the user would need to establish thresholds for each bridge separately -- this could be a tedious task given the number of bridges in a District. Ideally, most users would specify thresholds for a class of bridge (e.g. two span simple reinforced concrete over crossing) rather than individual bridges, making the setup task much easier. We are asking that the interface incorporate tools to allow our users that flexibility.

Caltrans ShakeCast User Needs Assessment: Draft Report

Prepared by U.S. Geological Survey, May, 2006

Funds for this report are provided under California Department of Transportation Contract No. 65A0204, Caltrans Needs Assessment, Task 1.

1. Introduction

One of the primary products of the Caltrans ShakeCast project is to develop a Graphical User Interface (GUI) to the U.S. Geological Survey's (USGS) standard ShakeCast software. The main objective of the User Needs Assessment is to determine the needs and expectations of the users regarding the GUI and the associated notification services and ShakeCast products that will be produced in the study.

We carried out the User Needs Assessment in two steps:

1. Interviewed the ShakeCast project manager Lorren Turner to identify key components for server management.
2. Convened a meeting with key earthquake responders and engineers with Caltrans to discuss roles and needs of the users.

The interviews were conducted from Feb 28 through Mar 3, 2006 at the Caltrans GeoResearch facility in Sacramento. The Caltrans ShakeCast User Needs Assessment Meeting was convened on May 9, 2006 at the Caltrans Division of Research & Innovation in Sacramento with earthquake response stakeholders in the Caltrans ShakeCast project. The meeting was intended to identify common and specific needs of earthquake response for different divisions and to clarify expectations regarding the functionality, and user interface of the Caltrans ShakeCast system. The agenda for the meeting included the following items:

- Current use of earthquake response technologies at Caltrans.
- Background of ShakeMap & ShakeCast and related earthquake notification tools.
- Current and planned features of ShakeCast regarding development framework and server and end-user interface.
- Discussion of earthquake response of various Caltrans units, including Structures Maintenance, Bridge Construction, Traffic Operations/TMCs, PEQIT/Earthquake Engineering, and Emergency Operations.
- Identification of "use scenario" for ShakeCast, including functionality, user interface, notifications, delivery pathways.

The results of this meeting and follow-up interview process are included in this document with earthquake response plans from different units providing the groundwork for this report.

2. Meeting Participants

Name	Agency
Loren Turner	Caltrans Research
Nick Burmas	Caltrans Research
Dave Wald	U.S. Geological Survey
Kuo-Wan Lin	U.S. Geological Survey
Steve Sahs	Caltrans Structures Maintenance
Monica Kress	Caltrans TMC/Traffic Operations
Larry Wooster	Caltrans TMC/Traffic Operations
Mark Yashinski	Caltrans Earthquake Engineering/PEQIT
Sri Balasubramanian	Caltrans Emergency Operations

3. Meeting Results

3.1 Structures Maintenance

3.1.1 General Concerns and Comments

- Each District has its own protocol for response.
- Structures Construction is the first to arrive and inspect established bridge designations. They inspect their own construction first then bridges on their assigned routes. They spend 5-10 minutes on each bridge. If any doubt, they close the bridge.
- Dolores Vales has an emergency response plan for Caltrans Structure Construction Division.
- Circulate meeting presentation PPT files to participants.
- REDARS is a planning tool with traffic modeling, not suitable for earthquake response.

3.1.2 Agency Specific Issues

- Takes 10 to 12 hours to mobilize Structures Maintenance crews.
- Want to receive bridge damage assessment summary sorted by route and postmile.
- Bridge inspection crew will inspect all bridges regardless of preliminary damage assessment summary.
- Toll bridge inspectors will go directly to established toll bridge designations.
- Identify other structures including tunnels and retaining walls that are not covered by bridge fragility analysis.

3.2 TMC/Traffic Operations

3.2.1 General Concerns and Comments

- Consider adding the assessment of potential landslide hazards.

3.2.2 Agency Specific Issues

- Want to have configurable email message.
 - Add/remove components.
 - Caltrans panel to define those templates.

- Useful for an initial statement of the overall exposure for media and other inquires.
- Have a section in the notification that provides summary info:
 - How many people impacted
 - How many structures impacted.

3.3 Earthquake Engineering/PEQIT

3.3.1 General Concerns and Comments

- Consider Shinozuka's fragility analysis.
- Consider more types of hazards.
- Consider vertical accelerations (leads to punching shear) in ShakeMap, which is not accounted for at this time.
- Toll bridge displacements are being measured – contact Mark for more info.
- Talk to Keith Knudsen about liquefaction hazards.
- Landslides may account for *half* of the road closures.
- Need to get SMART files every year.
- 100 bridges added/subtracted every year between state and local bridges.

3.3.2 Agency Specific Issues

- Damage maps in GIS Shapefile format, accessible via email or web portal.
- Bridge damage assessment summary in Excel compatible format.
- Bridge damage assessment summary for scenario earthquakes.
- Comparison between deterministic and probabilistic analysis.
- Expand single metric fragility assignment to multiple metrics.

3.4 Emergency Operations

3.4.1 General Concerns and Comments

- Justification and benefits of the ShakeCast project.

3.4.2 Agency Specific Issues

- Consider buildings in damage assessment.

3.5 U.S. Geological Survey

3.5.1 General Concerns and Comments

- World Wind is NASA's alternative to Google Earth, but is open-source.
- Caltrans needs more common protocols for accessing and receiving earthquake information above and beyond ShakeCast (ENS, web, CISM Display, etc).

4. Main Issues and Recommendations

Throughout the meeting many considerations for the Caltrans ShakeCast project were discussed. In general, concerns and needs varied across the user group according to the role of the organization, staff, and other available resources. Practical issues and concerns that confront the ShakeCast project are synthesized into the following four general categories:

- Desired data and functions of the Caltrans ShakeCast system.
- Roles and use scenarios of Caltrans units in earthquake response.
- Delivery of bridge damage assessment and earthquake information to ShakeCast users.
- Considerations of user interface/interaction for successful implementation of the ShakeCast system.

The combined expectations of the various Caltrans units are listed below for each category. These items, together with information developed as part of the overall ShakeCast project, provide a foundation for the development of the Caltrans ShakeCast system.

4.1 Data Products and System Functions

General consensus among meeting participants is that rapid notification of bridge damage assessment immediately after a significant earthquake is the key service of ShakeCast. The contents of notification need to be configurable components with each of these components its own set of users. The differing user needs will determine the overall content of notification. Recommended data product components include:

- Bridge damage assessment summary in MS-Excel compatible table for easy data import/export.
- Links to GIS products on bridge inventory, facilities, and ground shaking information.
- Summary of earthquake parameters and shaking information (ShakeMap).
- Summary of bridge damage assessment for route and traffic planning.
- Summary of other damage assessment that are not currently supported by the ShakeCast system, including affected population, buildings, liquefaction, landslides, and other hazards.

4.2 Use Scenarios

4.2.1 Structure Construction

- Recipient: Area Construction Managers and Senior Staff.
- Notification: Bridge damage assessment summary for the district and ShakeMap showing earthquake information and areas with strong ground shaking.
- Action: With established protocol, inspection crew was dispatched and teamed up with Structure Maintenance and PEQIT with specific route.

4.2.2 Structure Maintenance

- Recipient: Managers, Supervisors, Emergency coordinators, Assistant Division Chief, and Office Chiefs.
- Notification: Bridge damage assessment summary for the district and ShakeMap showing earthquake information and areas with strong ground shaking.
- Action: With established protocol for each district, structure maintenance crew team up with Structure Construction and PEQIT with specific route.

4.2.3 PEQIT

- Recipient: Staff of the Office of Earthquake Engineering
- Notification: Bridge damage assessment summary for the entire area and ShakeMap showing earthquake information and areas with strong ground shaking.
- Action: PEQIT staff team up with Structure Maintenance to inspect bridge performance. Additional data regarding ground shaking values and bridge design parameters is downloaded from the ShakeCast portal. Parametric data and GIS data are imported into in-house research tools for further processing.

4.2.4 TMC/Traffic Operations

- Recipient: TMC managers, EOC managers, Senior Staff
- Notification: Bridge damage assessment summary for the entire area and ShakeMap showing earthquake information and areas with strong ground shaking.
- Action: Examine impact of bridge damage on traffic and plan traffic reroute. Update traffic planning based on information from field reports. Prepare overview statement concerning total number of structures with area of strong seismic shaking for media and management inquiries.

4.3 ShakeCast Notifications

Feedbacks from the meeting participants show that various earthquake notification services, including CISM Display, CGS paging, USGS and CISM earthquake email, etc., have been used by different Caltrans units for the purpose of earthquake response. Without common protocol and technology to tie with ShakeCast notification, two generic forms were suggested:

- Text based short summary message. The short summary notification is designed for mobile devices such as cellular phones, pagers, and computers with limited Internet access and display. Detailed information regarding bridge damage and earthquake and visualization tools will be linked back to the ShakeCast web portal.
- Detailed damage information. Detailed damage notification is designed for permanent workstations and mobile devices with broadband Internet access. This notification contains detailed bridge damage assessment for the region specified in the notification profile.

As one of the key features of ShakeCast, contents of notifications are often subsets of the ShakeCast processing results and depend on the geographic and threshold settings (profile selection/customization) of different users. The ShakeCast web portal is the central repository that will host the entire damage assessment report for all processed events.

4.4 User Interface/Interaction

From user's perspective, the ShakeCast infrastructure comprises two major components: the Portal and Notification. The ShakeCast web portal is the primary method of user interaction to provide server management, account management, notification profile management, visualization tools, and access to facility inventory and shaking information. In our discussions with meeting participants and the project manager it became apparent

that the main objective of ShakeCast portal is to lower IT bar for adoption. Portal users may come from any Caltrans units and range from being complete novices in field to expert users. While expert users may want to create and customize multiple notification profiles, we anticipate that most ShakeCast users may simply wish to perform quick-and-dirty account signup and modification through the established interface and to select predefined profile templates provided by the portal.

5. Graphic User Interface

Use and functionality of the preliminary prototype of GUI was created after the meeting. Representative, annotated screens of the mock user interface are presented in Appendix.

In a general sense, the mock interface demonstrates elements of new user signup, account management, profile management, as well as depict how visualization tools and detailed bridge inventory earthquake information will be presented. The mock interface uses a combination of actual available and fictional data to exemplify user interface/interaction with the ShakeCast web portal.

The methods for developing the mock interface were based entirely on logistical considerations of developing a rapid prototype. The decision does not reflect any selection intentions of software technology for the final ShakeCast project.

6. Appendix

6.1 Mock Web Portal

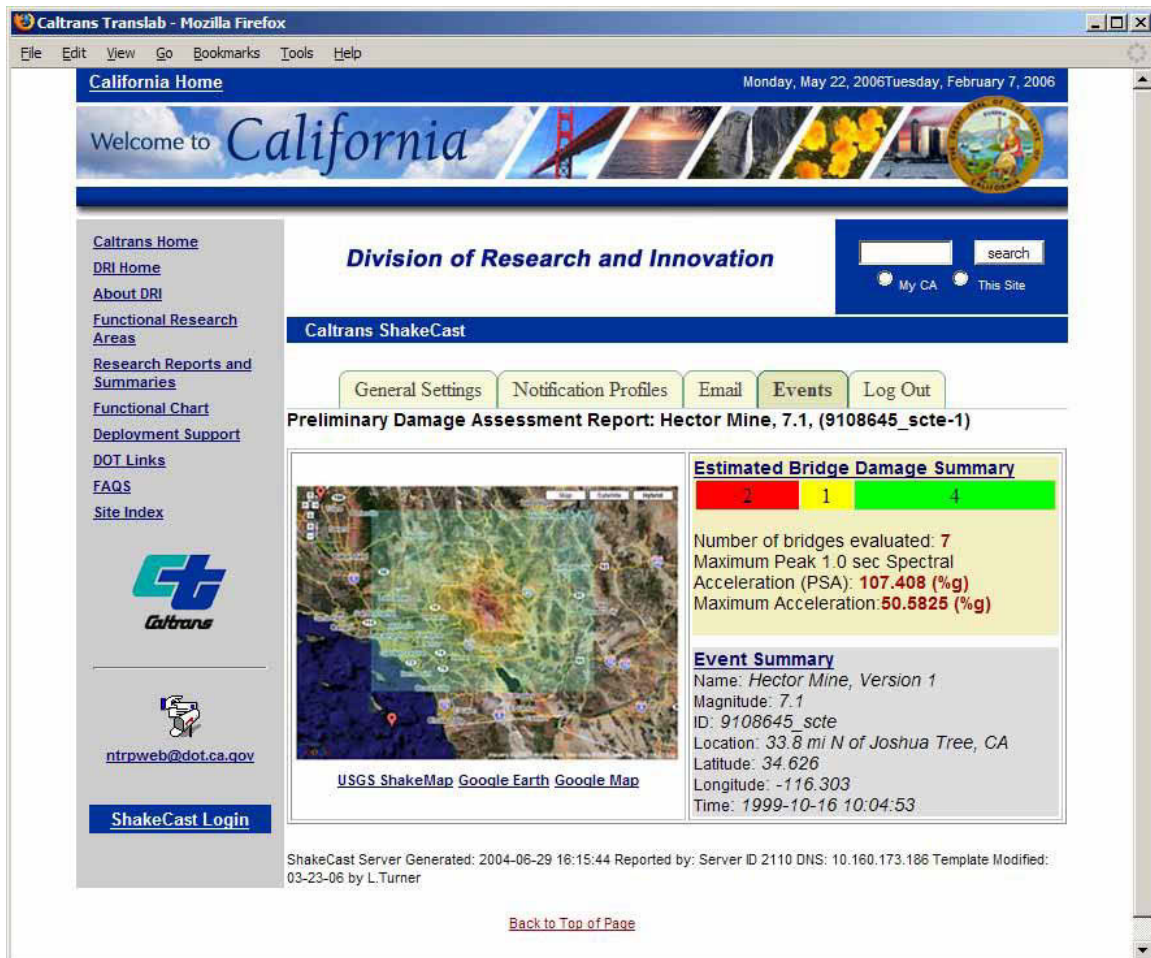


Figure 1. ShakeCast summary page is presented after user sign-in. From here ShakeCast users can manage their accounts, notifications profiles, and access detailed damage summary and shaking information.

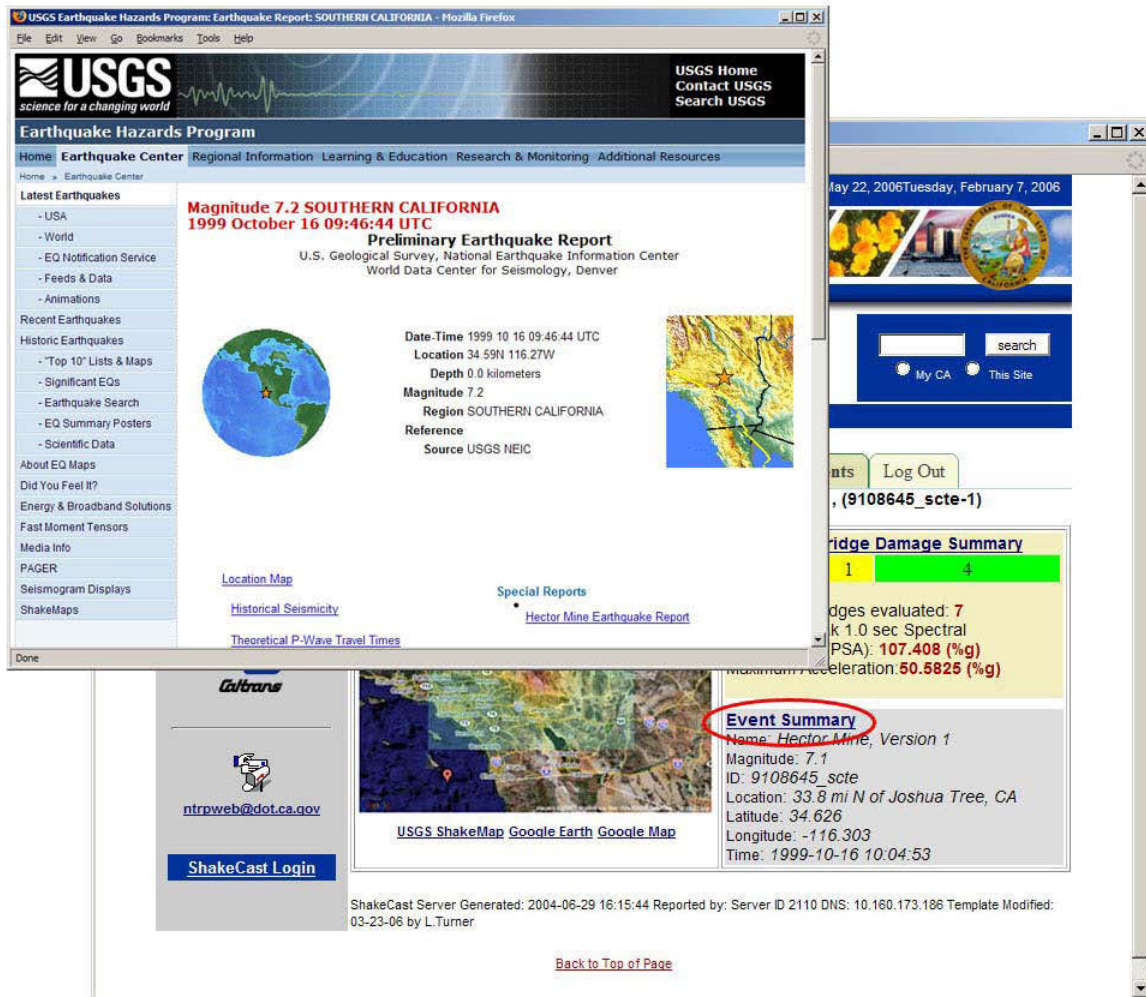


Figure 2. The earthquake report page from USGS is presented in a new window when clicking on the “Event Summary” link. The USGS earthquake report page contains detailed information and updates on the source parameters of the event.

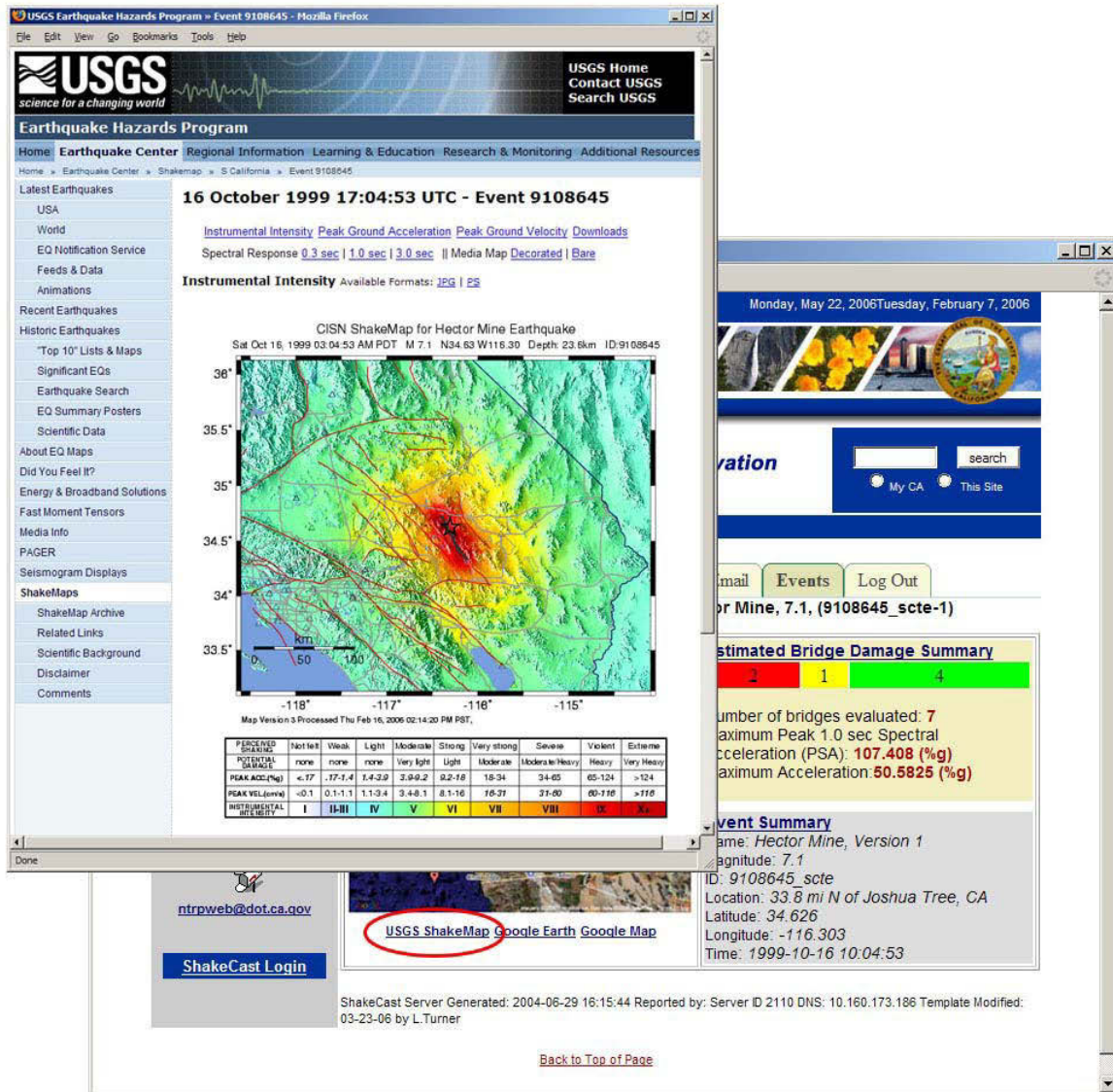


Figure 3. The USGS ShakeMap web page is accessible via the ShakeCast “USGS ShakeMap” link. The USGS ShakeMap web site stores the same ShakeMap products delivered via ShakeCast.

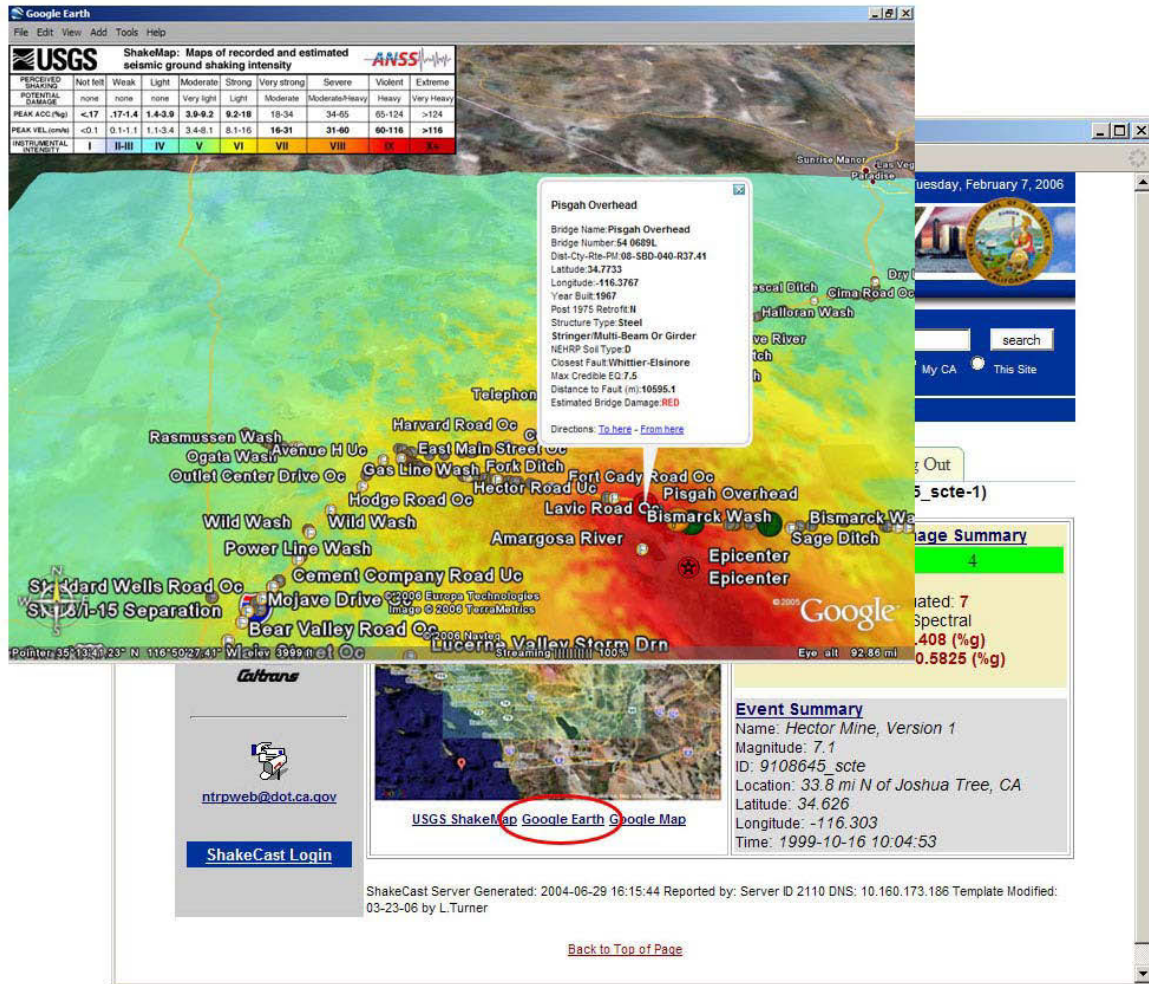


Figure 4. The Google Earth visualization tool (for ShakeMap and ShakeCast KMLs) is presented when clicking on the “Google Earth” link. The free Google Earth client software is required to use the feature.

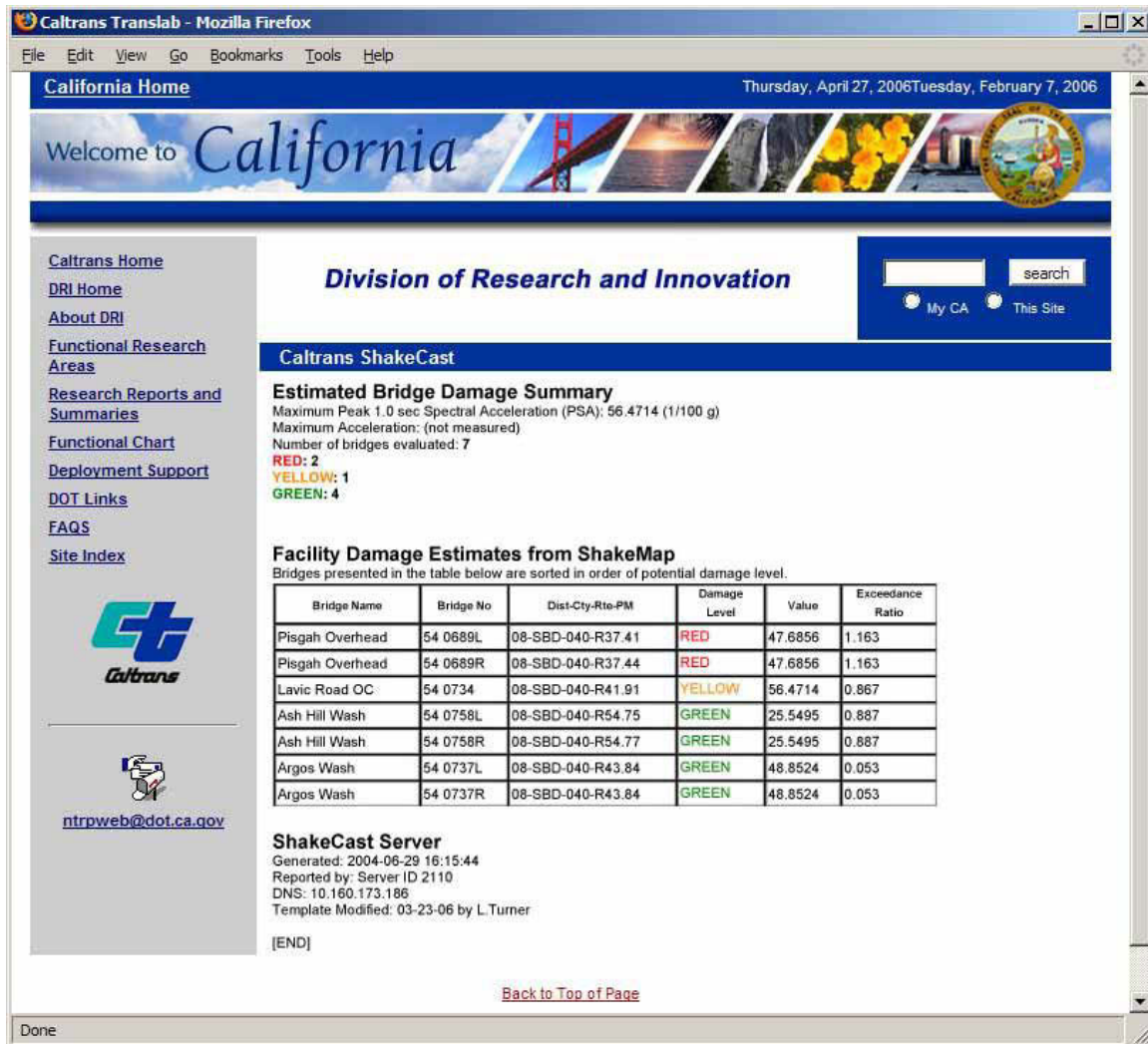


Figure 5. The bridge damage assessment summary page, this page provides detailed information regarding design parameters and ground shaking values for all assessed bridges.

6.2 Mock User Interface

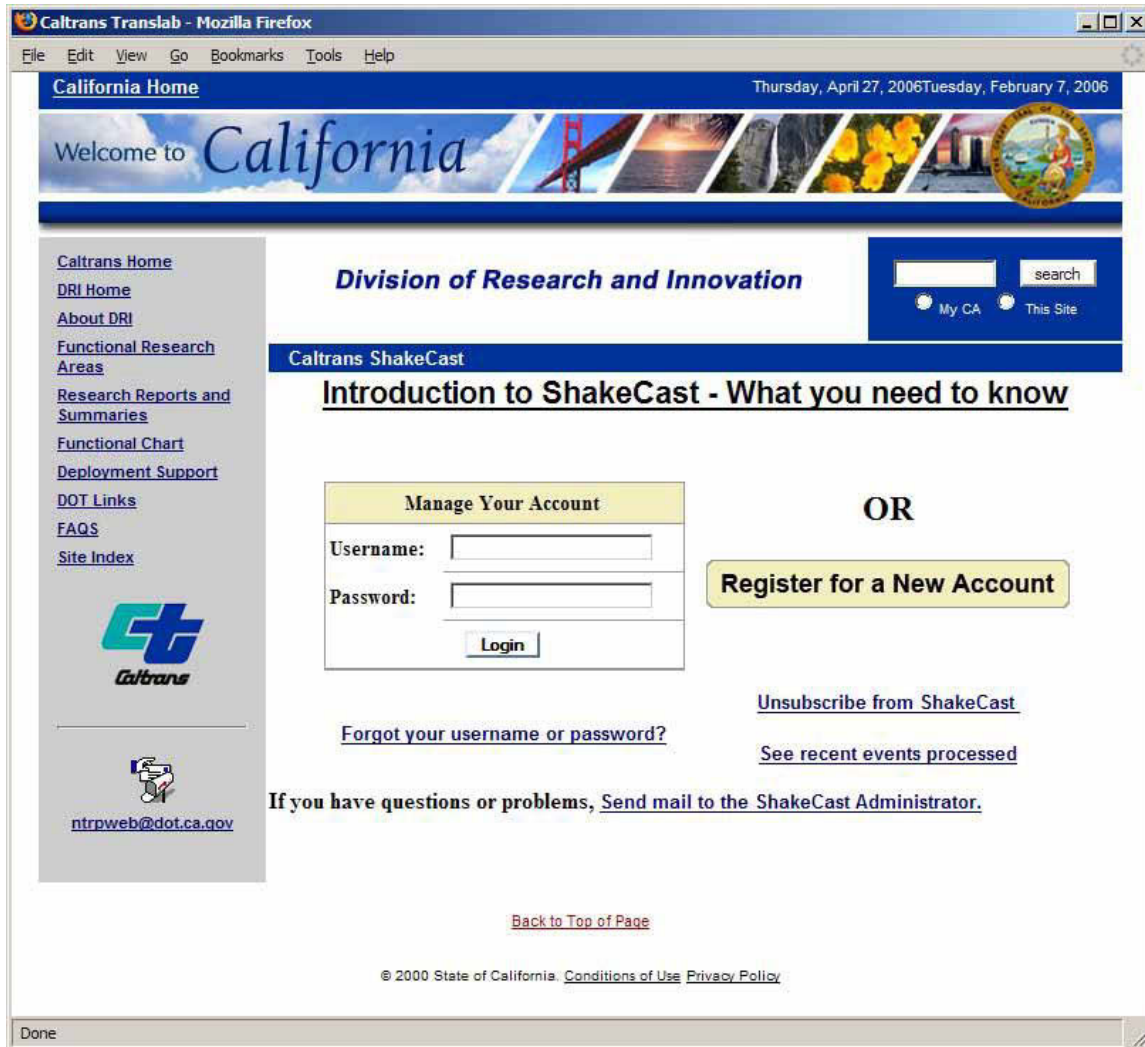


Figure 6. The front page of Caltrans ShakeCast web portal, user sign-in is required to access ShakeCast products.

Caltrans Translab - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

California Home Tuesday, May 16, 2006 Tuesday, February 7, 2006

Welcome to California

Division of Research and Innovation

Caltrans ShakeCast

Registration Step 1 - Set up Account

* Indicates a required field

First Name:*	Last Name:*	MI:
<input type="text"/>	<input type="text"/>	<input type="text"/>
Address 1:		
<input type="text"/>		
Address 2:		
<input type="text"/>		
City:*	State:*	Zip:
<input type="text"/>	<input type="text"/>	<input type="text"/>
Company/Office:		
<input type="text"/>		
Email/Username:*		
<input type="text"/>		

Enter a password for your account

Password:*	<input type="password"/>
Confirm:*	<input type="password"/>

N W G B K

If you are unable to see this image, please contact [ShakeCast Administrator](#)

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ntrpweb@dot.ca.gov

Figure 7. User sign-up page is the first step in registering a new ShakeCast account.

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Caltrans ShakeCast

General Settings Notification Profiles Email Events Log Out

General Account Settings

First Name:*	Last Name:*	MI:
<input type="text"/>	<input type="text"/>	<input type="text"/>
Address 1: <input type="text"/>		
Address 2: <input type="text"/>		
City:*	State:*	Zip:
<input type="text"/>	<input type="text"/>	<input type="text"/>
Company/Office: <input type="text"/>		
Email/Username:*		
<input type="text"/>		

Enter a password for your account

Password:*	<input type="text"/>
Confirm:*	<input type="text"/>

DELETE MY ACCOUNT

SUBMIT

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Figure 8. The general account setting page, from this view ShakeCast users can update their contact information.

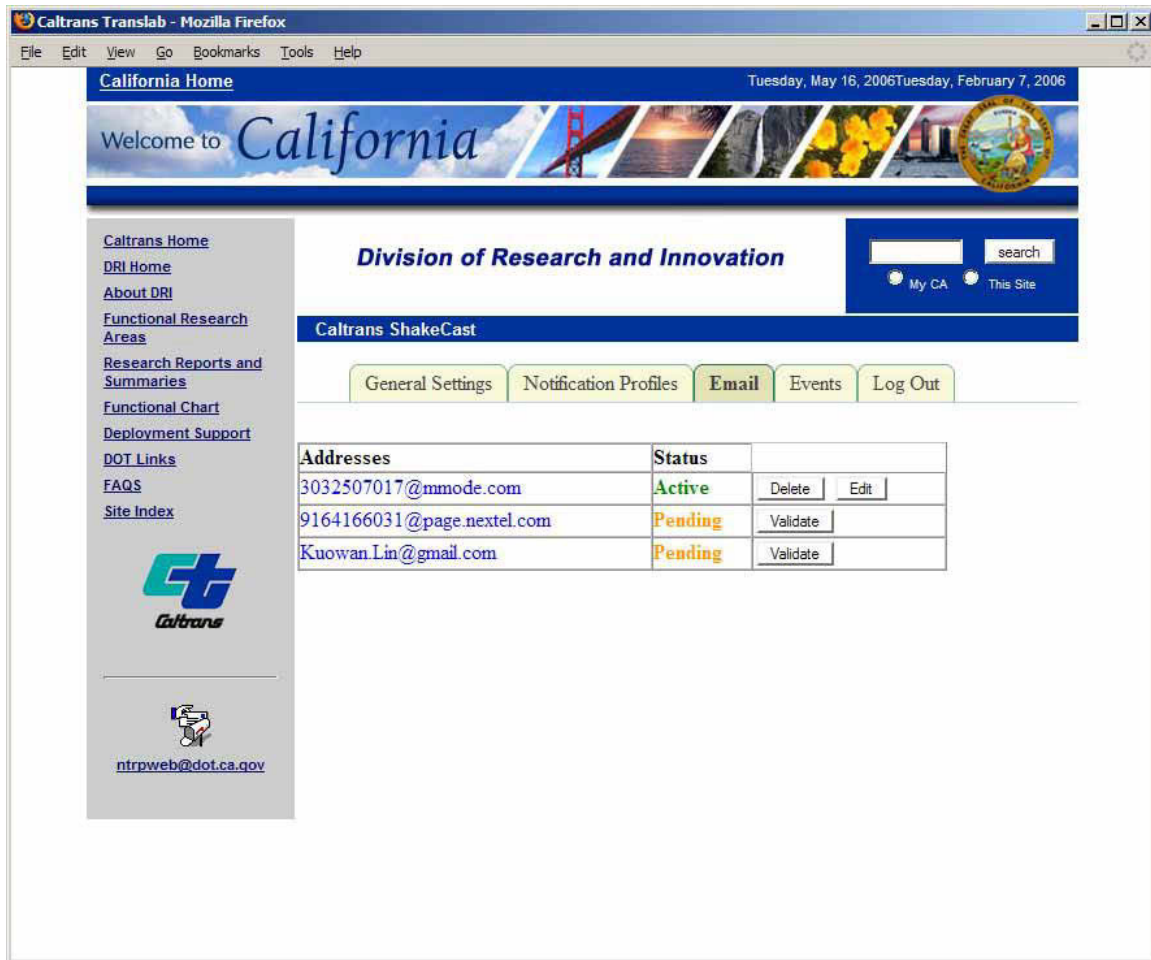


Figure 9. The management page of email list for receiving notification, users can validate, delete, or edit their email addresses.

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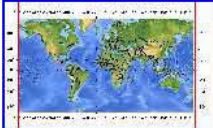
Caltrans ShakeCast

General Settings Notification Profiles Email Events Log Out

Summary Predefined Profile Custom Profile


ShakeCast Notification Profiles Associated with Kuowan.Lin's Account

Global Event (Predefined region: World)


[View with Google maps](#)

Geographic Bounds: rectangle	
South Latitude:	-90.000
North Latitude:	90.000
East Longitude:	180.000
West Longitude:	-180.000
Day Mag:	5.7
Night Mag:	6.2
Address 1:	3032507017@mmode.com (short) 08:00-22:00
Address 2:	Kuowan.Lin@gmail.com (long) 08:00-22:00
DELETE PROFILE EDIT PROFILE	

California (Predefined region: California)


[View with Google maps](#)

Geographic Bounds: polygon	
Day Mag:	3.5
Night Mag:	4.5
Address 1:	9164166031@page.nextel.com (short) 08:00-22:00
DELETE PROFILE EDIT PROFILE	

Figure 10. Summary of active notification profiles, each profile consists of a list of bridges enclosed within a defined region, notification metric threshold settings, and a list of email addresses for receiving notifications.

Caltrans Translab - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

California Home Monday, May 22, 2006 Tuesday, February 7, 2006

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Caltrans ShakeCast

General Settings Notification Profiles Email Events Log Out

Summary **Predefined Profile** Custom Profile

Addresses	Summary	Detailed Damage Info
<input checked="" type="checkbox"/> 3032507017@mmode.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 9164166031@page.nextel.com	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Kuowan.Lin@gmail.com	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Active: ☒ Yes ☐ No

Pick a Predefined Profile [Help](#)

- ☐ District 1
- ☐ District 2
- ☐ District 3
- ☐ District 4
- ☐ District 5
- ☐ District 6
- ☐ District 7
- ☐ District 8
- ☐ District 9
- ☐ District 10
- ☐ District 11
- ☐ District 12
- ☐ California - North
- ☐ California - South
- ☐ California

Name for this Profile:

Day Magnitude:

Night Magnitude:

SUBMIT

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Figure 11. Notification profile selection page, this profile selection page is presented with pre-defined profile template for each Caltrans district.


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Caltrans ShakeCast

General Settings Notification Profiles Email Events Log Out
Summary Predefined Profile Custom Profile

Addresses	Summary	Detailed Damage Info
<input checked="" type="checkbox"/> 3032507017@mmode.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 9164166031@page.nextel.com	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Kuowan.Lin@gmail.com	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Active: ☒ Yes ☐ No

Define a rectangular boundary
NOTE: Longitudes in the western hemisphere are negative [Help](#)

☐ Rectangle
☐ Circular
☐ Polygon

Latitude
South Lat
North Lat

Longitude
East Lon
West Lon

Name for this Profile:

Day Magnitude:

Night Magnitude:

SUBMIT

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Figure 12. Another example of notification profile selection page, this profile selection page is presented with options for defining custom rectangular region.

Caltrans ShakeCast Web Interface Specification: Draft Report

Prepared by U.S. Geological Survey, July, 2006

Funds for this report are provided under California Department of Transportation

Contract No. 65A0204, Caltrans ShakeCast Web Interface Specification, Task 2.

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1. Introduction

1.1 Rationale of Caltrans ShakeCast

The primary goals of the Caltrans ShakeCast project are to revise the web interface and to enhance the features of the USGS ShakeCast system to meet the specific needs of Caltrans' bridge inspection response immediately following a major earthquake. Caltrans ShakeCast is an automated system for the retrieval of ShakeMaps, analysis of shaking levels against Caltrans bridge vulnerabilities, and delivery of bridge inspection priority lists (likely damage assessment) to Caltrans users via pager and email.

Caltrans ShakeCast users:

- Will have access to a web portal from which they can access detailed information on Caltrans bridge facilities and related earthquake information products (e.g. ShakeMap).
- Will have access to a web portal to set up personalized accounts, identify facilities and regions for notification, and set shaking thresholds to trigger automated notification routines;
- Will automatically receive notifications (pager, email, web pages, etc.) of bridge damage assessment summaries and related earthquake information;
- Will be provided with visualization tools and GIS based data products through the web portal;

With the enhanced web interface, Caltrans ShakeCast administrators:

- Will have the tools to perform routine system maintenance and testing, including server health monitoring, system setup, end-to-end testing, earthquake scenario testing, etc.;
- Will be able to manage user accounts (e.g. account approvals, new account requests, etc.)

- Will be able to import, export, and maintain the parameters associated with the bridge inventory (including fragility settings);
- Will be able to configure notification templates, user profiles, and web portal templates.

Caltrans ShakeCast is thus an integrated environment for earthquake situational awareness of Caltrans bridges. By customizing personal profiles in the form of defining geographic regions, notification preferences, and delivery methods, Caltrans ShakeCast users receive near real-time critical notification and have access to detailed information tailored for their duty functions during earthquake emergency response.

Based on the USGS ShakeCast system, the Caltrans ShakeCast system will provide an extensive but easy to use web interface for both system and end-user services. The extended functionality will be integrated into the Caltrans ShakeCast system primarily as add-on modules without interfering with existing processes and will take advantage of available Internet technologies such as PHP, Perl, and online mapping tools, etc.

1.2 Users

Caltrans personnel can take advantage of the benefits of ShakeCast by registering with the Caltrans ShakeCast system. Once registered, there are three roles that the user can assume while interacting with the system: ShakeCast User, Group Administrator, and System Administrator, depending on their privileges.

- *ShakeCast User* – a single user or a member of a Caltrans unit. In this capacity, a ShakeCast User has access to personal profile and can update notification settings.
- *System Administrator* – a special user who can create and manage user accounts, facilities, and the ShakeCast server.
- *Group Administrator* – a ShakeCast user with appropriate rights to administer a Caltrans unit.

1.3 Functionality

The functionality of Caltrans ShakeCast is summarized as (i) the actions users can perform, and (ii) the actions administrators perform.

1.3.1 ShakeCast User Actions

- Register and login. In order to access Caltrans ShakeCast web portal, a user must register into the ShakeCast environment. The effect of a successful registration is that the user has a ShakeCast account consisting of a user name, a password, and may now log into the ShakeCast system using user name and password.
- Manage account. Once a user has logged in, he/she can perform basic management actions on an individual account. Account management operations include editing and deleting of account information and notification profiles. Deleting personal account is equivalent to un-registering ShakeCast services.

- Access bridge damage assessment summary. A bridge damage assessment summary is a collection of shaking parameters and fragility assessment of bridges for a significant earthquake. Users may browse collections of ShakeCast summary for both actual and scenario events.
- Access GIS products and additional resources. Visualization products and outside resources regarding ShakeMaps and earthquakes are made available by the system to ShakeCast users via web portal.

1.3.2 System Administrator Actions

- Manage user registration. Upon new user registration, the administrator will receive a notification email and has the rights to approve or deny user request. An administrator can also modify the status of current ShakeCast users to enable/disable their ShakeCast services.
- Manage bridge facility. System Administrators can administrate bridge facility records. An administrator can update bridge records in batch via global data import/export functions or modify individual bridge records. Fragility settings associated with a bridge facility can be assigned via facility management or computed by a custom fragility assessment module.
- Manage ShakeCast system. System Administrators can perform low level system maintenance and can examine logged entries of ShakeCast processes. System maintenance tasks include state of health monitoring, communication connectivity monitoring with ShakeMap and database servers, web server setup, and initiation of end-to-end tests and scenario exercises.
- Manage product configuration. System Administrators can manage notification and user profile templates. Product configuration also includes web portal configuration, which dictates portal layouts and user interactions with the portal.

1.3.3 Group Administrator Actions

- Perform same actions as of ShakeCast users.
- Manage user registration for the user group/division. The group administrator has the same privilege and performs the same tasks as the system administrator on managing user accounts of the same group, and only to the same user group.

2. User Web Interface

2.1 Flowchart diagram

This section describes user interactions with the ShakeCast user web interface, which include the following five major tasks:

- User Registration and Log-in
- General Account Settings
- Notification Profiles
- Email Management
- ShakeCast Event Reviews

A flowchart of the overall user interactions with the ShakeCast web interface, highlighting the major functions, is shown in Figure 2.1.

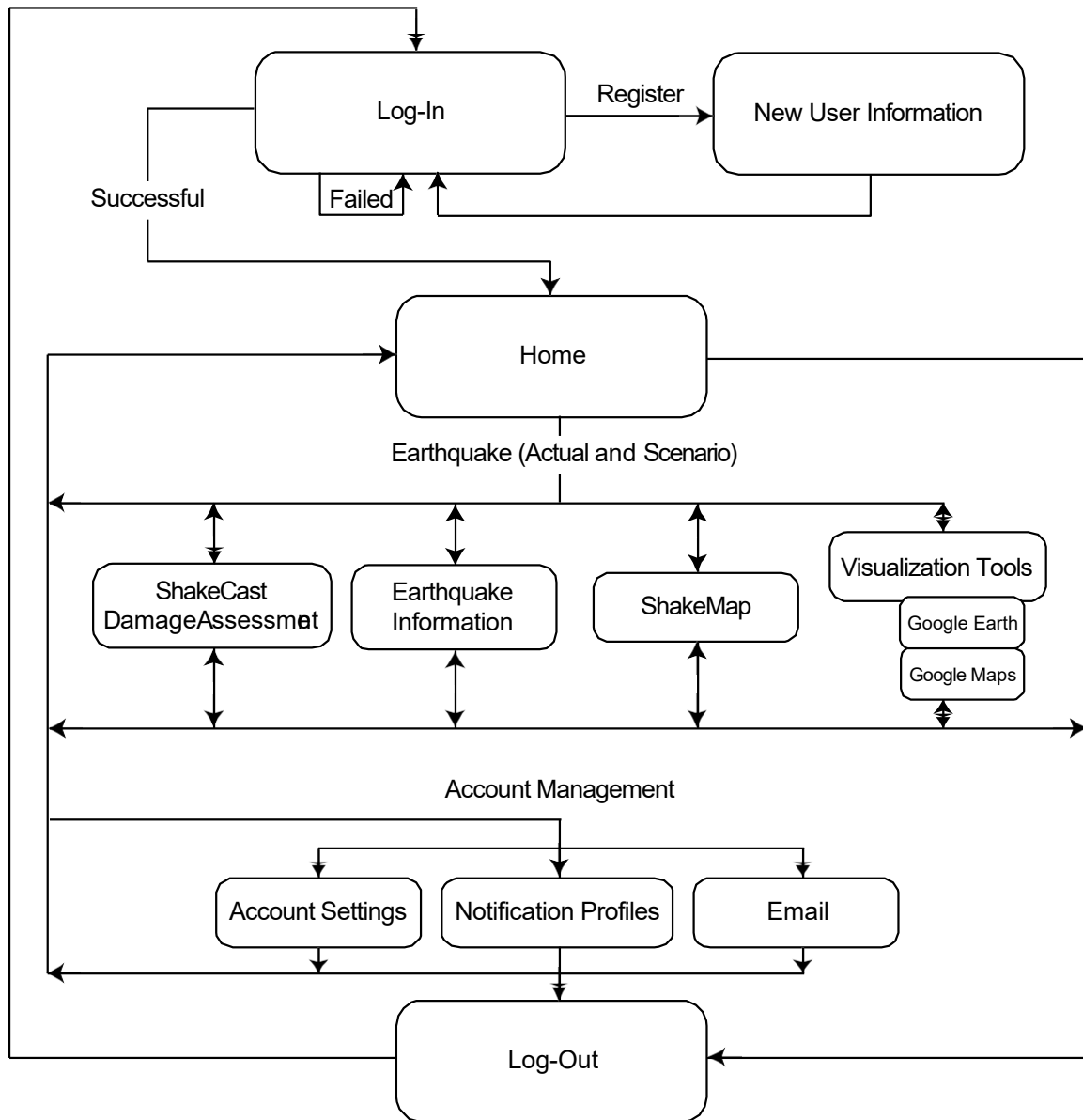


Figure 2.1 Flowchart diagram of the Caltrans ShakeCast user portal solution.

2.2 Portal wire frame

The following wire frame section describes the main elements of the web portal for Caltrans ShakeCast users. The portal is extensible and additional elements may be added at a later date. It is assumed that the pages and tabs defined here will form a core, mandatory set of functionality for an initial release. All sections of the portal will be intuitive and will conform to Caltrans webpage standards.

2.2.1 Welcome page

2.2.1.1 Welcome page links

The users will be able to link to the following pages from the Welcome page.

- Introduction
- Registration

2.2.1.2 Welcome page purpose

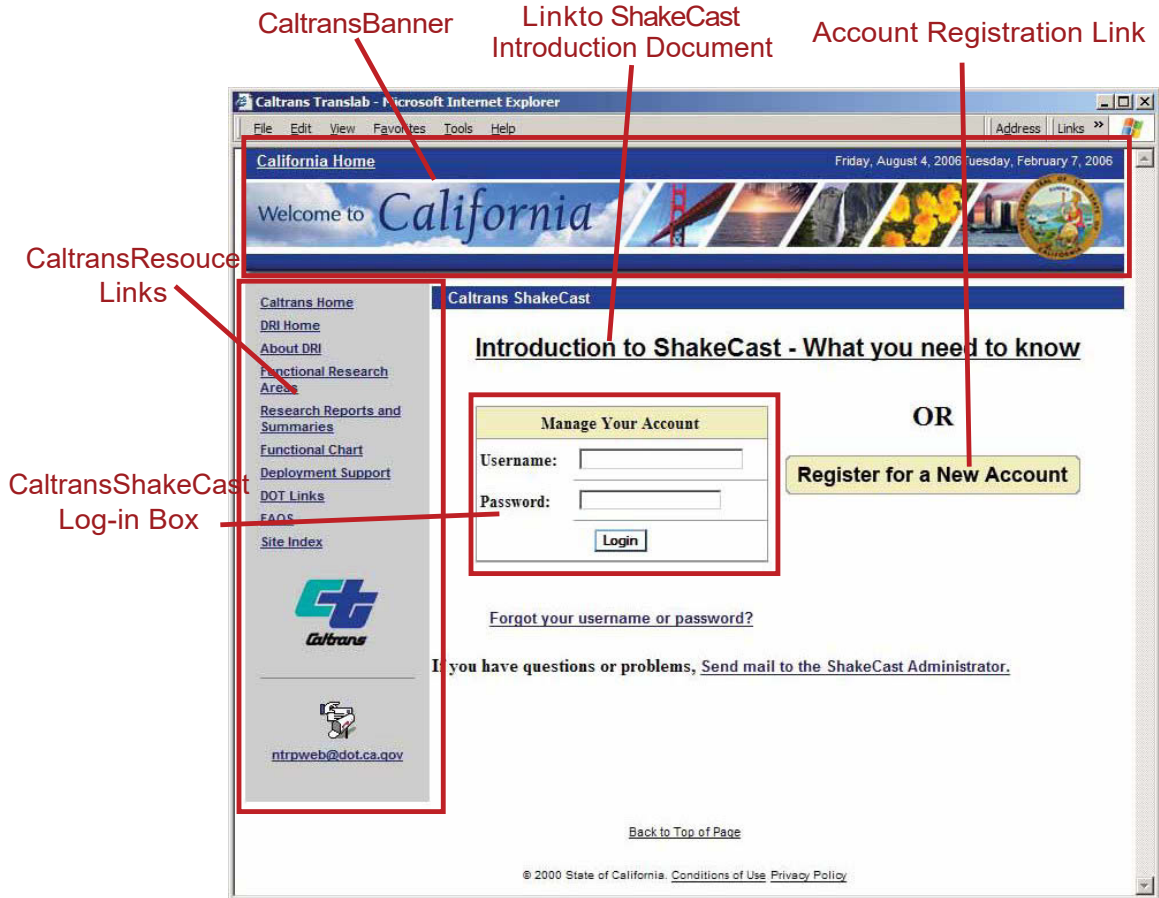
This page is the initial page of Caltrans ShakeCast web interface. This makes up the external layer of the portal and will be available to anyone regardless of sign-up status. It will be made up of a Log-in block, a Registration block, and an Introduction block.

The Log-in block will present the user with Username and Password text boxes, and a login button. The requirement is that the user will only have to sign in once, in order to access the ShakeCast portal and relevant products. If the login is unsuccessful, the user will get feedback that this is the case, and the login form will be reset.

A link will exist to the new user registration page.

A link will exist to the current introduction document of ShakeCast.

2.2.1.3 Welcome page content diagram



2.2.2 New User Registration page

2.2.2.1 New User Registration page purpose

Upon new user registration, this page will present the new user with Contact Information, Password, and Authentication form blocks, and a submit button.

The Contact Information block will collect required information of a new user, including name, address, Caltrans unit, and email address. The submitted email address will become user identification. If the submitted information is incomplete, the user will get feedback and the registration form will be reset with missing fields highlighted.

The Password block will collect the user assigned password and confirmation. If the result is inconsistent, the user will get feedback that this is the case, and the Password block will be reset and highlighted.

2.2.2.2 New User Registration page content diagram

Caltrans Translab - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address Links >>

California Home Friday, August 4, 2006 Tuesday, February 7, 2006

Welcome to California

Caltrans Home

DRI Home

About DRI

Functional Research Areas

Research Reports and Summaries

Functional Chart

Deployment Support

DOT Links

FAQS

Site Index

Caltrans ShakeCast

Registration Step 1 - Set up Account

* Indicates a required field

First Name:* Last Name:* MI:

Address 1:

Address 2:

City:* State:* Zip:

Company/Office:

Email/Username:*

Enter a password for your account

Password:* Confirm:*

submit

Back to Top of Page

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2.2.3 ShakeCast Home page

2.2.3.1 ShakeCast Home page links

The user will be able to access the following general function tabs from the Home page:

- Account Settings
- Events

and specific sub-function tabs for Events tab:

- Latest Event
- Past Events
- Test Events
- Scenario Events

and specific sub-function tabs for Latest Event tab:

- Damage Summary
- Bridge Damage Assessment

2.2.3.2 ShakeCast Home page purpose

Once successfully logged in, the Damage Summary Page of Events tab will be the default ShakeCast Home page. This page will contain Bridge Damage Assessment, Event Summary, and Visualization and Resources blocks, normally for the most recent event or scenario event.

The Bridge Damage Assessment block will present the user with a summary of bridge damage assessment including the number of assessed facilities and facilities in different

damage stage. The Bridge Damage Assessment block also will provide peak values of key parameters used for fragility analysis and will provide a link to the detailed damage assessment page.

The Event Summary block will present the user with source parameters for the earthquake including magnitude, location, and date/time. A link will exist to the USGS earthquake page containing detailed information for the event.

The Visualization and Resources block will present the user an interactive map utilizing a web based GIS engine (such as Google Maps). The GIS map will include geographic layer of the assessed region with additional layers of ShakeMaps and Caltrans bridge facilities. A link will exist to the KML version of the interactive map. A link will exist to the USGS ShakeMap page for the same event.

2.2.3.2 ShakeCast Home page content diagram

The screenshot shows the Caltrans ShakeCast Home page in a Microsoft Internet Explorer browser window. The page has a blue header with 'California Home' and a date of 'Tuesday, February 7, 2006'. Below the header is a 'Welcome to California' banner. The main content area is titled 'Caltrans ShakeCast' and contains several tabs: 'Account Settings', 'Events', 'Latest Event', 'Past Events', 'Test Events', 'Scenarios', 'Damage Summary', and 'Bridge Damage Assessment'. A red box highlights the 'Events' tab and its sub-tabs. Below the tabs is a 'Preliminary Damage Assessment Report: Hector Mine, 7.1, (9108645_scte-1)'. This report includes a map of California with a red dot indicating the earthquake location, and a table of 'Estimated Bridge Damage Summary' with columns for 'Number of bridges evaluated', 'Maximum Peak 1.0 sec Spectral Acceleration (PSA)', and 'Maximum Acceleration'. The table shows values of 7, 10.408 (%g), and 50.5825 (%g) respectively. Below the map is an 'Event Summary' block with details: Name: Hector Mine, Version 1; Magnitude: 7.1; ID: 9108645_scte; Location: 33.8 mi N of Joshua Tree, CA; Latitude: 34.626; Longitude: -116.303; Time: 1999-10-16 10:04:53. At the bottom of the page is a 'Log Out' link and a footer with copyright information.

Annotations on the screenshot include:

- Function TabsBlock**: Points to the top navigation bar.
- Account Settings Tab**: Points to the 'Account Settings' tab.
- EventsTab**: Points to the 'Events' tab.
- SubTabsBlock**: Points to the sub-tabs under 'Events'.
- LatestEvent Tab**: Points to the 'Latest Event' sub-tab.
- PastEventsTab**: Points to the 'Past Events' sub-tab.
- TestEventsTab**: Points to the 'Test Events' sub-tab.
- ScenariosTab**: Points to the 'Scenarios' sub-tab.
- Log-out**: Points to the 'Log Out' link at the bottom.
- ShakeCastVisualization and ResourcesBlock**: Points to the map area.
- Bridge DamageAssessment Block**: Points to the 'Bridge Damage Assessment' sub-tab.
- Event Summary Block**: Points to the 'Event Summary' block.

2.2.4 Bridge Damage Assessment page

2.2.4.1 Bridge Damage Assessment page links

The user will be able to access the following general function tabs from the Bridge Damage Assessment page:

- Account Settings
- Events

and specific sub-function tabs for Events tab:

- Latest Event
- Past Events
- Test Events
- Scenario Events

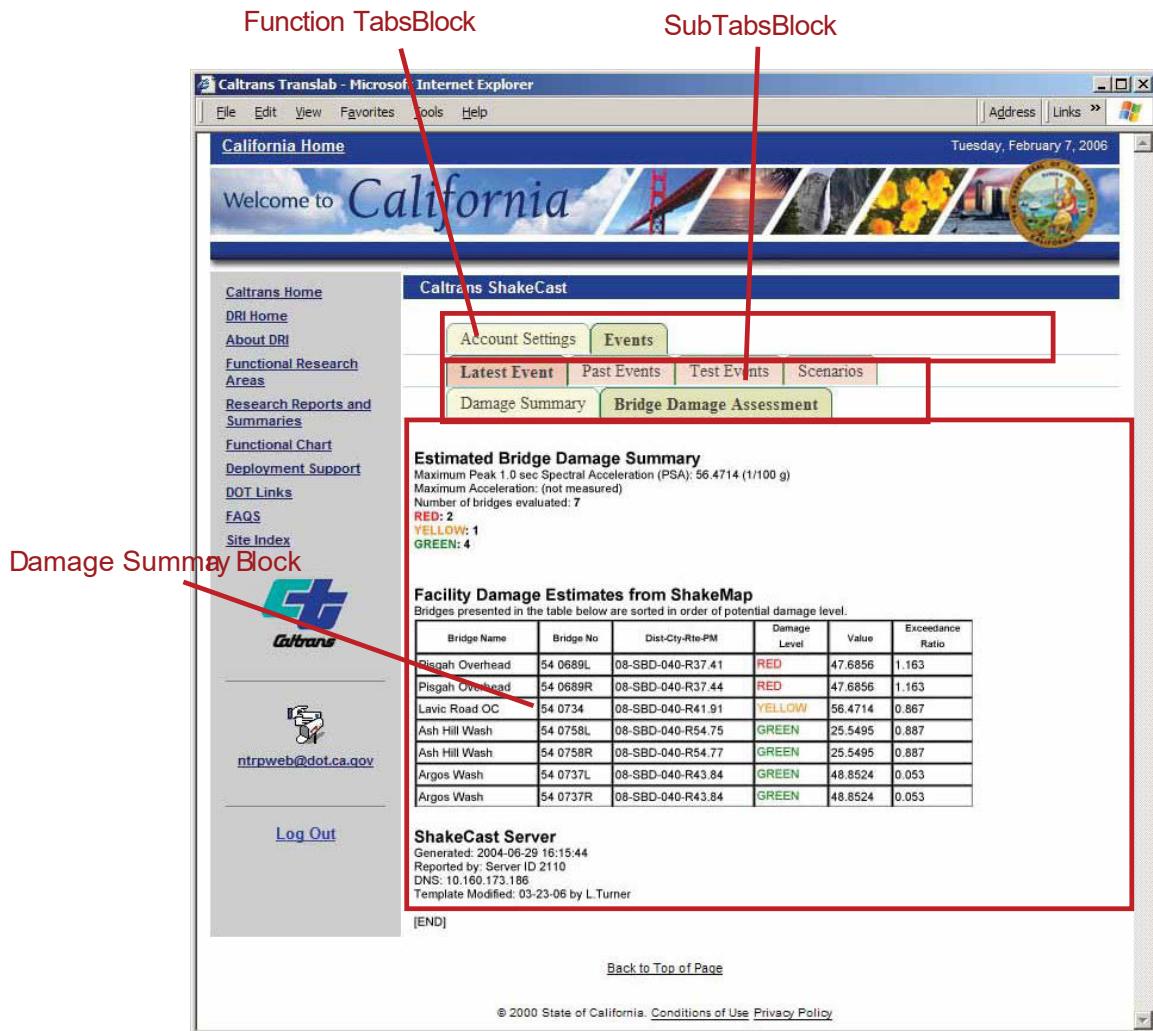
and specific sub-function tabs for Latest Event tab:

- Damage Summary
- Bridge Damage Assessment

2.2.4.2 Bridge Damage Assessment page purpose

This page will contain damage assessment of the entire bridge inventory within affected regions from an earthquake (the area of the ShakeMap for the event). It is a master list compared with the partial-list notification ShakeCast users received based on the settings of their notification profiles. The ShakeCast user will be able to sort the table by clicking on the column header. The content of the page will be dynamic to display new versions of ShakeCast when they become available.

2.2.4.3 Bridge Damage Assessment page content diagram



2.2.5 Past Events page

2.2.5.1 Past Events page links

The user will be able to access the following general function tabs from the Past Events page:

- Account Settings
- Events

and specific sub-function tabs for Events tab:

- Latest Event
- Past Events
- Test Events
- Scenario Events

2.2.5.2 Past Events page purpose

Recent Events page will present the user a table listing events which the user had received notifications. A pull-down menu will exist to allow the user to select the time window of past events.

Each row of the table represents one ShakeCast event and will contain key fields of the event including a link to detailed assessment report, event identification, magnitude, and location. The ShakeCast user will be able to sort the table in alphabetical order by the clicking the column header.

A link will exist for each event to specific Bridge Damage Assessment page.

2.2.5.3 Past Events page content diagram

Function TabsBlock

SubTabsBlock

California Home

Welcome to California

Caltrans Home

DRI Home

About DRI

Functional Research Areas

Research Reports and Summaries

Functional Chart

Deployment Support

DOT Links

FAQS

Site Index

Caltrans ShakeCast

Account Settings

Events

Latest Event

Past Events

Test Events

Scenario Events

Recent Events Sent To Your Account

Show only events larger than magnitude go

Event ID	GMT Time	Event Processed	Magnitude	Latitude/Longitude	Sent to
USlka6	2006-04-12 16:52:00	2006-04-12 17:24:28	5.7	37.655/ 21.073 More Info	3032507017@mmode.com Kuowan.Lin@gmail.com 2 addresses
USlkac	2006-04-12 01:06:59	2006-04-12 01:39:53	6.0	56.263/ 164.153 More Info	3032507017@mmode.com Kuowan.Lin@gmail.com 2 addresses
USlfal	2006-04-07 08:30:45	2006-04-07 09:14:41	6.4	-16.535/ 176.994 More Info	Kuowan.Lin@gmail.com 3032507017@mmode.com 2 addresses
NC51169755	2006-04-07 01:06:54	2006-04-07 01:11:40	4.2	35.729/ -121.096 More Info	9164166031@page.nextel.com 1 address
USldck	2006-04-05 17:43:15	2006-04-06 16:08:12	5.5	-37.352/ 78.320 More Info	Kuowan.Lin@gmail.com 3032507017@mmode.com 2 addresses
USlcad	2006-04-04 02:30:28	2006-04-04 02:46:24	5.9	18.689/ -107.057 More Info	Kuowan.Lin@gmail.com 3032507017@mmode.com 2 addresses

Event Summary Block

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2.2.6 General Account Settings links

2.2.6.1 General Account Settings page links

The user will be able to access the following general function tabs from the General Account Settings page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

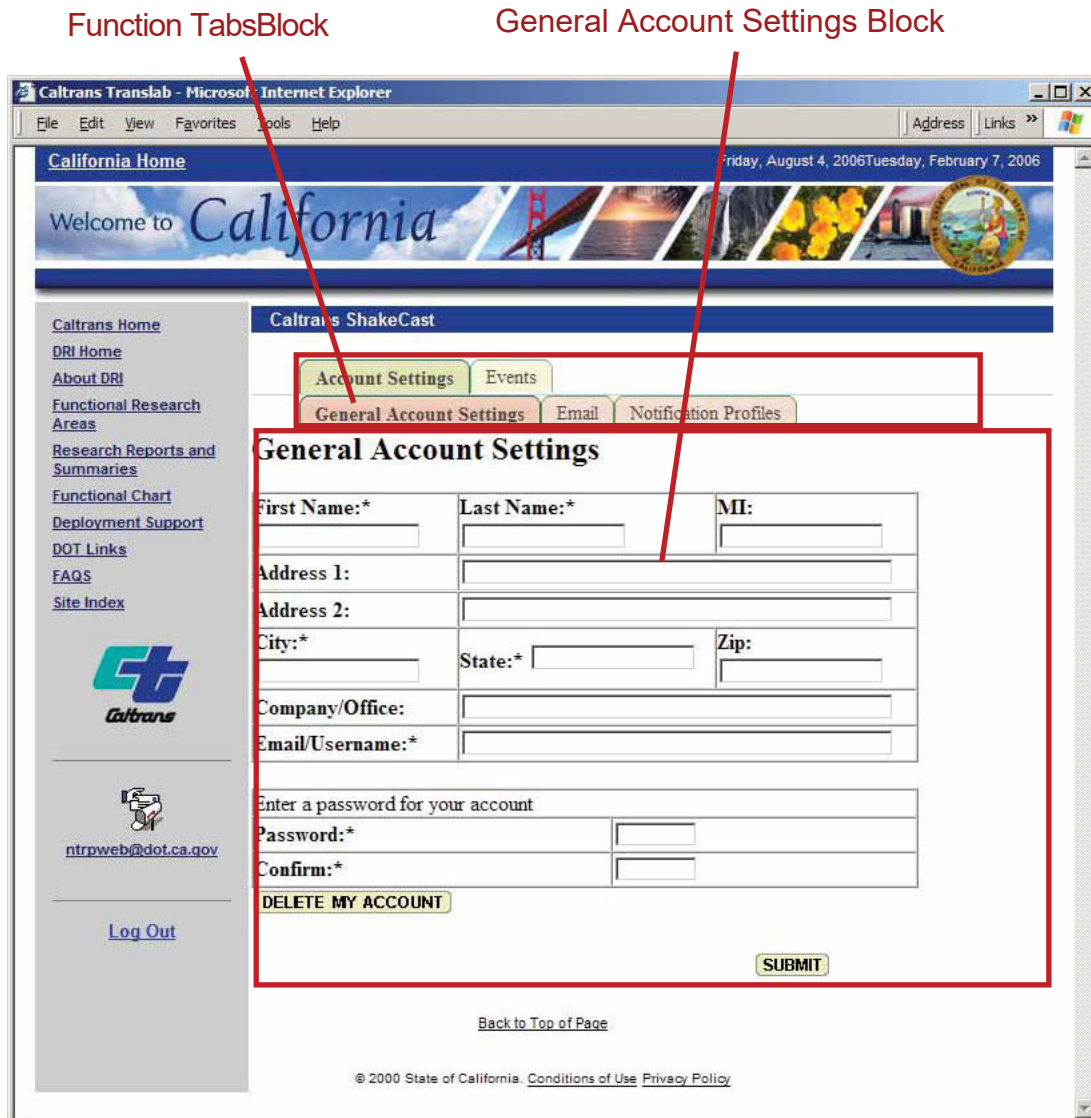
- General Account Settings
- Email
- Notification Profiles

2.2.6.2 General Account Settings page purpose

This page contains the same information as submitted during new user registration. This page will present the same content as the New User Registration page except for the Security Authentication block. The page allows the user to update contact information and to change password.

A link will exist to the Delete My Account action. The page will present the user a warning message that the account will be removed from the ShakeCast system if the delete action is confirmed. If successful, the user will be redirected to the ShakeCast default page (2.2.1).

2.2.6.3 General Account Settings page content diagram



2.2.7 Email page

2.2.7.1 Email page links

The user will be able to access the following general function tabs from the Email page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

- General Account Settings
- Email
- Notification Profiles

2.2.7.2 Email page purpose

This page will summarize email addresses, a summary of their addresses, current state, available actions, and possibly associated profiles. Available actions for an active email

address will be “Edit” and “Delete.” The only available action for a newly submitted email address will be “Validate.”

The Edit button will link the user to a page similar to the Add New Email Address page to allow the user to update an active email address.

The Delete button will present the user a dialog window to confirm the action. If the confirmation is unsuccessful, the user will get feedback that this is the case. After confirmation the Email page will be refreshed with updated information.

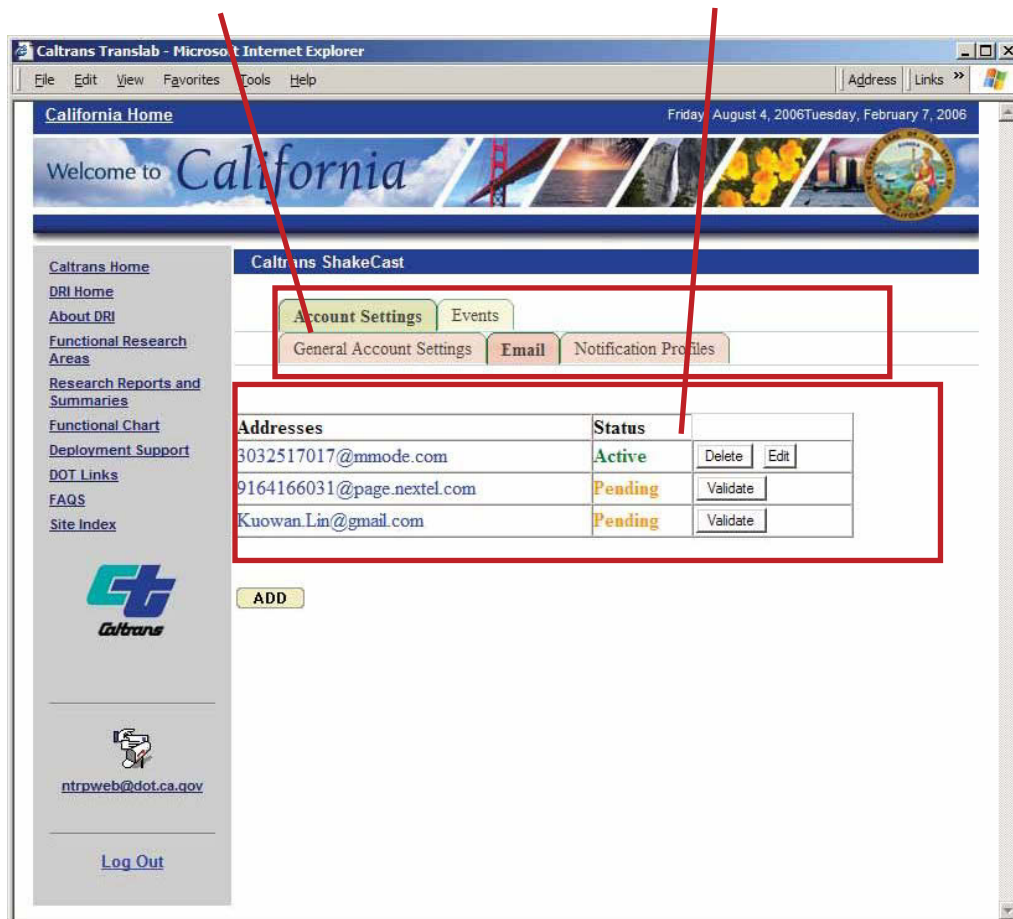
The Validate button will present the user a dialog window to enter the confirmation code for the new email address. If the confirmation is unsuccessful, the user will get feedback that this is the case. After confirmation the Email page will be refreshed.

A link will exist to the Add New Email Address page.

2.2.7.3 Email page content diagram

Function TabsBlock

EmailAddressBlock



2.2.8 New Email Address page

2.2.8.1 New Email Address page links

The user will be able to access the following general function tabs from the New Email Address page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

- General Account Settings
- Email
- Notification Profiles

2.2.8.2 New Email Address page purpose

This page contains a single text field and a submit button for registering a new email address. Upon successful submission, the page will inform the user that a confirmation code has been sent to the registered email address. The user will be able to validate the email address in the Email page using the provided confirmation code.

A possible link will exist to provide lookup of email addresses for mobile devices.

2.2.8.3 New Email Address page content diagram

Function TabsBlock

New EmailAddressBlock

Caltrans Translab - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address Links >>

California Home Friday, August 4, 2006 Tuesday, February 7, 2006

Welcome to California

Caltrans Home

DRI Home

About DRI

Functional Research Areas

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Account Settings Events

General Account Settings Email Notification Profiles

Register a new email address

Enter your email address (one address only)

A **confirmation number** will be sent to the address you entered. Please save this number to enter on the next page. There may be a short delay for pager/cell mail.

NOTE: If you have any sort of spam-blocker, you are responsible for configuring it to allow mail from 'shakecast@dot.ca.gov'. If you do not do this, you will be unable to use this service.

To find your address for messaging to cell phones, see <http://www.lifehacker.com/software/cell-phones/send-sms-from-email-127033.php>

SUBMIT

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2.2.9 Notification Profiles Summary page

2.2.9.1 Notification Profiles Summary page links

The user will be able to access the following general function tabs from the Notification Profiles Summary page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

- General Account Settings
- Email
- Notification Profiles

and specific sub-function tabs for Notification Profiles tab:

- Summary
- Predefined Profile
- Custom Profile

2.2.9.2 Notification Profiles Summary page purpose

The Notification Profiles Summary page will present the user a table listing notification profiles. Each Notification Profile block will display information of name, geographic boundaries, magnitude thresholds, and email addresses associated with the profile. The page will present the user a map outlining geographic boundaries for each profile and possible link to view the map in a separate window.

A link will exist to allow the user to delete the profile. Upon selection, a confirmation dialog window will be present to confirm the deletion of the profile. The user will get feedback of the result of such action, and the Notification Profile Summary page will be reset with updated information.

A link will exist to the Edit Profile page for each profile. Upon selection, the link will bring the user to either Predefine Profile or Custom Profile page with appropriate field filled based on user selection.

2.2.9.3 Notification Profiles Summary page content diagram

Function TabsBlock

SubTabsBlock

Notification Profile Block

California Home

Welcome to California

Friday, August 4, 2006 Tuesday, February 7, 2006

Caltrans Home

Caltrans ShakeCast

Account Settings Events

General Account Settings Email Notification Profiles

Summary Predefined Profile Custom Profile

ShakeCast Notification Profiles Associated with Lin's Account

California (Predefined region: California)

Geographic Bounds: polygon

Day Mag: 3.5

Night Mag: 4.5

Address 1: 9164166031@page.nextel.com (short)

08:00-22:00

DELETE PROFILE EDIT PROFILE

View with Google maps

CA cities (Predefined region: California cities)

Geographic Bounds: circle

Center at 34.055,-118.246 (California cities)

Radius: 80.0

Day Mag: 4.5

Night Mag: 5

2.2.10 Predefined Profile page

2.2.10.1 Predefined Profile page links

The user will be able to access the following general function tabs from the Predefined Profile page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

- General Account Settings
- Email
- Notification Profiles

and specific sub-function tabs for Notification Profiles tab:

- Summary
- Predefined Profile
- Custom Profile

2.2.10.2 Predefined Profile page purpose

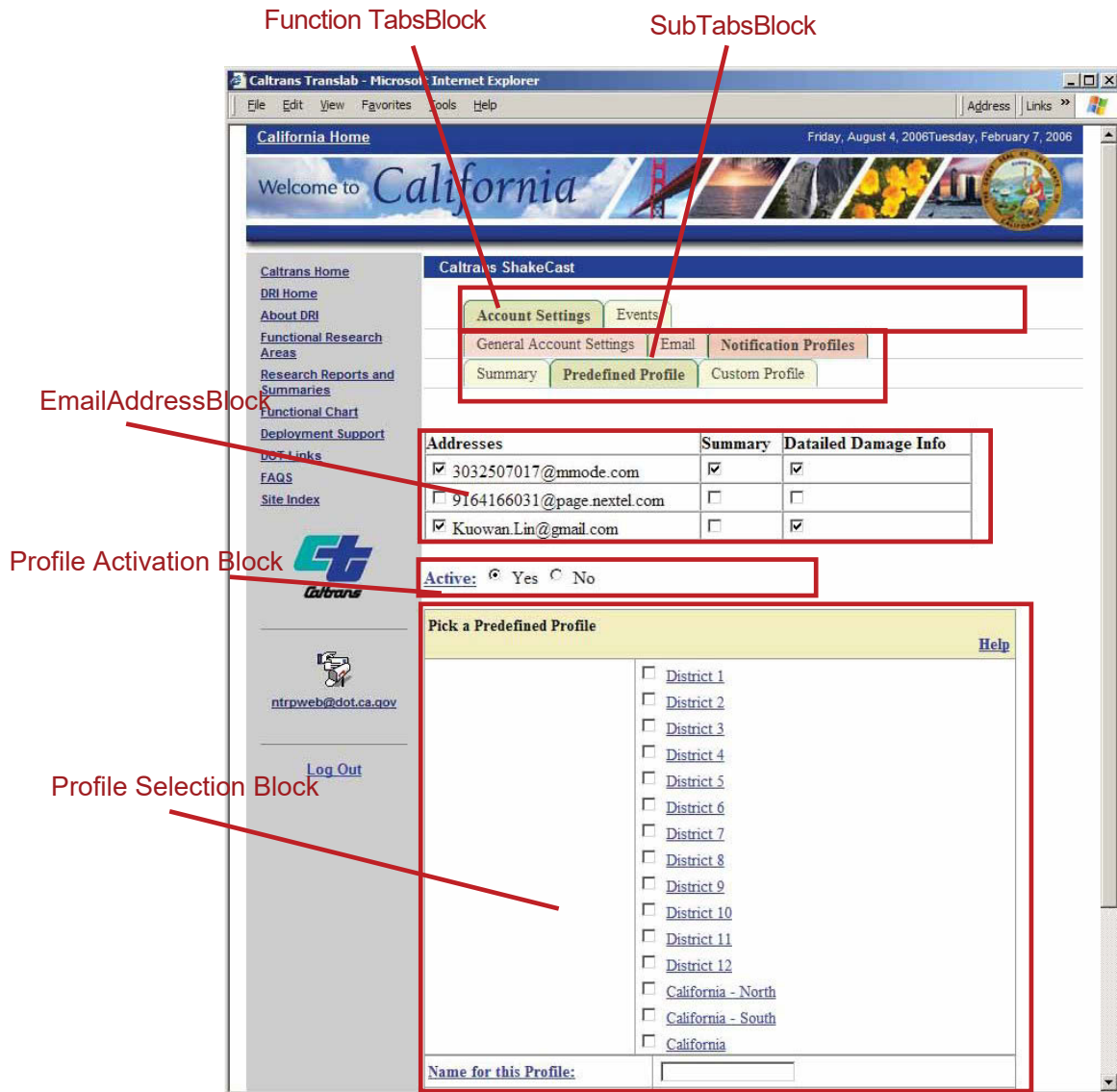
This page will allow the user to create a new profile and will present the user a fill-in form with Email Address, Activation, and Profile Selection blocks, and a submit button.

The Email Address block will contain a table listing active email addresses. The block will allow the user to select email addresses and message formats to be associated with the notification profile.

The Activation block will present the user a radio button to allow the user to switch on/off the notification service once the profile is created.

The Profile Selection block will contain a list of selectable predefined geographic boundaries, text boxes for naming the profile and setting magnitude thresholds, and a selection button for receiving test events. The list of predefined geographic boundaries will cover the Caltrans district boundaries and also the entire State.

2.2.10.3 Predefined Profile page content diagram



2.2.11 Custom Profile page

2.2.11.1 Custom Profile page links

The user will be able to access the following general function tabs from the Custom Profile page:

- Account Settings
- Events

and specific sub-function tabs for Account Settings tab:

- General Account Settings
- Email
- Notification Profiles

and specific sub-function tabs for Notification Profiles tab:

- Summary
- Predefined Profile

- Custom Profile

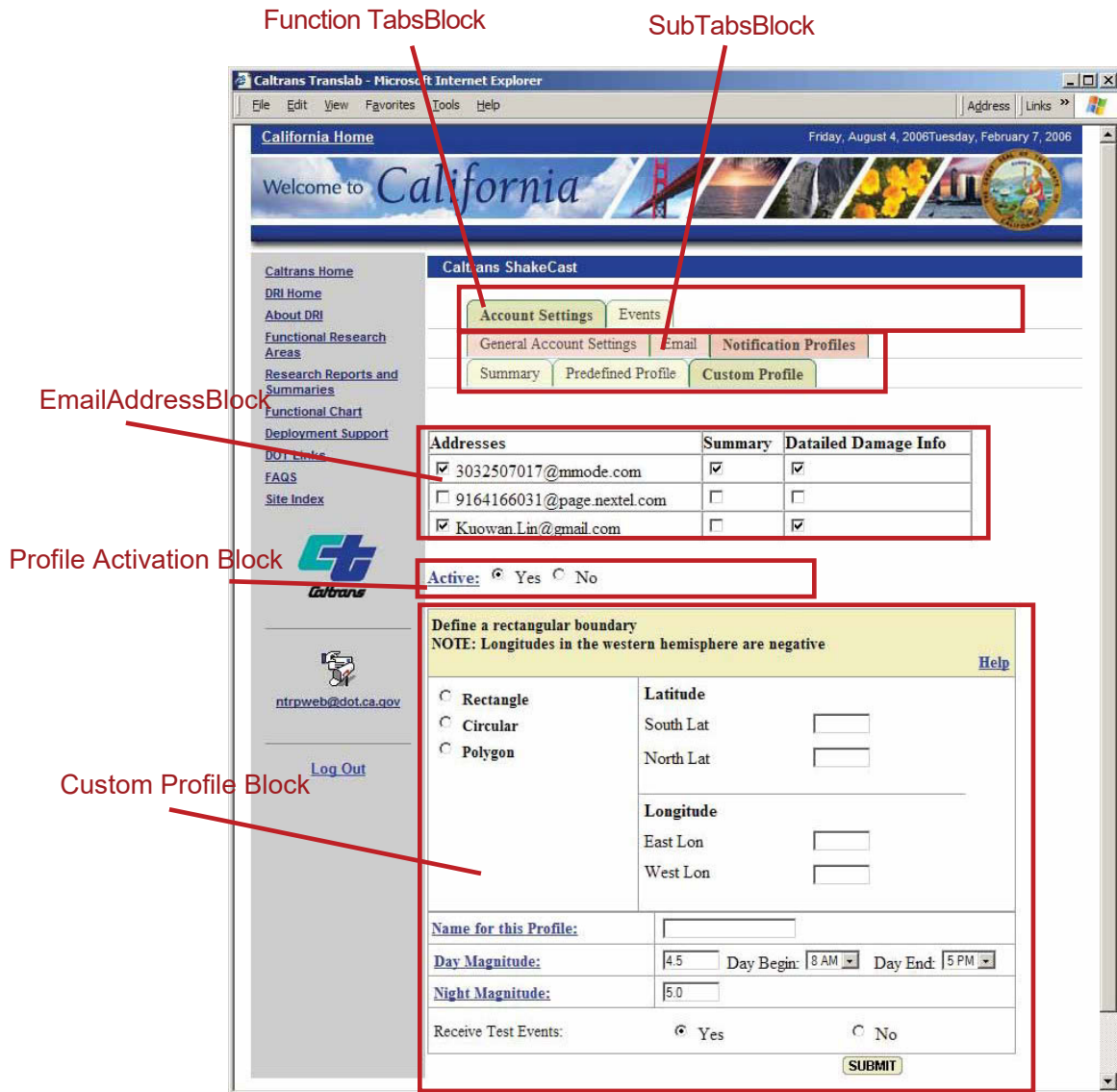
2.2.11.2 Custom Profile page purpose

Like the Predefined Profile page, Custom Profile page will allow the user to create a new profile and will present the user a fill-in form with Email Address, Activation, and Profile Definition blocks, and a submit button.

The Email Address block and the Activation block will function the same as in the Predefined Page.

The Profile Definition block will contain a toolbox section for defining geographic boundaries, text boxes for naming the profile and setting magnitude thresholds, and a selection button for receiving test events. The toolbox section will allow the user to define rectangular, circular, and polygon boundaries. The page will refresh its content based on user selection of boundary toolbox. The Rectangular boundary toolbox will contain text boxes for entering two corner points of a region. The Circular boundary toolbox will contain text boxes for entering the location and radius of a circular region. The Polygon boundary toolbox will allow the user to import an external file containing latitude and longitude information. A link will present for each boundary toolbox to the GIS based mapping service such as Google Maps to allow the user to define the boundaries interactively.

2.2.11.3 Custom Profile page content diagram



3. Administration Web Interface

3.1 Flowchart diagram

This section describes user interactions for the ShakeCast administration web interface, which include the following four major tasks:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

The flowchart of the overall administrator interactions with the ShakeCast web interface, highlighting the major tasks, is shown in Figure 3.1.

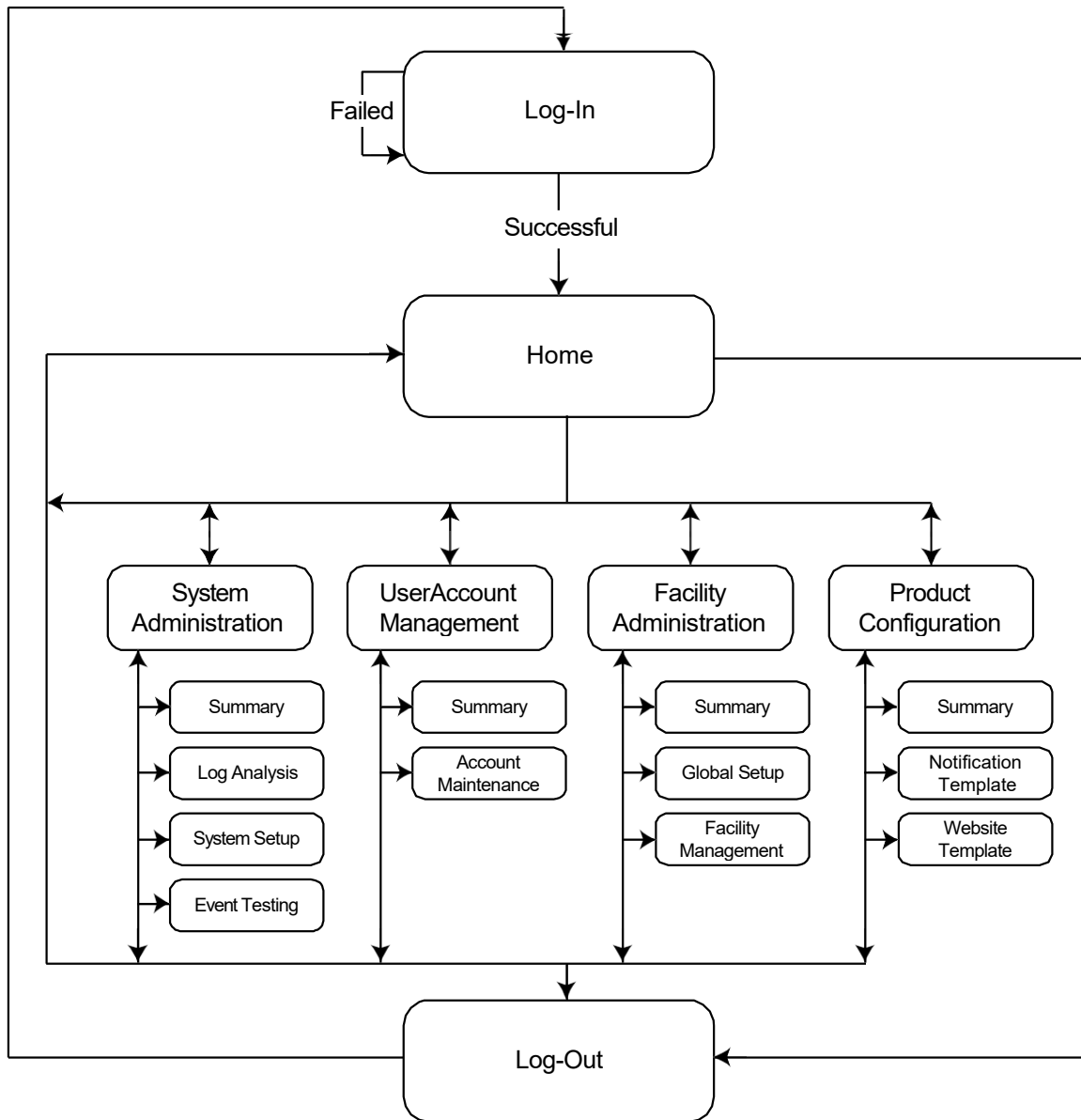


Figure 3.1 Flowchart diagram of the Caltrans ShakeCast administrator portal solution.

3.2 Portal wire frame

The following wire frame section describes the main elements of the web portal for Caltrans ShakeCast administrators. The purpose of an administrative account is to manage ShakeCast services and user accounts. The account can only be created manually and there can be more than one administrator account. The portal is extensible and additional elements may be added at a later date. It is assumed that the pages and tabs defined here will form a core, mandatory set of functionality for an initial release. All sections of the portal will be intuitive and will conform to Caltrans webpage standards.

3.2.1 Welcome page

The Welcome page of 2.2.1 will also be the initial page of ShakeCast administrator web interface. The only exception is that a user can not sign up for a new account as an administrator.

3.2.2 ShakeCast Administrator Home page

3.2.2.1 ShakeCast Administrator Home page links

The user will be able to access the following general function tabs from the ShakeCast Administrator Home page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

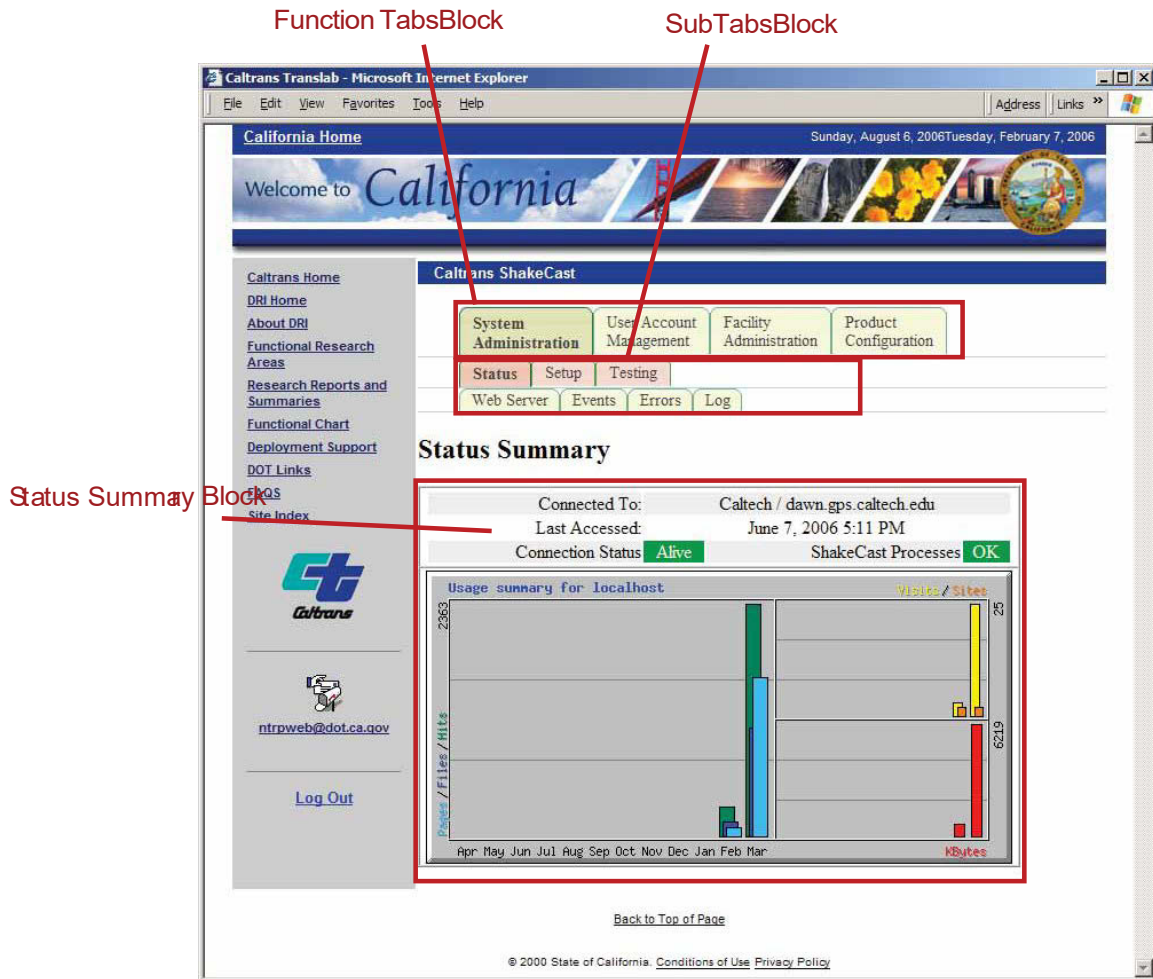
3.2.2.2 ShakeCast Administrator Home page purpose

Once successfully logged in, the ShakeCast Administrator Home Page will be the initial page for ShakeCast administrators and it will contain a Status Summary block.

The Status Summary block will present the administrator with a summary of server activities including server identification, event processing, network connectivity, and access statistics for the Caltrans ShakeCast server.

Current condition of the ShakeCast server regarding network connectivity and processes will be displayed with one of the three color denotations, Green/Yellow/Red. The Green status indicates a normal process with no reported errors. The Yellow status indicates that the monitored process had just experienced errors and an attempt to re-launch the process is underway. The Red status indicates that the process had been declared as non-functioning after failed recovery attempts (criteria to be defined).

3.2.2.3 ShakeCast Administrator Home page content diagram



3.2.3 Web Server Usage Summary and Statistics page

3.2.3.1 Web Server Usage Summary and Statistics page links

The user will be able to access the following general function tabs from the Web Server Usage Summary and Statistics page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

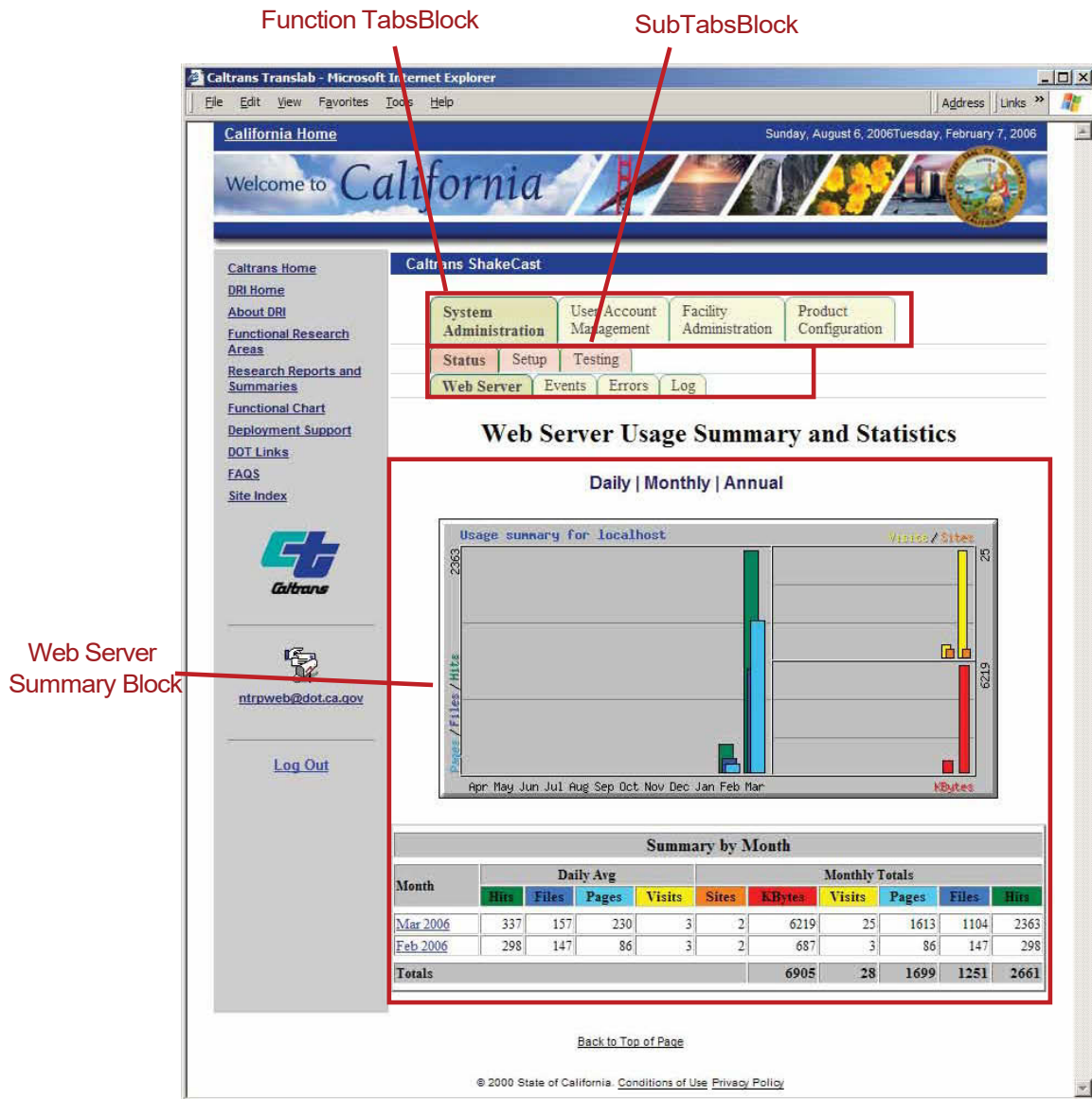
- Status
- Setup
- Testing

3.2.3.2 Web Server Usage Summary and Statistics page purpose

This page will be the interface page to the ShakeCast Web server access log, usually an Apache web server log. It will present the ShakeCast administrator a summary of Web

portal access and will provide links to the break-outs of analysis. This page will utilize popular open-sourced web log analyzing tools to generate statistics of the access log.

3.2.3.3 Web Server Usage Summary and Statistics page content diagram



3.2.4 ShakeCast Event Summary and Statistics page

3.2.4.1 ShakeCast Event Summary and Statistics page links

The user will be able to access the following general function tabs from the ShakeCast Event Summary and Statistics page:

- System Administration
- User Account Management
- Facility Management

- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.4.2 ShakeCast Event Summary and Statistics page purpose

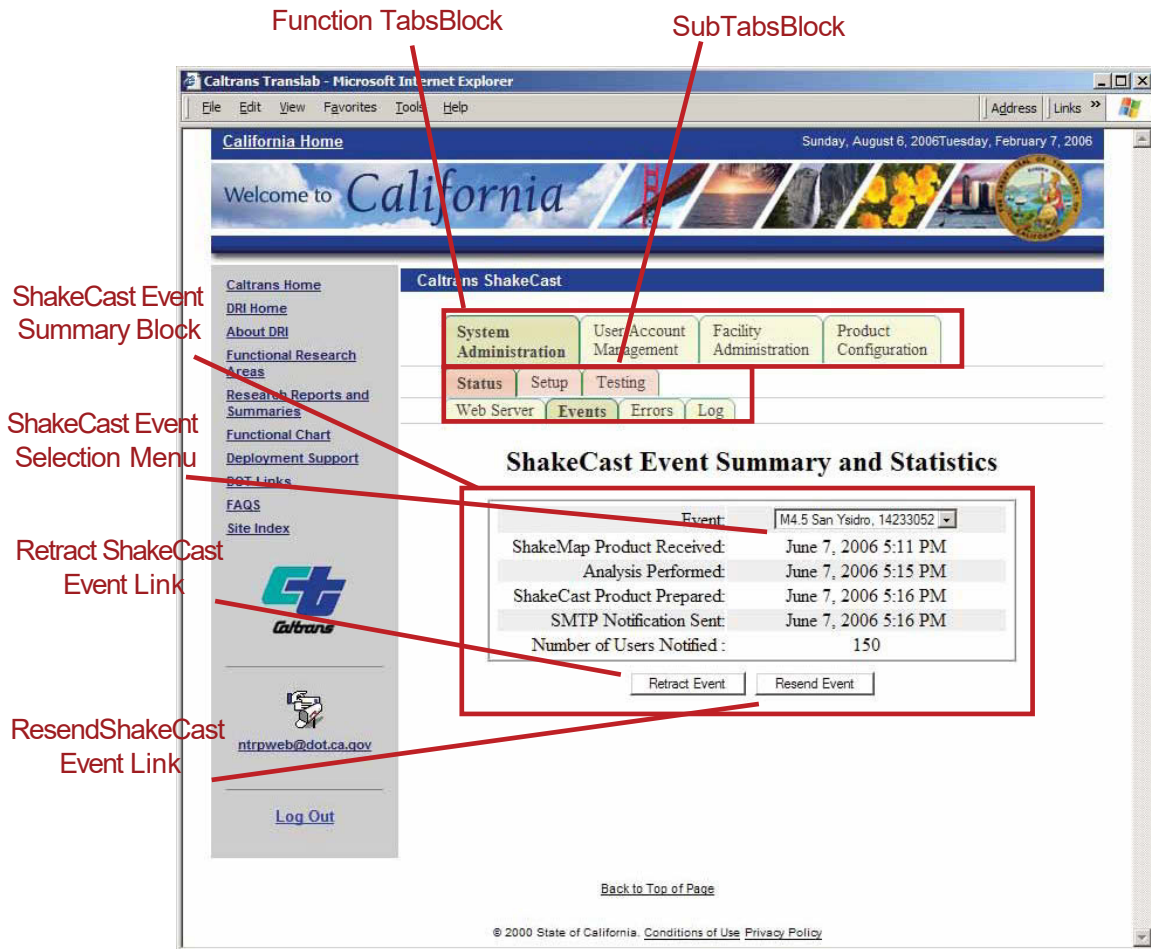
This page will summarize recent ShakeCast events processed by the Caltrans ShakeCast server. A summary of the results of a ShakeCast process will include information regarding earthquake identification, time of received ShakeMap products, and time of ShakeCast analyses and notifications.

A pull-down menu will exist to select a recently processed ShakeCast event.

A link will exist to resending ShakeCast notification for a recently processed earthquake. The administrator will receive a warning in a separate window to confirm the action and will receive feedback after the notification is sent.

A link will exist to retracting a ShakeCast notification. This link will allow the administrator to enter a message for the retracting notification. It will provide feedback after the notification is sent to ShakeCast users.

3.2.4.3 ShakeCast Event Summary and Statistics page content diagram



3.2.5 Web/ShakeCast Server Error page

3.2.5.1 Web/ShakeCast Server Error page links

The user will be able to access the following general function tabs from the Web/ShakeCast Server Error page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.5.2 Web/ShakeCast Server Error page purpose

This page will be the interface page to the error logs of both Web and ShakeCast servers. It will present the ShakeCast administrator a summary of reported errors associated with either the Web portal server or the ShakeCast server. The page will utilize popular open-sourced web log analyzing tools to generate statistics of error logs.

A link will exist to the Web Server Error page.

A link will exist to the ShakeCast Server Error page.

3.2.5.3 Web Server Error page content diagram

Function TabsBlock

SubTabsBlock

Web Server Error Log Block

#	Hits	KBytes	URL
1	226	313	/_mmServerScripts/MMHTIPDB.php
2	43	820	/phpmyadmin/css/phpmyadmin.css.php
3	30	499	/
4	27	185	/ens/mailparams.php
5	26	103	/Untitled-1.php
6	19	130	/Untitled-6.php
7	19	3	/ens/icol.css
8	17	103	/Untitled-4.php
9	17	11	/xampp/
10	17	18	/xampp/head.php
11	17	77	/xampp/navi.php
12	17	22	/xampp/start.php
13	16	16	/ens/admin/systemstatus.php
14	16	6	/xampp/Untitled-24.php
15	15	194	/ens/
16	13	23	/phpmyadmin/left.php
17	12	33	/ens/admin/adminuser.php
18	12	156	/ens/passwd.php
19	11	14	/Templates/bgtemplate.dwt.php
20	10	19	/phpmyadmin/
21	10	9	/webalizer/webalizer.php
22	9	27	/css/base.css

3.2.5.4 ShakeCast Server Error page content diagram

Function TabsBlock

SubTabsBlock

ShakeCastServer Error Log Block

Date/Time	Server	User/Process	Message
Thu Jul 27 09:09:08 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_event.pl": Password Mismatch
Thu Jul 27 09:09:08 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_shakemap.pl": Password Mismatch
Thu Jul 27 09:09:11 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:14 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:15 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:16 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:17 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:18 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:19 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 09:09:20 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch
Thu Jul 27 12:39:24 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_shakemap.pl": Password Mismatch
Thu Jul 27 12:39:24 2006	127.0.0.1	user 1301:	authentication failure for "/scripts/s/new_product.pl": Password Mismatch

3.2.6 ShakeCast Server Log page

3.2.6.1 ShakeCast Server Log page links

The user will be able to access the following general function tabs from the ShakeCast Server Log page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

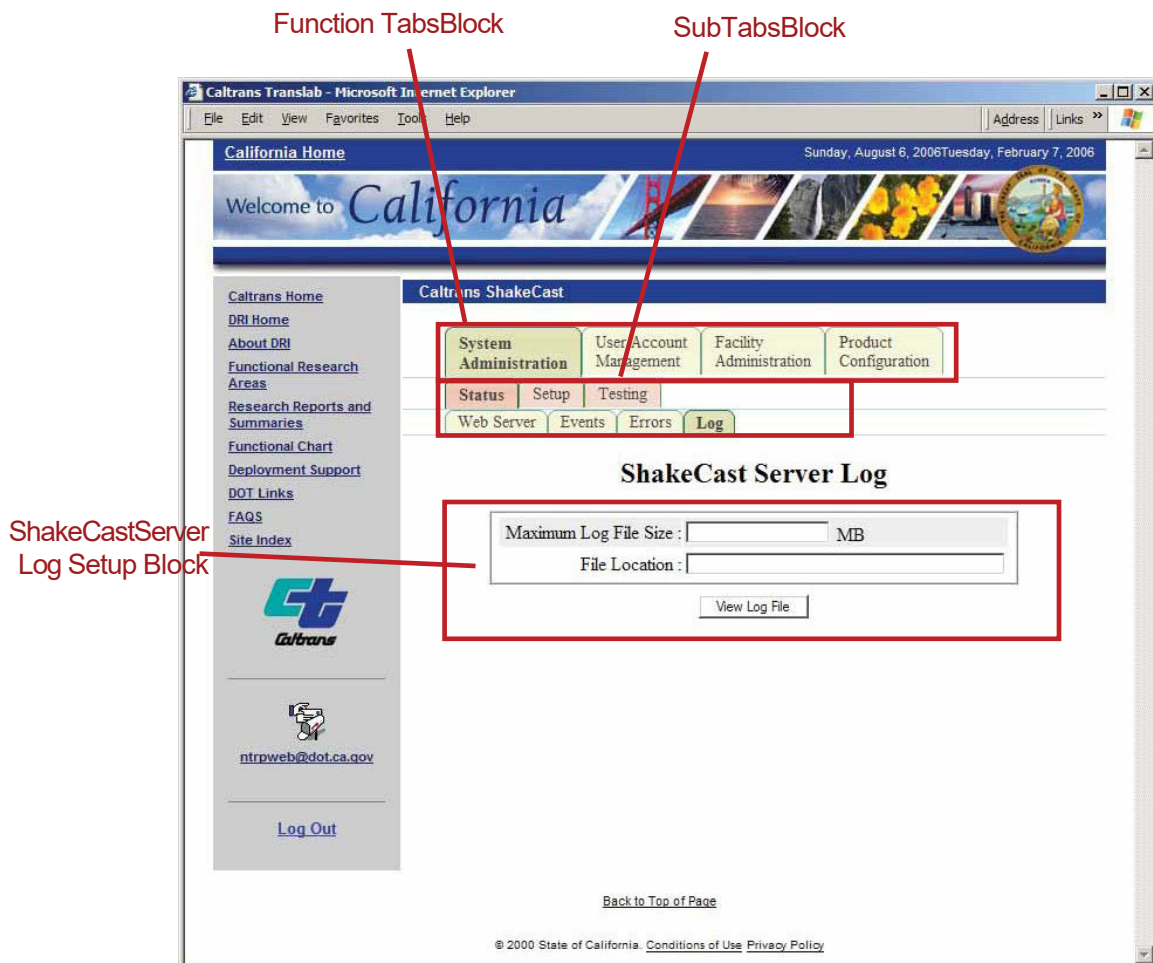
- Status
- Setup
- Testing

3.2.6.2 ShakeCast Server Log page purpose

This page will be the management page for the process log file of the Caltrans ShakeCast server. This page will present the administrator the current location and the maximum file size of the ShakeCast process log. It will also allow the ShakeCast administrator to specify the maximum file size and the location of the ShakeCast process log.

A link will exist to viewing the ShakeCast process log.

3.2.6.3 ShakeCast Server Log page content diagram



3.2.7 Server Setup Summary page

3.2.7.1 Server Setup Summary page links

The user will be able to access the following general function tabs from the Server Setup Summary page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.7.2 Server Setup Summary page purpose

This page will provide the administrator a summary table listing all servers associated with the Caltrans ShakeCast service. The ShakeCast related server setup includes ShakeCast, Upstream, SMTP, and Database connection servers.

A warning message will present if any server setup has been changed and restart of server is needed.

3.2.7.3 Server Setup Summary page content diagram

The screenshot shows the Caltrans ShakeCast web interface. Annotations include:

- Function TabsBlock**: Points to the 'System Administration' tab.
- SubTabsBlock**: Points to the 'Setup' sub-tab.
- ShakeCastServer Summary Block**: Points to the 'ShakeCast Server' entry in the table.

Server Setup Summary

Server Name	DNS Name	ShakeCast ID	IP Address
ShakeCast Server	shakecast.dot.ca.gov	1301	192.168.0.254
Upstream Server	dawn.gps.caltech.edu	1	131.215.66.41
SMTP Server	smtp.dot.ca.gov		192.168.0.1
Database Server	shakecast.dot.ca.gov		192.168.0.100

3.2.8 ShakeCast Server Setup page

3.2.8.1 ShakeCast Server Setup page links

The user will be able to access the following general function tabs from the ShakeCast Server Setup page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

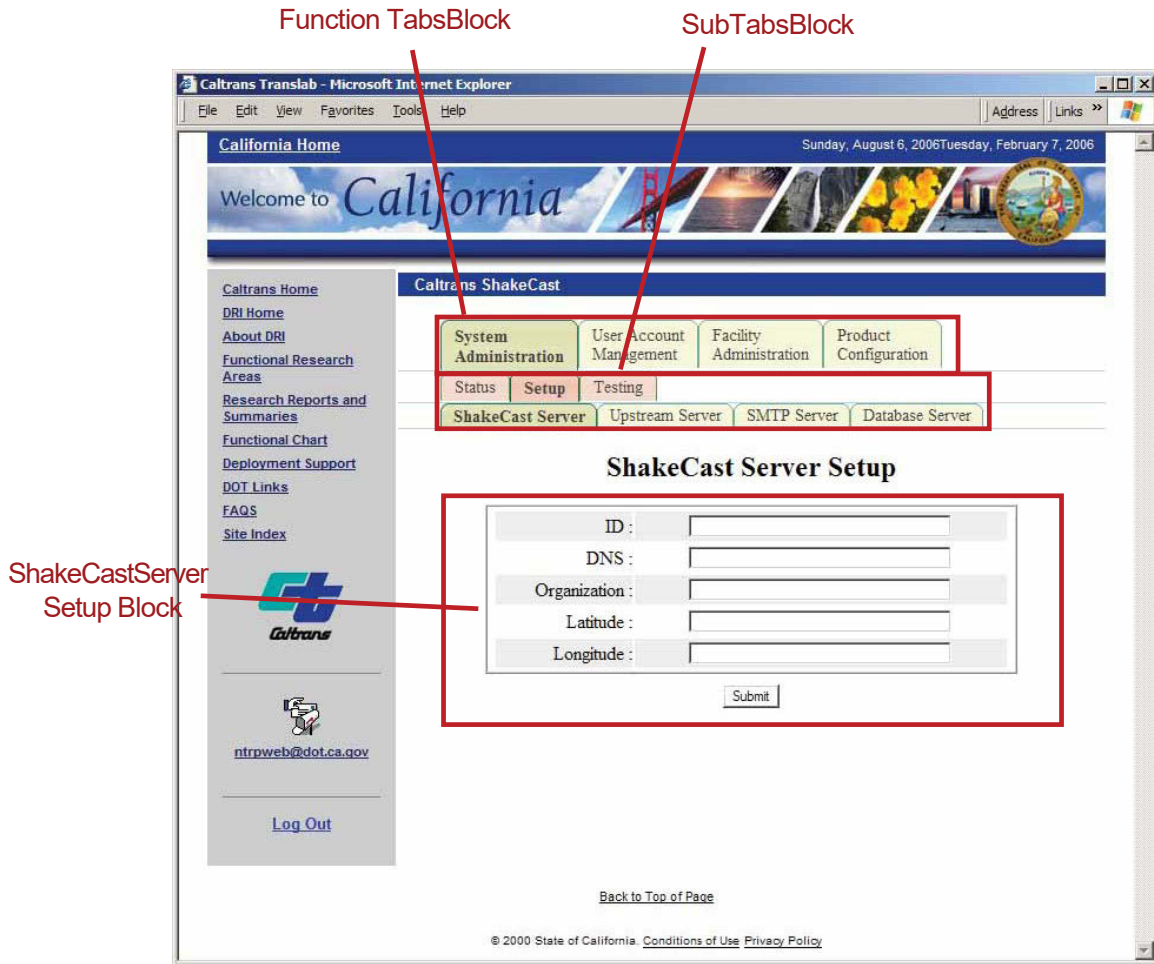
- Status
- Setup
- Testing

3.2.8.2 ShakeCast Server Setup page purpose

This page is the interface page of Caltrans ShakeCast server configuration. It will present the administrator a table listing the current setup of server in editable text fields (server identification, DNS, organization, and location in latitude and longitude) and a submit button.

If the update of a ShakeCast server setup is unsuccessful, the administrator will receive feedback that this is the case, and the ShakeCast Server Setup page will be reset. If the update is successful, the Server Setup Summary page will be present with updated information.

3.2.8.3 ShakeCast Server Setup page content diagram



3.2.9 ShakeCast Upstream Servers page

3.2.9.1 ShakeCast Upstream Servers page links

The user will be able to access the following general function tabs from the ShakeCast Upstream Servers page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.9.2 ShakeCast Upstream Servers page purpose

This page is the interface page of Caltrans ShakeCast Upstream Servers configuration. It will present the administrator a table listing current setup of the upstream servers in editable text fields (one server per row) and a submit button.

If the update of ShakeCast upstream servers is unsuccessful, the administrator will get feedback that this is the case, and the ShakeCast Server Setup page will be reset. If the update is successful, the Servers Setup Summary page will be present with updated information.

3.2.9.3 ShakeCast Upstream Servers page content diagram

The screenshot shows the Caltrans ShakeCast interface in a Microsoft Internet Explorer browser window. The page title is "California Home" and the date is "Sunday, August 6, 2006". The main content area is titled "Caltrans ShakeCast" and contains several function tabs: "System Administration", "User Account Management", "Facility Administration", and "Product Configuration". Below these are sub-tabs: "Status", "Setup", and "Testing". The "Setup" sub-tab is selected, showing a table of "ShakeCast Upstream Servers". The table has columns for "ID", "DNS", and "Organization". The first two rows are populated with data: ID 1301, DNS dawn.gps.caltech.edu, Organization USGS/Caltech ShakeCast Server; and ID 1302, DNS shakecast.dwr.ca.gov, Organization DWR Peer. A "Submit" button is at the bottom of the table. A red box labeled "ShakeCastUpstream Server Setup Block" points to the table. Another red box labeled "Function TabsBlock" points to the top row of function tabs. A third red box labeled "SubTabsBlock" points to the "Setup" sub-tab.

Function TabsBlock

SubTabsBlock

ShakeCastUpstream Server Setup Block

ID	DNS	Organization
1301	dawn.gps.caltech.edu	USGS/Caltech ShakeCast Server
1302	shakecast.dwr.ca.gov	DWR Peer

Submit

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3.2.10 SMTP Server Settings page

3.2.10.1 SMTP Server Settings page links

The user will be able to access the following general function tabs from the SMTP Server Settings page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status

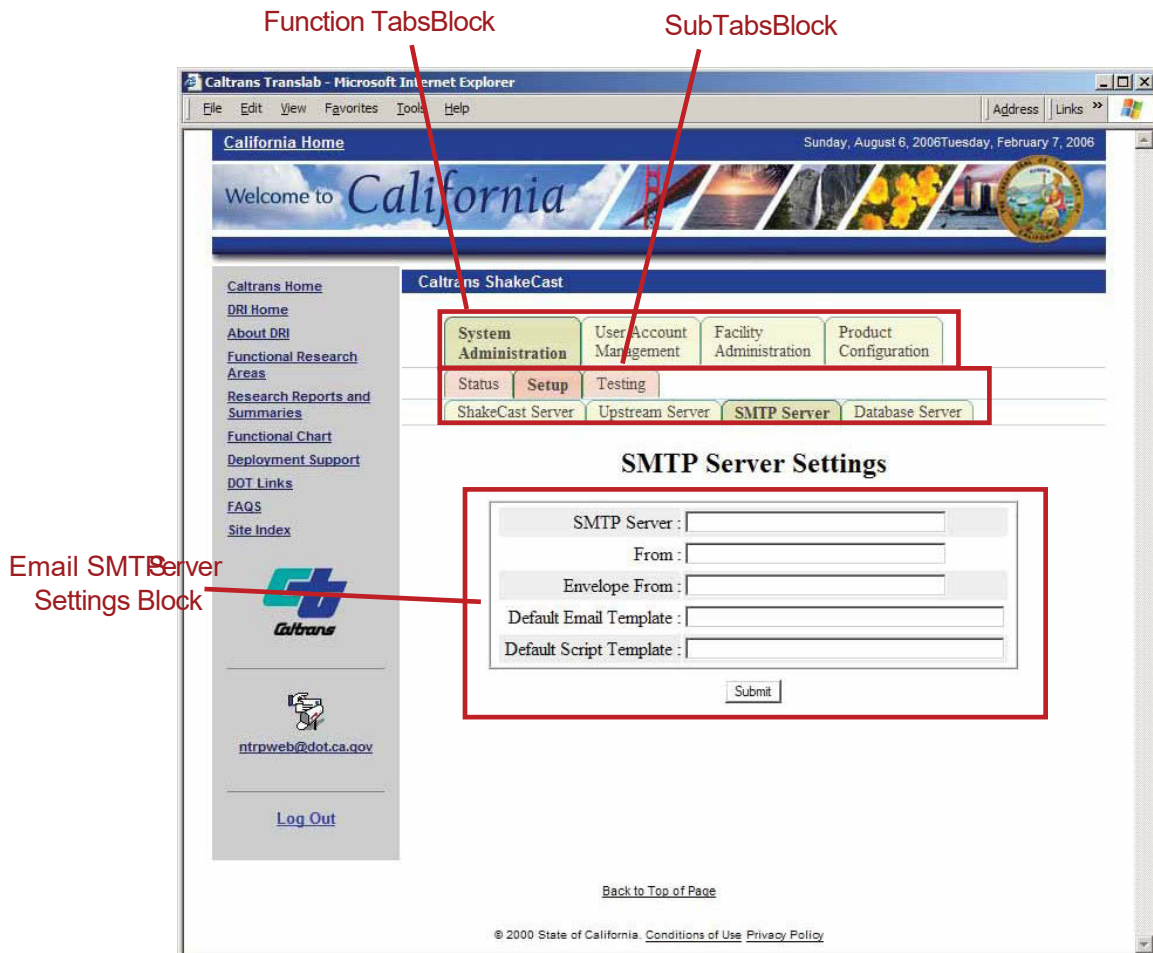
- Setup
- Testing

3.2.10.2 SMTP Server Settings page purpose

This page is the interface page of Caltrans ShakeCast SMTP Server configuration. It will present the administrator a table listing current setup of the SMTP server in editable text fields and a submit button.

If the update of the ShakeCast SMTP server setup is unsuccessful, the administrator will receive feedback that this is the case, and the SMTP Server page will be reset. If the update is successful, the Server Setup Summary page will be present with updated information.

3.2.10.3 SMTP Server Settings page content diagram



3.2.11 Database Server Connection Settings page

3.2.11.1 Database Server Connection Settings page links

The user will be able to access the following general function tabs from the Database Server Connection Settings page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

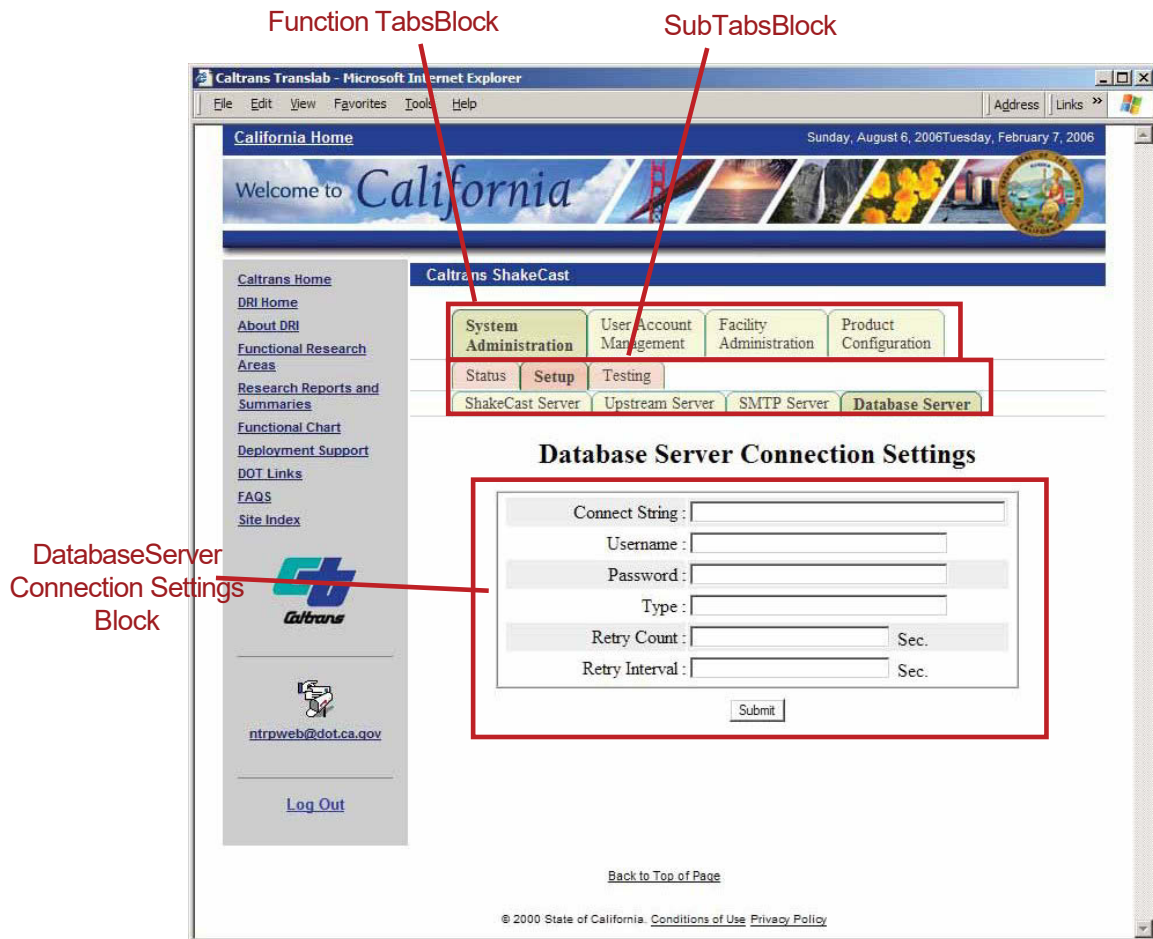
- Status
- Setup
- Testing

3.2.11.2 Database Server Connection Settings page purpose

This page is the interface page of Caltrans ShakeCast Database Server Connection configuration. It will present the administrator a table listing current settings of the database server connection in editable text fields and a submit button.

If update of settings for the ShakeCast database server connection is unsuccessful, the administrator will get feedback that this is the case, and Database Server Connection Settings page will be reset. If the update is successful, the Server Setup Summary page will be present with updated information.

3.2.11.3 Database Server Connection Settings page content diagram



3.2.12 Event Testing Summary page

3.2.12.1 Event Testing Summary page links

The user will be able to access the following general function tabs from the Event Testing Summary page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.12.2 Event Testing Summary page purpose

This page is the initial page of the Event Testing function for Caltrans ShakeCast system and it will present the administrator a summary table listing at least five of the recently run test events by with the Caltrans ShakeCast server. Each row of the table represents

one recently run test event and will include information regarding event identification, location, magnitude, and the time of test run.

3.2.12.3 Event Testing Summary page content diagram

Function TabsBlock

SubTabsBlock

Event Testing Summary Block

Event Testing Summary

Recently Run Tests						
ID	Date	Latitude	Longitude	Location	Mag	Run Date
Chino_Hills_scte	May 30 2005 12:00:00 GMT	33.9	-117.6	Chino Hills Fault Scenario	6.7	May 30 2006 12:00:00 GMT
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	June 30 2006 12:00:00 GMT
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	June 21 2006 12:00:00 GMT

3.2.13 Trigger Test Events page

3.2.13.1 Trigger Test Events page links

The user will be able to access the following general function tabs from the Trigger Test Events page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.13.2 Trigger Test Events page purpose

This page will provide the Caltrans ShakeCast administrator a table listing available test events. Each row of the test event table consists of a test event and will include event identification and source parameters, a link to the triggering new test event, and a link to the triggering test event update.

The administrator will receive feedback after the test event has been triggered and will be redirected back the Event Testing Summary page with update information.

3.2.13.3 Trigger Test Events page content diagram

The screenshot shows the Caltrans ShakeCast web application in Microsoft Internet Explorer. The page has a header with 'California Home' and a date 'Sunday, August 6, 2006'. A sidebar on the left contains links like 'Caltrans Home', 'DRI Home', and 'Log Out'. The main content area is titled 'Caltrans ShakeCast' and features a 'Function TabsBlock' with tabs for 'System Administration', 'User Account Management', 'Facility Administration', and 'Product Configuration'. Below these is a 'SubTabsBlock' with 'Status', 'Setup', 'Testing', and 'Manage' tabs. The 'Testing' tab is active, showing the 'Trigger Test Event' section. This section contains a 'Trigger Test Event Block' which is a table titled 'Recently Run Tests'. The table has columns for ID, Date, Latitude, Longitude, Location, Mag, Version 1, and Version N+1. Red arrows point from labels to specific elements: 'Function TabsBlock' to the top tabs, 'SubTabsBlock' to the sub-tabs, 'Trigger Test Event Block' to the table, 'Trigger New Test Event Link' to the 'Run' button in the first row, and 'Trigger Test Event Update Link' to the 'Run' button in the last row.

Function TabsBlock

SubTabsBlock

Trigger Test Event Block

Trigger New Test Event Link

Trigger Test Event Update Link

ID	Date	Latitude	Longitude	Location	Mag	Version 1	Version N+1
Chino Hills_scte	May 30 2005 12:00:00 GMT	33.9	-117.6	Chino Hills Fault Scenario	6.7	Run	Run
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	Run	Run
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	Run	Run
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	Run	Run
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	Run	Run

3.2.14 Manage Events page

3.2.14.1 Manage Events page links

The user will be able to access the following general function tabs from the Manage Events page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for System Administration tab:

- Status
- Setup
- Testing

3.2.14.2 Manage Events page purpose

This page will be the interface page of Caltrans ShakeCast test event management. It will present the administrator actual event table and scenario event table blocks and a submit button.

The requirement is that the administrator will be able to navigate through rows of actual events processed by the ShakeCast server to add/remove events from the test event inventory. For scenario events, the table will present the administrator a list of available scenario events located on the upstream ShakeCast server.

The administrator will receive feedback on the result after submitting the event update and the Manage Events page will be refreshed.

3.2.14.3 Manage Events page content diagram

Function TabsBlock

SubTabsBlock

Event Management Block for Actual Events

Event Management Block for Scenario Events

Add/ Remove Actual Events as Test Events

Add/Remove Scenario Events as Test Events

Caltrans ShakeCast

System Administration User Account Management Facility Administration Product Configuration

Status Setup Testing

Trigger Manage

Manage Events

Actual Events

ID	Date	Latitude	Longitude	Location	Mag	Test Event
Chino_Hills_scte	May 30 2005 12:00:00 GMT	33.9	-117.6	Chino Hills Fault Scenario	6.7	<input type="checkbox"/>
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	<input checked="" type="checkbox"/>
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	<input type="checkbox"/>
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	<input type="checkbox"/>
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	<input type="checkbox"/>

Scenario Events

ID	Date	Latitude	Longitude	Location	Mag	Test Event
Chino_Hills_scte	May 30 2005 12:00:00 GMT	33.9	-117.6	Chino Hills Fault Scenario	6.7	<input checked="" type="checkbox"/>
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	<input type="checkbox"/>
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	<input type="checkbox"/>
Hayward_scte	Mar 06 2003 12:00:00 PST	37.644	-121.644	Hayward Fault Scenario	6.9	<input type="checkbox"/>
14151344_scte	Jun 12 2005 15:41:46 GMT	33.53	-116.57	6 mi. ESE of Anaa, CA	5.2	<input type="checkbox"/>

Submit

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3.2.15 User Account Management page

3.2.15.1 User Account Management page links

The user will be able to access the following general function tabs from the User Account Management page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

3.2.15.2 User Account Management page purpose

This page is the primary page of Caltrans ShakeCast user account management and it will present the ShakeCast administrator Pending Users table and Approved Users table blocks and action button links.

Each row of either table will consist of one user account and will include primary user identification, user type, and current status. A link will exist to the General Account Settings (2.2.6) for detailed information. A checkbox will exist to allow the administrator to perform one of the three user management tasks, Delete, Approve, or Suspend.

For Pending Users table block, a link will exist to the user deletion action and a link will exist to the user approval action. For Approved Users table block, a link will exist to the user deletion action and a link will exist to the user suspension action.

The administrator will receive feedback on the result of user management action and the User Account Management page will be reset.

3.2.15.3 User Account Management page content diagram

Function TabsBlock

UserAccount Management Block for Pending Users

Username/Email	Name	Phone	Organization	Type	Current Status
loren1@dot.ca.gov	Loren Turner	916-123-4567	GeoResearch	User	New <input type="checkbox"/>
gw@microsoft.com	G.W. Gates	3700644	Richmond	User	Suspended <input checked="" type="checkbox"/>
abc@yahoo.com	John Doe	123456789	Caltrans	User	New <input type="checkbox"/>

UserAccount Management Block for Approved Users

Username/Email	Name	Phone	Organization	Type	Current Status
loren_turner@dot.ca.gov	Loren Turner	916-123-4567	GeoResearch	Administrator	Active <input type="checkbox"/>
dw@usgs.gov	Dave Wald	303-123-4567	USGS	User	Active <input checked="" type="checkbox"/>
klin@yahoo.com	K. Lin	916-155546	CGS	User	Active <input type="checkbox"/>

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3.2.16 Facility Global Setup Summary page

3.2.16.1 Facility Global Setup Summary page links

The user will be able to access the following general function tabs from the Facility Global Setup Summary page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

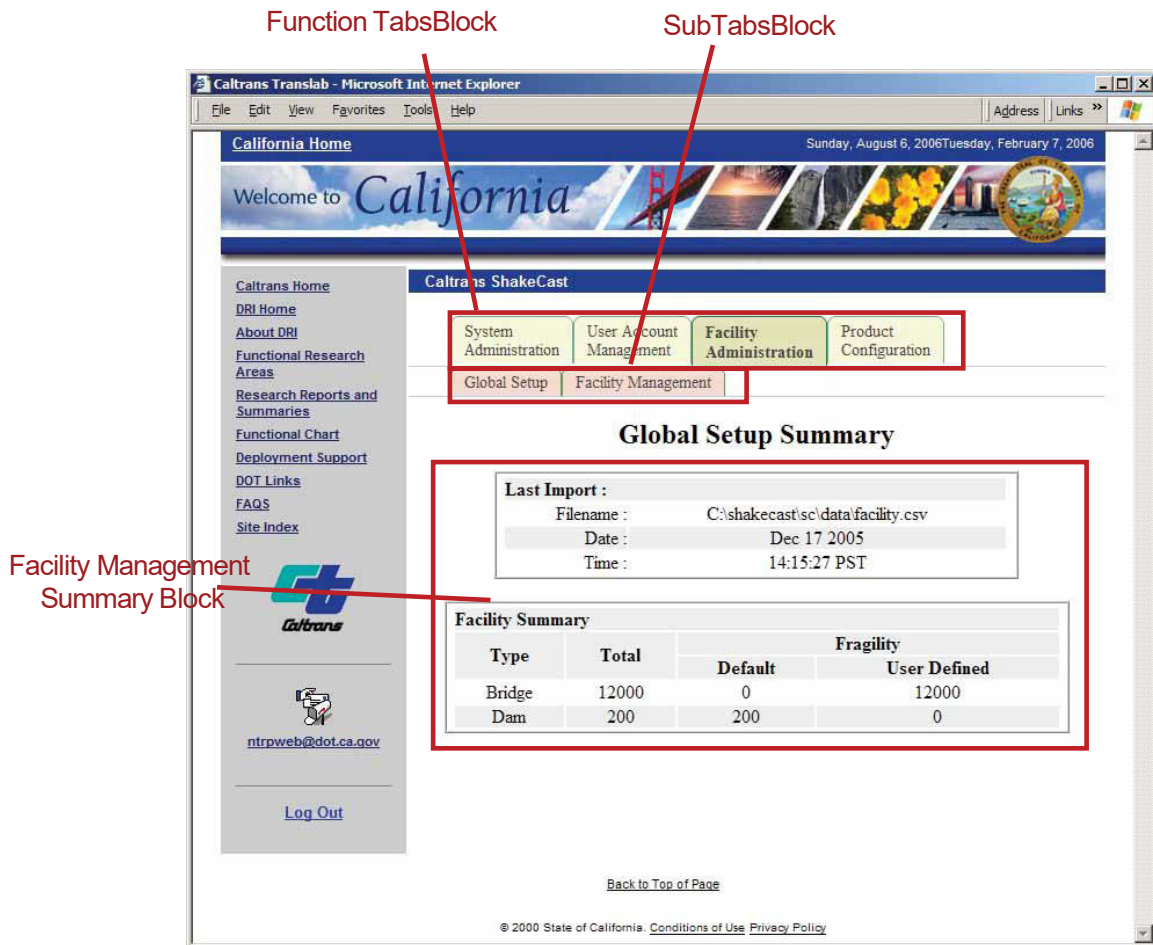
and specific sub-function tabs for Facility Administration tab:

- Global Setup
- Facility Management

3.2.16.2 Facility Global Setup Summary page purpose

This page is the initial page of Facility Administration for Caltrans ShakeCast system. This page will present the administrator a Last Import text block, a summary table block of facility inventory, and action button links. The Last Import text block will include information regarding date/time, and filename of the imported facility list. The Facility Summary table block will include key statistics of the facility inventory including type, number, and fragility settings.

3.2.16.3 Facility Global Setup Summary page content diagram



3.2.17 Global Data Import page

3.2.17.1 Global Data Import page links

The user will be able to access the following general function tabs from the Global Data Import page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Facility Administration tab:

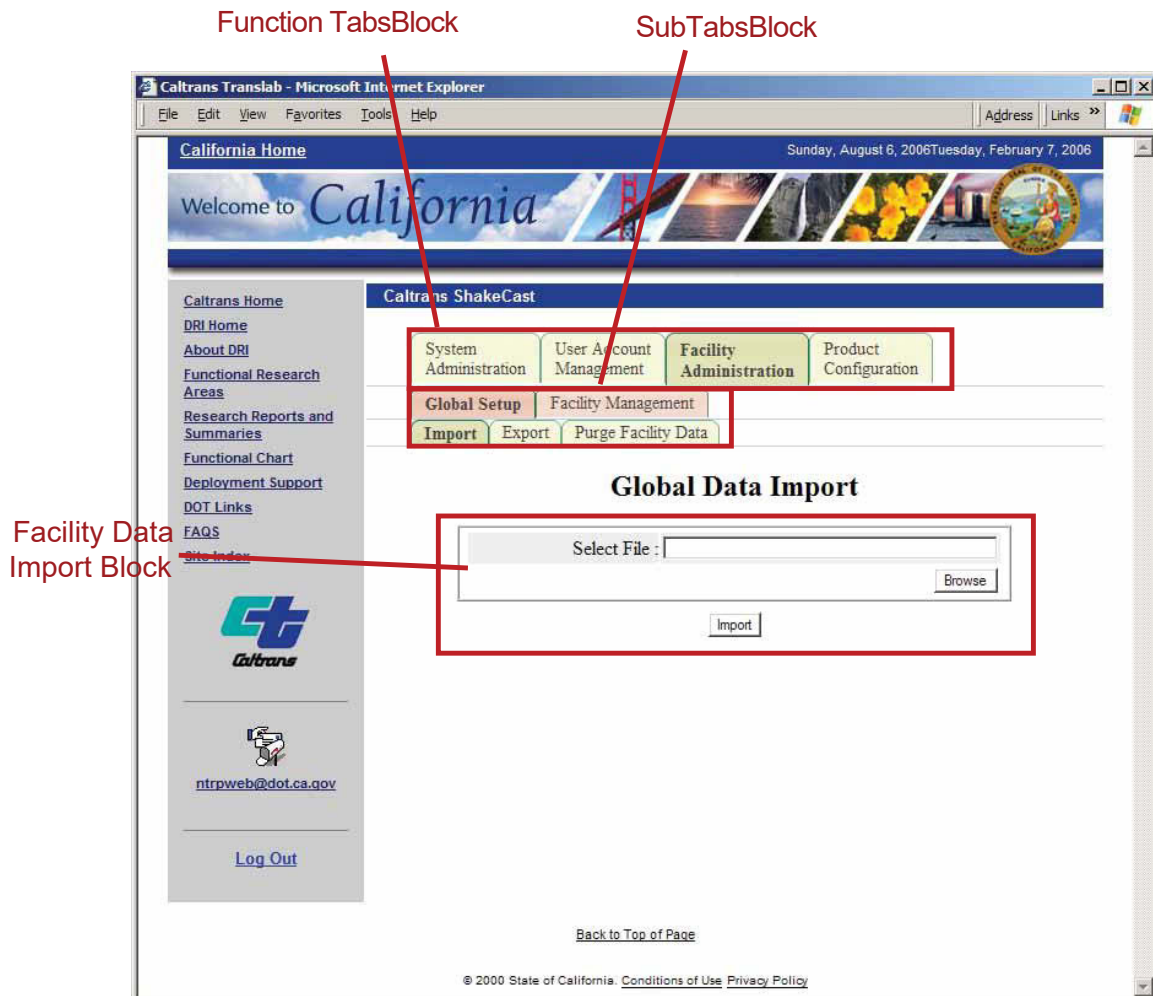
- Global Setup
- Facility Management

3.2.17.2 Global Data Import page purpose

This page is the interface page to the Caltrans ShakeCast facility import function. It will present the administrator a text field for the facility filename, a browse button, and a submit button.

After submitting information of the imported file, the administrator will receive a warning and confirmation feedback that the import function will replace information of existing facilities inside the ShakeCast database. If the global facility import action is successful, the administrator will be redirected to the Global Setup Summary page (3.2.16) and the page will be refreshed.

3.2.17.3 Global Data Import page content diagram



3.2.18 Global Data Export page

3.2.18.1 Global Data Export page links

The user will be able to access the following general function tabs from the Global Data Export page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

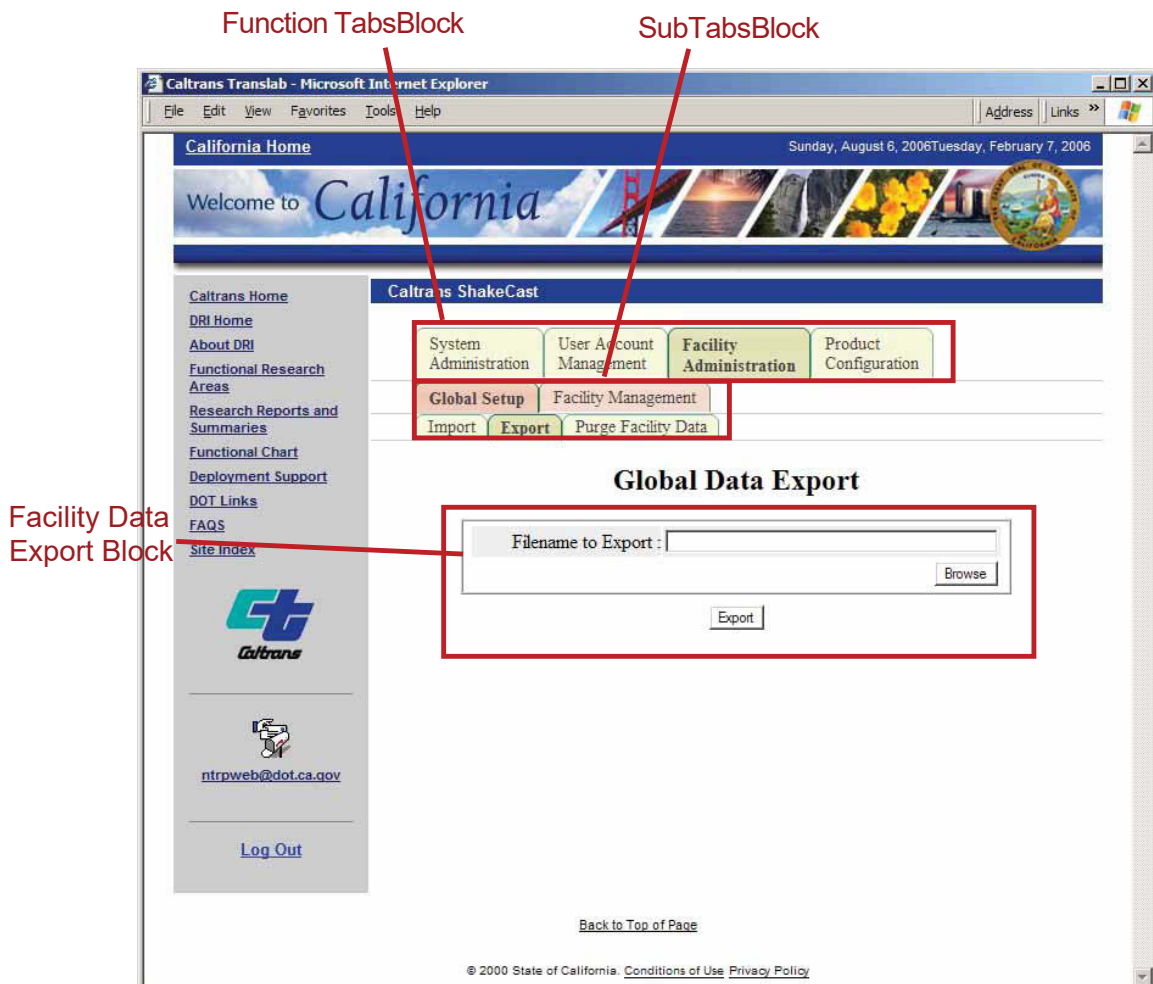
and specific sub-function tabs for Facility Administration tab:

- Global Setup
- Facility Management

3.2.18.2 Global Data Export page purpose

This page is the interface page to the Caltrans ShakeCast facility import function. It will present the administrator a text field for the facility filename, a browse button, and a submit button. After submitting information of the exported file, the administrator will receive a feedback on the result of the global facility export action.

3.2.18.3 Global Data Export page content diagram



3.2.19 Delete All Facility Data page

3.2.19.1 Delete All Facility Data page links

The user will be able to access the following general function tabs from the Delete All Facility Data page:

- System Administration
- User Account Management

- Facility Management
 - Product Configuration
- and specific sub-function tabs for Facility Administration tab:
- Global Setup
 - Facility Management

3.2.19.2 Delete All Facility Data page purpose

This page allows the ShakeCast administrator to purge the facility database before importing and rebuilding a new facility inventory. The page will present the administrator a warning message that such action is taking place, and a password field for confirmation, and a submit button.

After initiating the Delete All action, the administrator will receive feedback on the result and will be redirect to the Global Setup Summary page (3.2.16).

3.2.19.3 Delete All Facility Data page content diagram



3.2.20 Facility Management Summary page

3.2.20.1 Facility Management Summary page links

The user will be able to access the following general function tabs from the Facility Management Summary page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

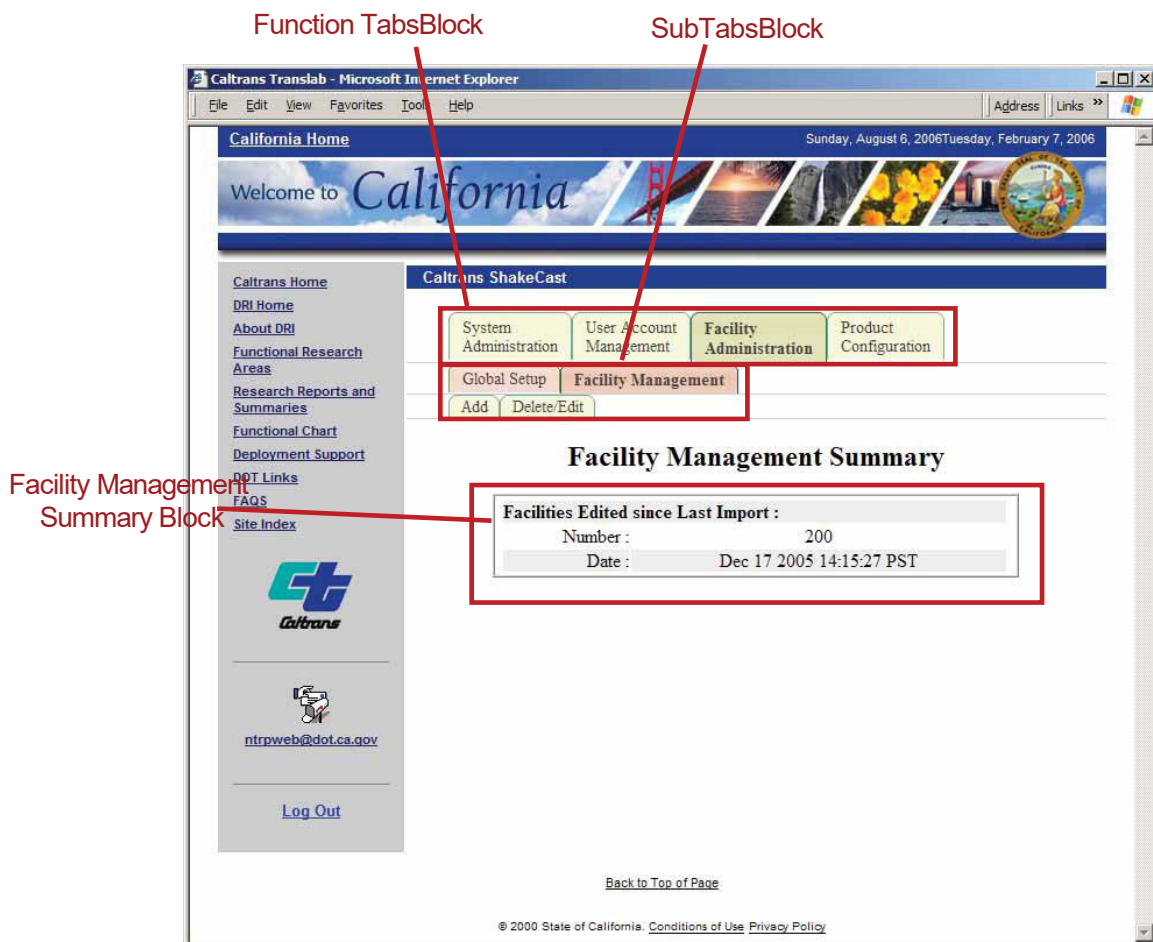
and specific sub-function tabs for Facility Administration tab:

- Global Setup
- Facility Management

3.2.20.2 Facility Management Summary page purpose

This page is the initial page of Facility Management for Caltrans ShakeCast Facility Administration. This page will present the administrator a quick summary table regarding the number and data/time of modified facilities since the most recent global import of facility inventory.

3.2.20.3 Facility Management Summary page content diagram



3.2.21 Add Facility page

3.2.21.1 Add Facility page links

The user will be able to access the following general function tabs from the Add Facility page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Facility Administration tab:

- Global Setup
- Facility Management

3.2.21.2 Add Facility page purpose

This page is the interface page to adding a new facility to the Caltrans ShakeCast facility inventory. It will be made up of Facility Type, General Facility Information, Facility Specific Information, and Facility Fragility Settings blocks, and a submit button.

The Facility Type block will present the administrator a pull-down menu to specify facility type of the new facility.

The General Facility Information block will consist of a Name text field, a Description text field, and a latitude/longitude text box, which are common information among all facility types.

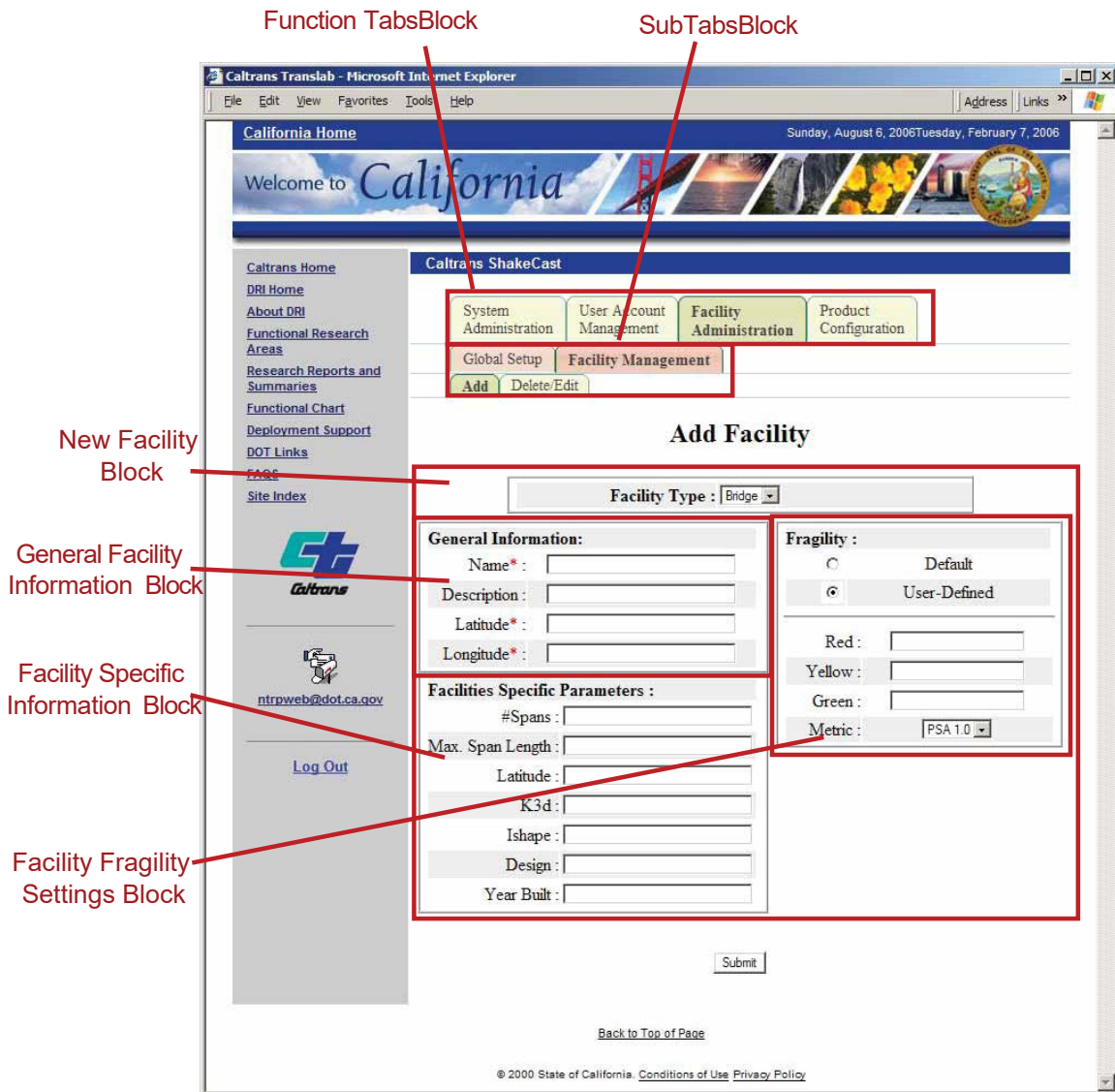
The Facility Specific Information block will present the administrator a list of key facility parameters that will be used for fragility analysis. E.g. for bridge fragility analysis using key NBI characteristics, the list of facility specific information will include a Number of Spans text field, a Maximum Span Length text field, a K3D text field, a Ishape text field, a Design text field, and a Year Built text field.

The Facility Fragility Settings block will consist of a selectable radio button for the default or user-defined fragility settings. The User-Defined text block will consist of a pull-down menu for metric selection and a threshold field for each of the three damage stages, red, yellow, and green.

All required data fields will be marked. The required data fields include the name and location of a facility, facility-specific information and fragility settings if User-Defined fragility settings are chosen.

After submitting a new facility, if successful the administrator will be redirected to the Facility Management Summary page (3.2.20). If unsuccessful, the administrator will receive feedback that this is the case and the page will be reset.

3.2.21.3 Add Facility page content diagram



3.2.22 Edit/Delete Facility page

3.2.22.1 Edit/Delete Facility page links

The user will be able to access the following general function tabs from the Edit/Delete Facility page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Facility Administration tab:

- Global Setup
- Facility Management

3.2.22.2 Edit/Delete Facility page purpose

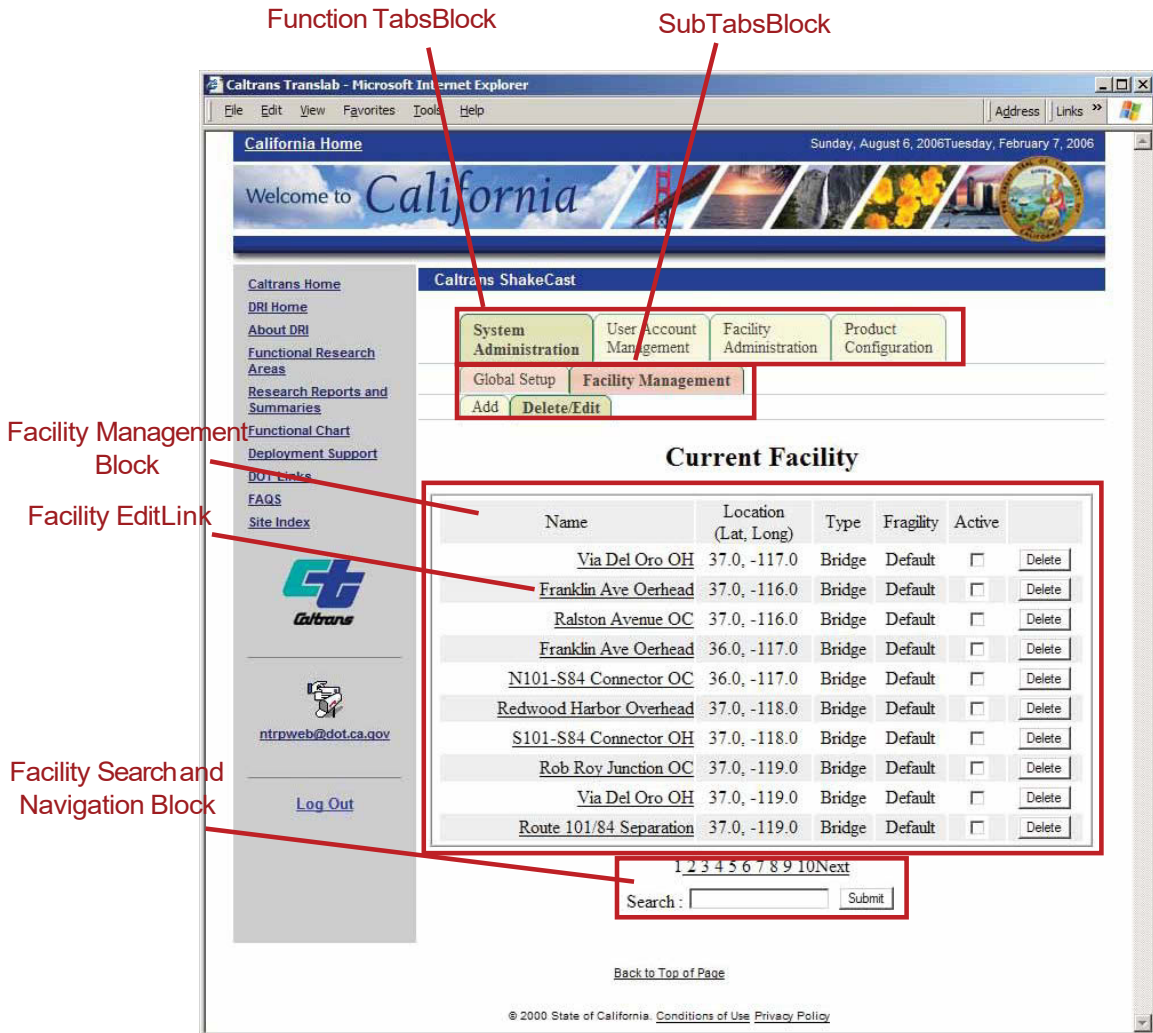
This page displays current facilities of the Caltrans ShakeCast system and will consist of a facility listing table block and a facility navigation/search block.

Each row of the facility table represents one facility and will be made up of a facility identification field, a fragility setting field, a status checkbox field, and a Delete link. A link will exist from the facility identification field to the Edit Facility page. The Edit Facility page will be identical to the Add Facility page except for the title of the page. The status checkbox field will allow the administrator to enable/disable a specific facility for ShakeCast processing.

A confirmation dialog will be present if the administrator selects the Delete link of an email template. If successful, the Edit/Delete Facility page will be refreshed with updated information.

The navigation/search block will present the administrator a search engine like interface to allow faster look-ups for specific facilities.

3.2.22.3 Edit/Delete Facility page content diagram



3.2.23 Email Notification Summary page

3.2.23.1 Email Notification Summary page links

The user will be able to access the following general function tabs from the Email Notification Summary page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Product Configuration tab:

- Notification
- Web Site

3.2.23.2 Email Notification Summary page purpose

This page is the initial page of Caltrans ShakeCast product configuration. This page will present the administrator a summary table block listing email notification profiles and their recipient counts. Each row of the email template table represents one notification

profile and will be made up of a notification identification field, a notification type field, a recipient count field. The Email Notification Summary page will only list active email notification templates.

3.2.23.3 Email Notification Summary page content diagram

The screenshot shows the Caltrans ShakeCast website interface. The main navigation area contains several tabs: System Administration, User Account Management, Facility Administration, and Product Configuration. Below these, there are sub-tabs for Notification and Web Site. The Notification sub-tab is selected, leading to the Email Notification Summary page. This page displays a table with the following data:

Name	Category	Number of Subscribers
California	Email	150
California	PAGE	150
N. California	Email	100
N. California	PAGE	90
S. California	Email	60
S. California	PAGE	60
District 1	Email	20
District 1	PAGE	10
District 2	Email	20
District 2	PAGE	20

The left sidebar contains links to various Caltrans resources, including Home, DRI Home, About DRI, Functional Research Areas, Research Reports and Summaries, Functional Chart, Deployment Support, DOT Links, FAQs, and Site Index. The bottom of the page includes a 'Log Out' button and a footer with copyright information for the State of California.

3.2.24 Import Email Template page

3.2.24.1 Import Email Template page links

The user will be able to access the following general function tabs from the Import Email Template page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

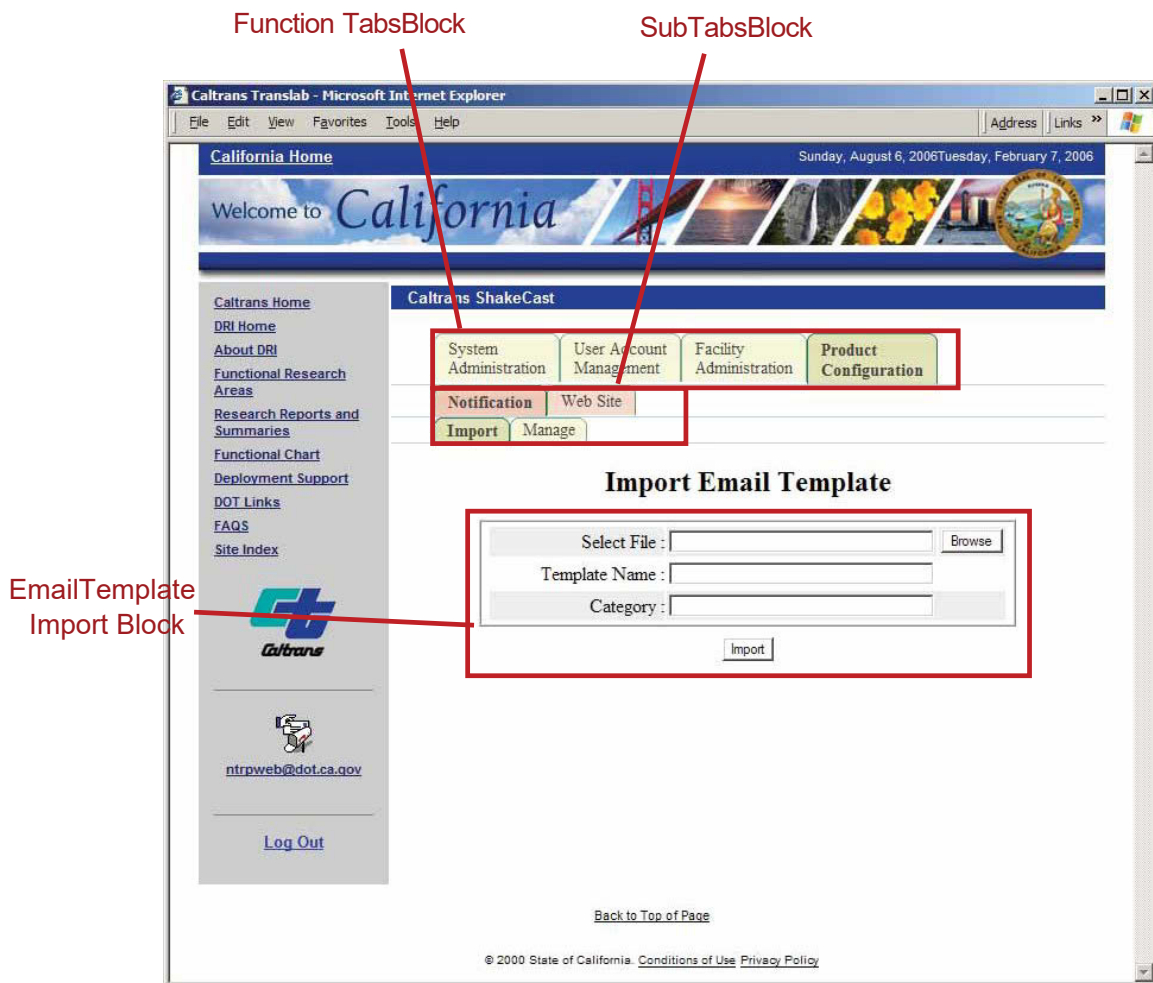
and specific sub-function tabs for Product Configuration tab:

- Notification
- Web Site

This page is the interface page to the Caltrans ShakeCast email template import function. It will present the administrator a Select File text field and a browse button for selecting the email template, a Template Name text field, a Category text field, and a submit button.

After submitting information of the importing file, the administrator will receive feedback of the result of the template import action. If successful, the administrator will be redirected to the Manage Email Templates page (3.2.25) with imported email template highlighted.

3.2.24.3 Import Email Template page content diagram



3.2.25 Manage Email Templates page

3.2.25.1 Manage Email Templates page links

The user will be able to access the following general function tabs from the Manage Email Templates page:

- System Administration

- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Product Configuration tab:

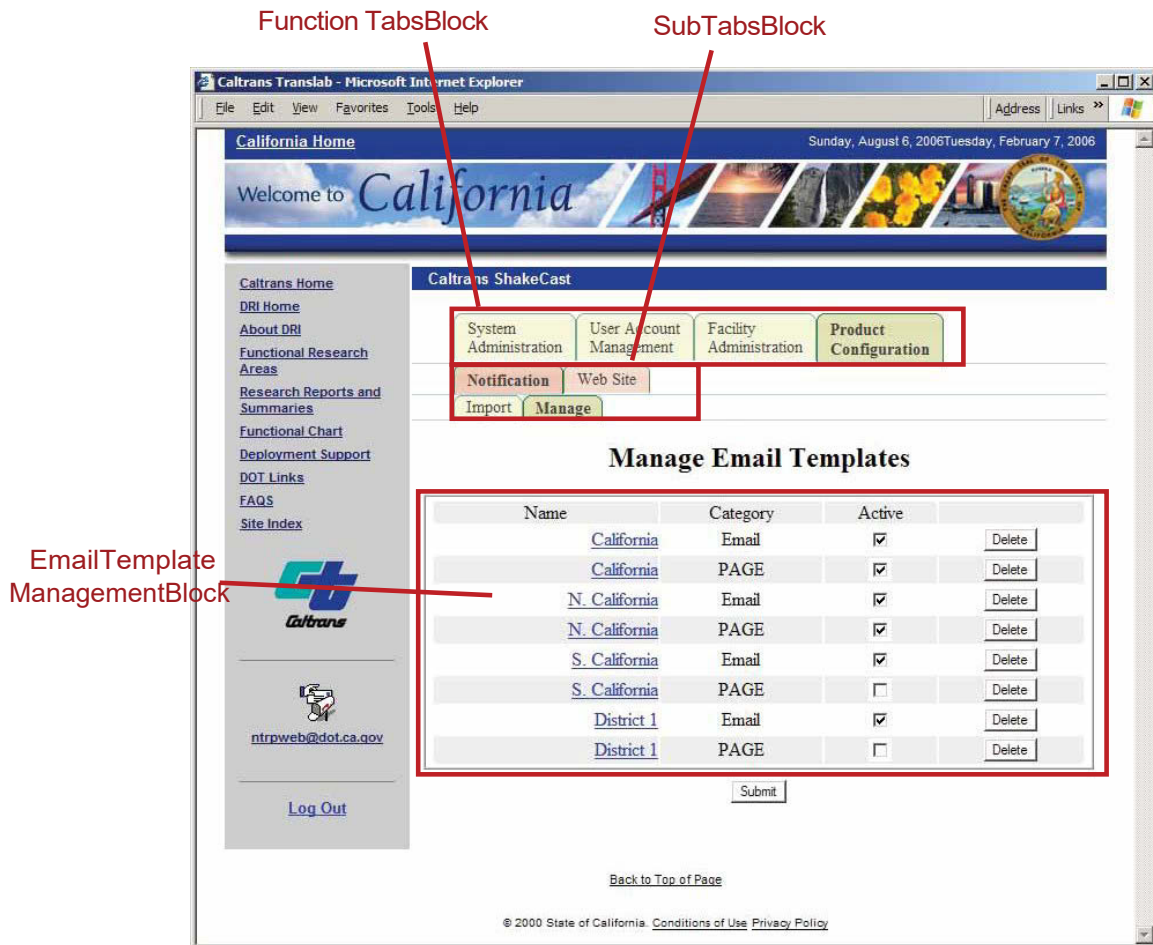
- Notification
- Web Site

3.2.25.2 Manage Email Templates page purpose

This page displays a table listing current email templates of the Caltrans ShakeCast system. Each row of the email template table represents one email template and will be made up of an Email Name field, a Category field, a status checkbox field, and a Delete link. A link from the Email Name field will exist to preview the content of the email template. The status checkbox field will allow the administrator to enable/disable the availability of a specific template to ShakeCast users.

A confirmation dialog will be present if the administrator selects the Delete link of an email template. If successful, the Manage Email Templates will be refreshed with updated information.

3.2.25.3 Manage Email Templates page content diagram



3.2.26 Web Site Template page

3.2.26.1 Web Site Template page links

The user will be able to access the following general function tabs from the Web Site Template page:

- System Administration
- User Account Management
- Facility Management
- Product Configuration

and specific sub-function tabs for Product Configuration tab:

- Notification
- Web Site

3.2.26.2 Web Site Template page purpose

This page is the configuration page for the Caltrans ShakeCast user web interface and will determine the framework layer and default page (2.2.3) of the portal. It will be made up of a Web Site Outline block, a Template Options block, and a Preview/Submit block.

The Web Site Outline block will present the administrator the outline and configurable elements of the portal. The configurable elements will be labeled in conjunction with the Template Options block.

The Template Options block will consist of at least a banner image field, an agency logo field, a additional links box, a Google Maps option menu, a facility table field, an earthquake summary field, a disclaimer field, and a preview/submit field. The requirement is that the administrator will be able to choose the default ShakeCast web template or to supply his/her own design via the interface.

A link will exist to the web site preview page.

3.2.26.3 Web Site Template page content diagram

The screenshot shows the 'Caltrans ShakeCast' web site template configuration interface. The page is titled 'Web Site Template' and contains several sections:

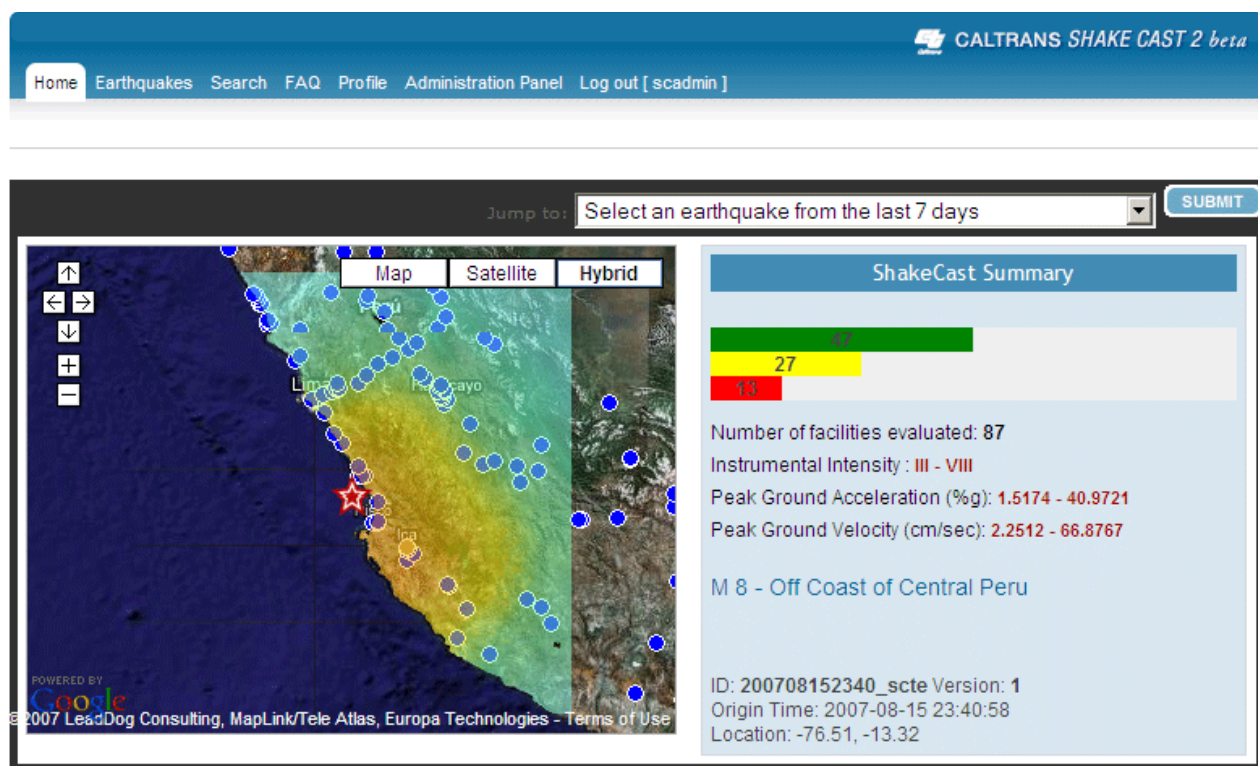
- Function TabsBlock:** A horizontal row of tabs including 'System Administration', 'User Account Management', 'Facility Administration', 'Product Configuration', 'Notification', and 'Web Site'.
- SubTabsBlock:** A sub-section within the 'Web Site' tab, containing a grid of numbered blocks [1] through [7].
- WebSiteOutlineBlock:** A vertical sidebar on the left containing links such as 'Caltrans Home', 'DRI Home', 'About DRI', 'Functional Research Areas', 'Research Reports and Summaries', 'Functional Chart', 'Deployment Support', 'DOT Links', 'FAQS', and 'Site Index'.
- Template OptionsBlock:** A main configuration area on the right containing:
 - [1] Banner Image: A text input field with a 'Browse' button.
 - [2] Agency Logo Image: A text input field with a 'Browse' button.
 - [3] Additional Links: A table with columns 'Name' and 'URL' for adding links.
 - [4] Google Map: A dropdown menu set to 'Hybrid'.
 - [5] Facility Table: A text input field with a 'Browse' button.
 - [6] Earthquake Summary: A text input field with a 'Browse' button.
 - [7] Disclaimer: A text input field.
- Template Preview:** A 'Preview' button at the bottom of the configuration area.

Red lines and labels point to these specific blocks: 'Function TabsBlock' points to the top tabs; 'SubTabsBlock' points to the grid of numbered blocks; 'WebSiteOutlineBlock' points to the left sidebar; 'Template OptionsBlock' points to the main configuration area; and 'Template Preview' points to the 'Preview' button.



ShakeCast Manual

By Kuo-Wan Lin and David J. Wald



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ShakeCast Manual

By Kuo-Wan Lin and David J. Wald

1. Introduction

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.

1.1 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. It is available and can be found on the Internet at <http://earthquake.usgs.gov/shakemap>. It was developed for and is used primarily for emergency response, loss estimation, and public information. However, for an informed response to a serious earthquake, critical users must go beyond just looking at ShakeMap, and understand the likely extent and severity of impact on the facilities for which they are responsible. To this end the U.S. Geological Survey (USGS) has developed *ShakeCast*.

ShakeCast allows utilities, transportation agencies, businesses, and other large organizations to control and optimize the earthquake information they receive. With ShakeCast, they can automatically determine the shaking value at *their* facilities, set thresholds for notification of damage states for each facility, and then automatically notify (via pager, cell phone, or email) specified operators and inspectors within their organizations who are responsible for those particular facilities so that they can set priorities for response. A schematic diagram showing the ShakeMap/ShakeCast flow of data and information is shown in figure 1.1.

In addition to real-time notification, ShakeCast also can generate and deliver scenario earthquakes for facility response plans (fig. 1.2). This application includes routine testing of the system, earthquake scenario exercises, and evaluating performance and response under potential earthquake conditions. ShakeMap is now used routinely to generate earthquake scenarios for many regions; ShakeCast will further allow planning exercises to be performed using the same notification tools that will be available and in place for responding to a real earthquake.

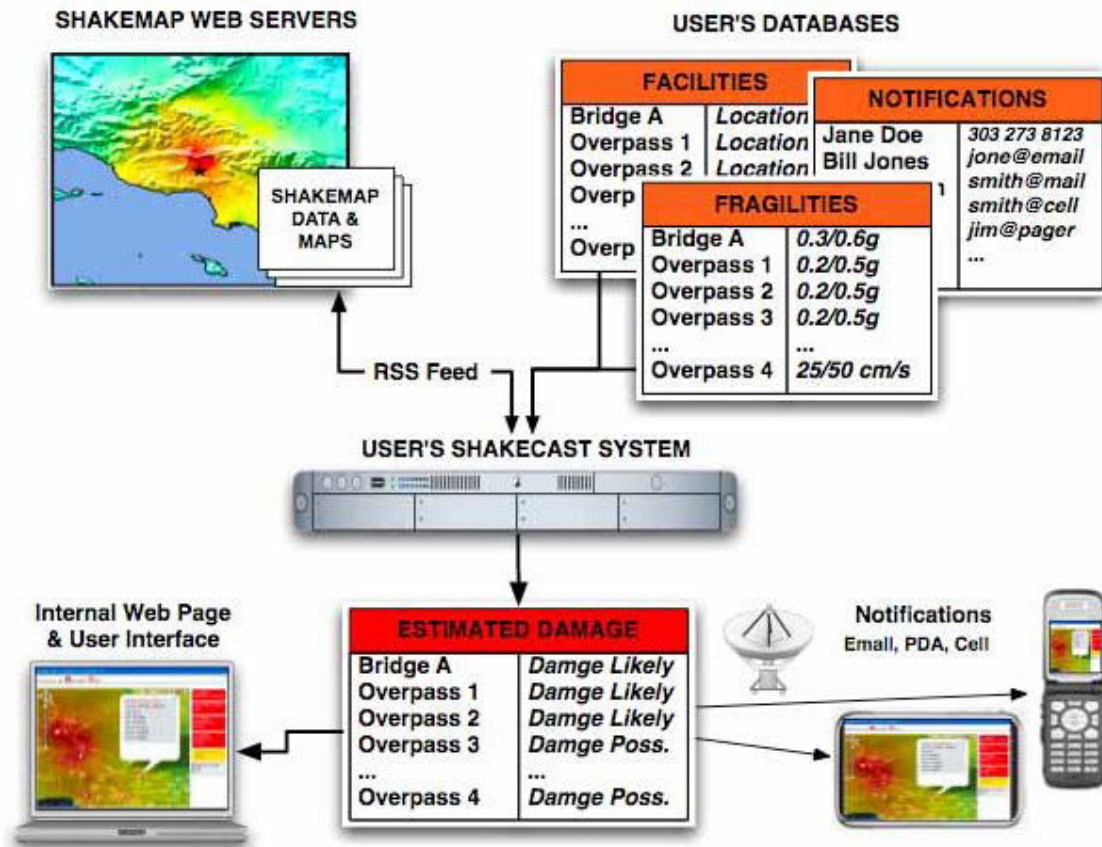


Figure 1.1 ShakeCast flow chart indicating flow of USGS ShakeMap data, users' ShakeCast inventory and user databases, and notifications.

1.2 ShakeCast Technology

Individuals, companies, utilities, and agencies could develop their own strategies and tools for utilization of ShakeMap given their unique facilities and communication paths. However, such efforts are costly and complex. Instead, USGS is facilitating this process with ShakeCast, building a more general-use tool for most of the critical user needs. The ShakeCast software is customizable for facilities, fragilities, and notifications, and we anticipate additional adaptations will be made because the open-source code is provided. Such innovations then can be provided into the tool kit included with updates of the ShakeCast system.

Information Technology (IT) security is a primary concern for users requiring automatic electronic delivery of information. By taking advantage of standard Internet protocols, ShakeCast users avoid most typical corporate and government concerns and firewall limitations. By using Really Simple Syndication (RSS) and interval polling, users initiate all communications with the USGS Web servers that host ShakeMap and retrieve selected products as a request rather than a "push." This RSS approach allows users to update software automatically under conditions of their own choosing.

ShakeCast software is built upon open-source tools, providing standard, freely available software for all users, encouraging user improvements, and simplifying interfacing with existing users' response tools. ShakeCast uses the Apache Web server and PHP (Hypertext Preprocessor) for dynamic Web content, MySQL for facility and notification databases, and is wrapped in

Practical Extraction and Report Language (PERL) scripting. Exchange files are in Extensible Markup Language (XML) for standardized interfacing with Web, geographic information systems (GIS), spreadsheets, databases, and other applications.

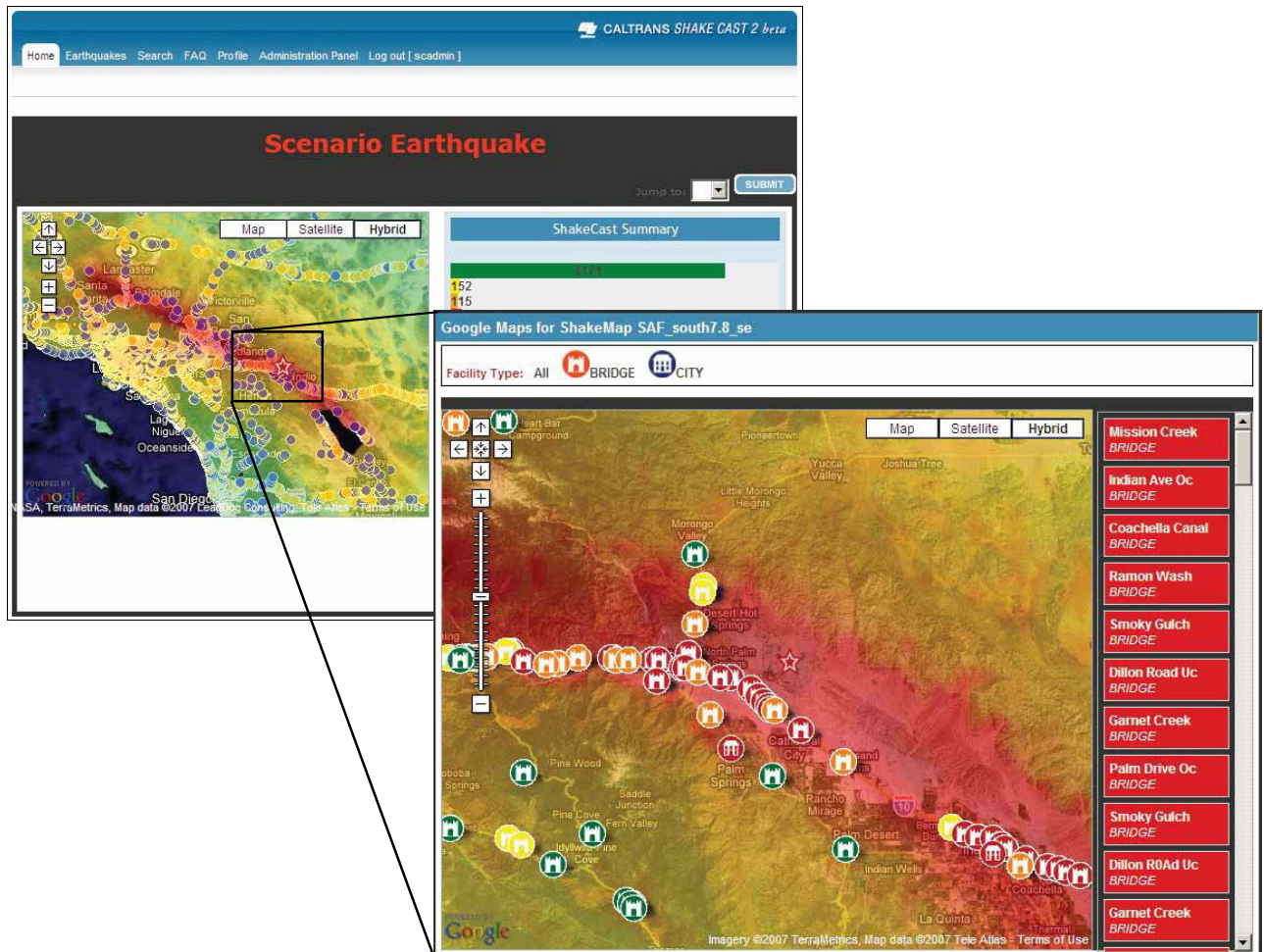


Figure 1.2 The ShakeCast users' interface summary page in mapping mode. The unique features in the mapping mode include variable image size, selectable facility type, customizable facility icons, and color-coding to show possible damage.

1.3 Where Can ShakeCast Be Used?

ShakeMap is now produced for all earthquakes around the globe of magnitude 5.5 or larger. Globally, these ShakeMaps are primarily predictive and thus lack the resolution and certainty of shaking estimates for maps made in regions of dense seismic instrumentation for which it was principally developed. Regions in the United States that have ShakeMap operating with reasonable (but variable) seismic station coverage include major parts of California, Washington, Oregon, Nevada, Utah, Hawaii, and Alaska. Other regions are improving station coverage. Hence, since ShakeMaps are produced for any region of the world, ShakeCast can be deployed for any exposure of facilities worldwide, again with more uncertainty for the results in regions not specifically listed above.

We use the term “facilities” loosely; at the USGS National Earthquake Information Center (NEIC) in Golden, Colo., we assign cities as “facilities” and run ShakeCast to determine shaking levels at cities within the United States and around the globe any time a ShakeMap is produced. The list of cities, their populations, and the intensity estimated at each city becomes a Hypertext Markup Language (HTML) email notification that proves useful for NEIC analysts and for other response purposes. Ultimately, these city-based notifications will be integrated as an option in the USGS Earthquake Notification Service (ENS), but it does not reduce the need for critical users to put their own inventories in an in-house ShakeCast system.

1.4 ShakeCast Availability

ShakeCast is available in two levels, full and “Lite.” We describe in detail the full ShakeCast system that allows users to estimate impact to numerous facilities, each potentially with different vulnerabilities and notification recipients. We expect this system to be deployed by critical users in an earthquake-hardened, operational environment. We have also made available ShakeCast Lite, a subset of the system that allows users to automatically receive ShakeMap products on their laptop or desktop computers, and launch predefined applications using those maps or data. For example, many users employ ShakeCast Lite to automatically open a Web browser showing the latest ShakeMap in their region, launch Google Earth® with the ShakeMap KML file, download ShakeMap grid files and initiate loss-estimation applications, or deliver ShakeMap GIS files to their corporate GIS department for further analyses. ShakeCast Lite is simple to install and use.

1.5 Acknowledgments

USGS contracted with Gatekeeper Systems, Inc., Pasadena, Cali., to help develop the prototype ShakeCast system (Version 1.0). Earlier funding for ShakeCast was provided by the American Lifelines Alliance (ALA), and it is now supported by the U.S. Geological Survey under the Advanced National Seismic System (ANSS). Motivation and support for the development of Version 2 of ShakeCast was provided by the California Department of Transportation (Caltrans) under the coordination efforts of Loren Turner.

An overview of ShakeCast from the users' perspective is provided in figure 2.1. Organizations using ShakeMap/ShakeCast first download and install the ShakeCast (Version 2) software package on a hardened in-house computer system. The software is installed with an interactive installation script. Facility, vulnerability, and notification data are input using import tools and simple, comma separated (CSV) users' files. ShakeCast comes preconfigured, but custom configuration is simplified via ShakeCast tools and the Web interface. The Web interface allows an administrator to access all functions of the local ShakeCast system, and end users are able to manage their own personal information and notification preferences.

Build Your Inventory Database Prior to Earthquakes

- Define regions of interest
- Collect structure information (location and fragility)
- Identify notification recipients, notification thresholds, and message formats

edit facility information

Facility Name:

Short Name:

Facility Type:

Facility Address:

Latitude:

Longitude:

Business Owner

Business Owner	New Limit	High Limit	Mobile
Overseas, probably not	<input type="text" value="11.7333"/>	<input type="text" value="112.7333"/>	<input type="text" value="11.7333"/>

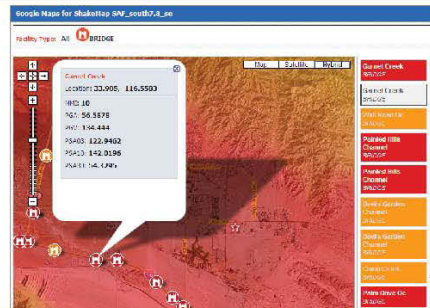
- ## Automatically Receive the Earthquake Notification

- Alert from the ShakeCast system soon after an earthquake is located and ground shaking data is estimated
- Alert message contains earthquake source parameters and the number of facilities likely affected
- Quick summary table indicates the estimated damage state of facilities sorted according to impact

ShakeCast Event: Magnitude 7.3					
FACILITY Shaking Estimates from ShakeMap					
VA Hospital Name	Damage Level	Metric	Value	Score/Scale Ratio	
Charlottesville, VA Hospital	Major	MMF1	10	1.429	
Columbia, VA Hospital	Major	MMF1	7.01	1.001	
Atlanta, VA Hospital	Severe	MMF1	6.52	0.7691	
Augusta, VA Hospital	Severe	MMF1	6.32	0.660	
Richmond, VA Hospital	Severe	MMF1	5.66	0.330	
Greenville, VA Hospital	Severe	MMF1	5.5	0.250	
Johnston City, NC Home VA Hospital	Severe	MMF1	5.41	0.205	

- ## Check the Damage Assessment Estimate

- The ShakeCast web interface provides quick summary of affected facilities, earthquake information, and Google Maps GIS tools
- Event Table contains detailed information on ground shaking measures, facility information, and damage estimates
- The GIS interface groups both ShakeMap and users' facilities into categories for better navigation and damage assessment



- ## Provide Updates for Post-Earthquake Response

- ShakeCast system continues to receive ShakeMap updates and to provide updated prioritized list of facilities for inspection
- ShakeCast system automatically downloads selected ShakeMap products for comprehensive damage analysis
- ShakeCast system is capable of processing scenario earthquakes for the purpose of emergency planning and exercise



Figure 2.1 ShakeCast overview from the users' perspective.

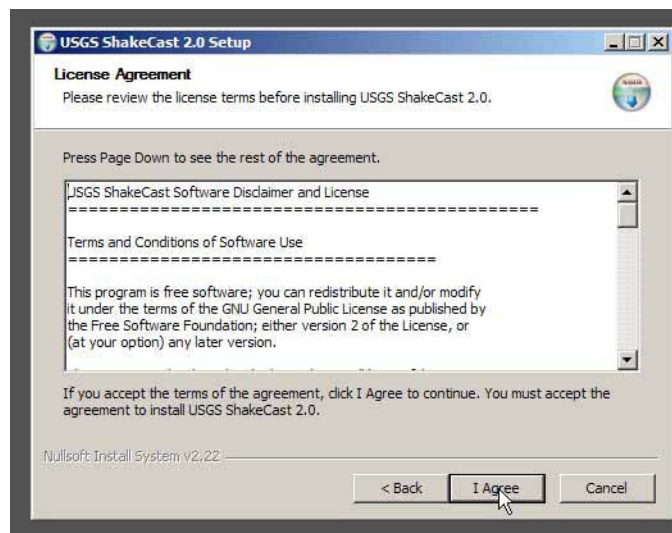
2.1 Hardware/Software Requirements

Version 2 of ShakeCast has been tested on a Microsoft Windows PC computer running the XP Professional operating system. Although the installation package is currently only available for Microsoft Windows, we plan to provide support for UNIX, Mac, and LINUX operating systems in the future.

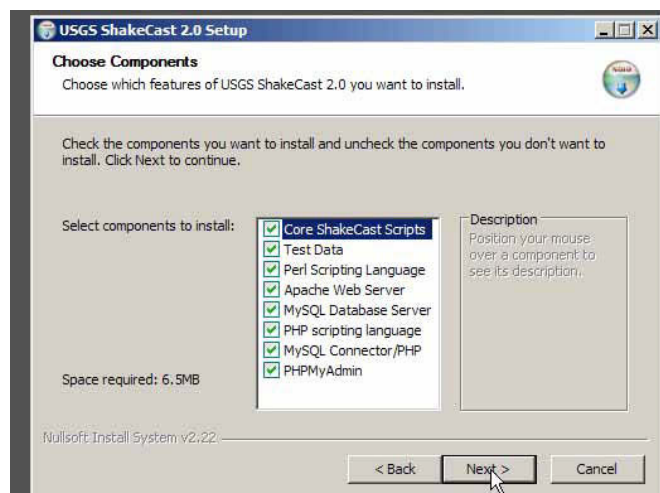
2.2 Initial Installation

To start the ShakeCast installation process:

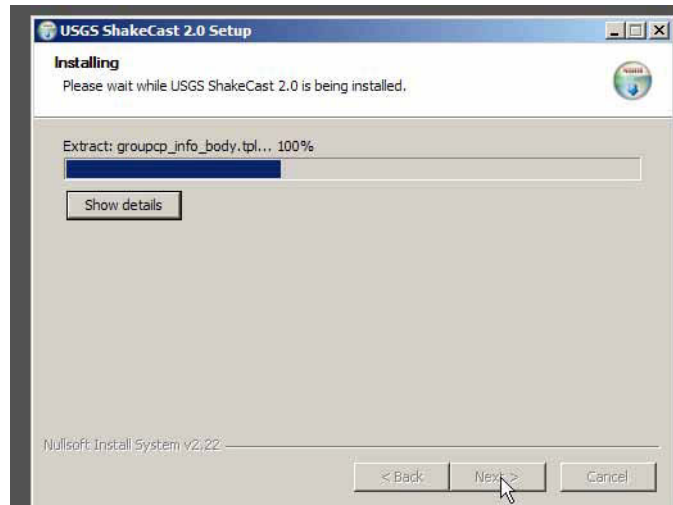
1. The **installer** unpacks the files needed for the installation, which takes less than a minute. After unpacking the installation files, the installer presents an option to view the **license agreement**. You may choose to **Accept** the license agreement and continue the installation process.



2. The installer displays a **Choose Components** screen that allows you to choose programs to install. We recommend that you keep the default settings, unless you are an advanced user who wants more precise control over the components that will be installed.



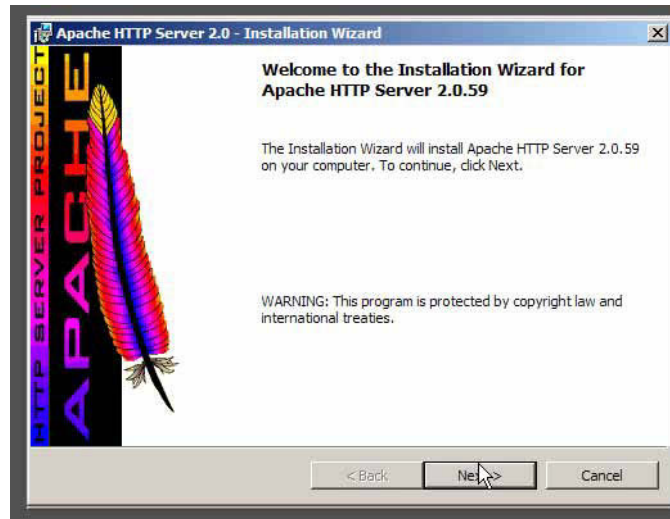
3. After ensuring that the desired program features are selected, click the **Next** button to continue with the installation. Now that you have given the installer all of the information it needs to proceed, progress boxes track the installation process.



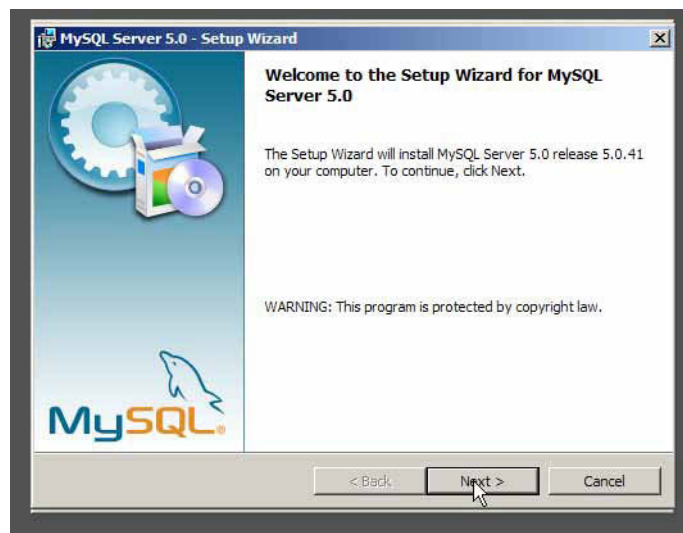
After installing the core ShakeCast script, the installer will download and start the ActivePerl setup dialog. Click the **Next** button to continue with the installation.



4. After installing the ActivePerl software, the installer will download and start the Apache Web server setup dialog. Click the **Next** button to continue with the installation.



5. After installing the Apache software, the installer will download and start the MySQL database setup dialog. Click the **Next** button to continue with the installation.



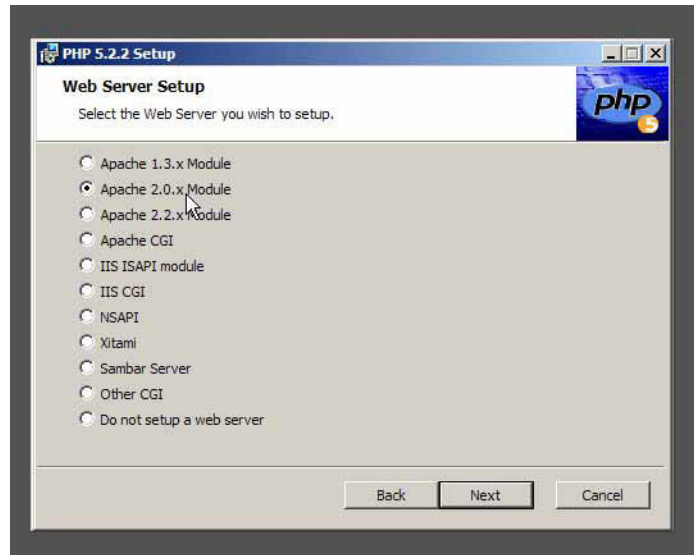
6. After installing the MySQL software, configure the database and create a root password.



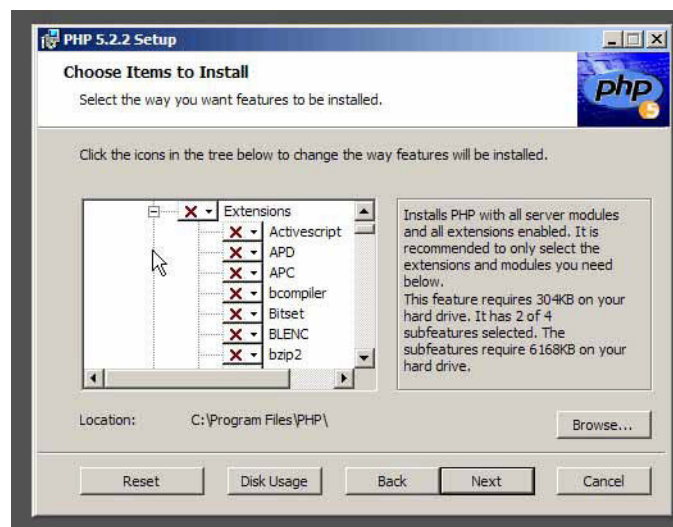
7. After completing the MySQL software configuration, the installer will download and start the PHP setup dialog. Click the **Next** button to continue with the installation.



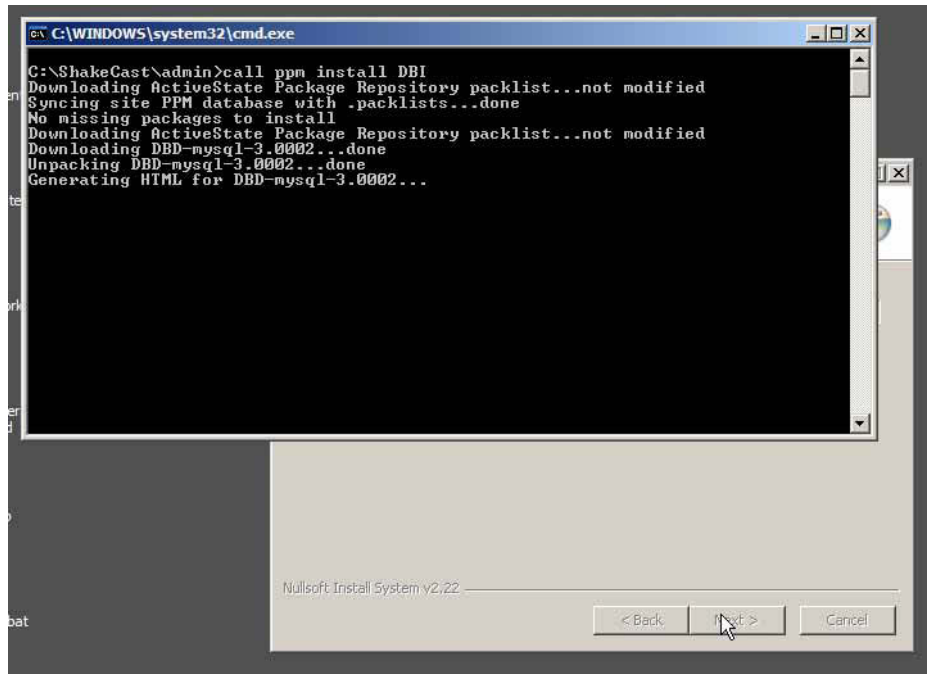
8. After completing the core PHP installation, the installer will start the PHP configuration dialog. Select Apache 2.0.x Module then click the **Next** button to locate the installation directory for Apache Web server.



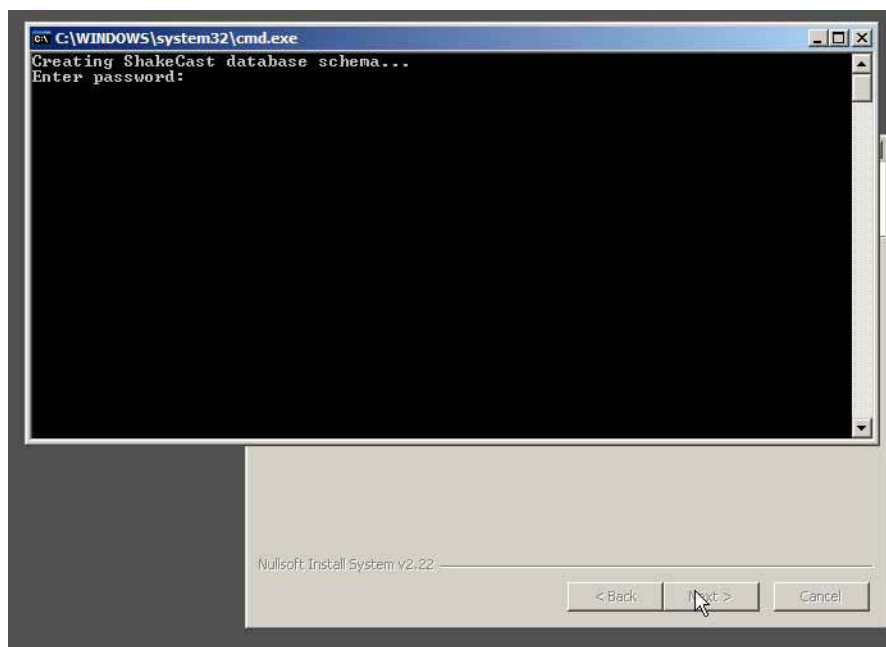
9. In the last step of PHP setup configuration, select to install the Extensions GD2, Multi-byte String, Mcrypt, Mysql, Mysqli, and SMTP. Click the **Next** button to continue with the installation.



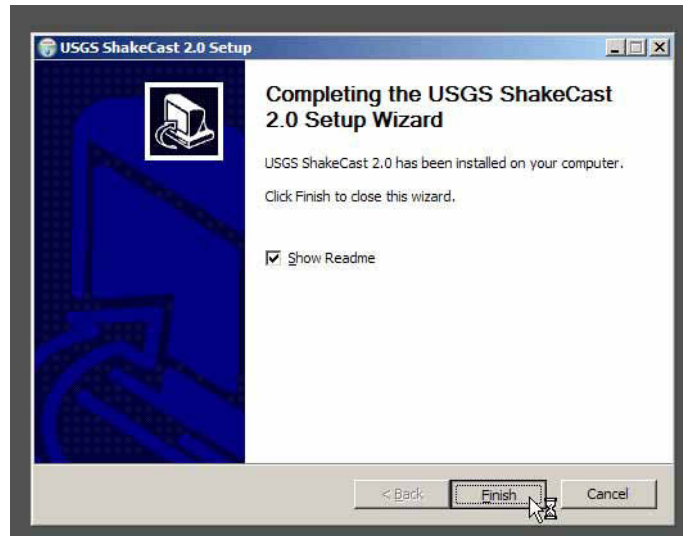
10. After completing the PHP installation, the installer will start the Perl module installation. A DOS Window will appear showing the progress of module installation.



11. After completing the Perl module installation, the installer will start the ShakeCast database configuration. A new DOS Window will appear with a prompt for the password to access the database. Type in the root password entered during the MySQL installation and hit **Enter** to continue with the installation.



12. After completing the ShakeCast database creation and data population, a brief dialog confirms the last steps of the installation process.



2.3 Finalize Installation

A few final configuration steps are required.

1. Notification. The file "c:\shakecast\sc\conf\sc.conf" contains a *Notification* section that looks like:

```
# Notification Configuration
<Notification>
  From          shakemaster@example.com
  EnvelopeFrom   shakemaster@example.com
  SmtServer      smtp.example.com
  DefaultEmailTemplate default.txt
  DefaultScriptTemplate default.pl
  #Username      username
  #Password      password
</Notification>
```

Modify the *From* (what an email recipient sees), *EnvelopeFrom* (what the SMTP server uses in the protocol) and the *SmtServer* fields to define how email notifications will be sent.

Uncomment and edit the *Username* and *Password* fields if authentication is required for your SMTP server.

2. RSS Daemon. The file "c:\shakecast\sc\conf\sc.conf" contains an *RSS* daemon section that looks like:

```
# RSS Daemon configuration
<rss>
  AUTOSTART      1
  # the LOG & LOGGING setting only applies to messages logged out of
  # GenericDaemon; other messages from polld itself are controlled by the
  # settings of LogLevel and LogFile in the system-wide configuration above
  LOG            c:/shakecast/sc/logs/sc.log
  LOGGING        1
  MSGLEVEL       2
  POLL          60
  PORT           53458
```

```
PROMPT      rssid>
SERVICE_NAME rssid
SERVICE_TITLE ShakeCast RSS Daemon
SPOLL 10
REGION SC CI NC NN
#TIME_WINDOW 30
</rss>
```

Modify the *REGION* (to download ShakeMaps only from selected regions), the *POLL* (polling interval in seconds), and the *TIME_WINDOW* (in days for triggering ShakeCast processing). Available ShakeMap regions are listed in table 2.1.

Table 2.1. ShakeMap region code and description

Region Code	Description
SC	Southern California
CI	Southern California
NC	Northern California
NN	Nevada
UT	Utah
PN	Pacific Northwest
HV	Hawaii
AK	Alaska
GLOBAL	Global and U.S. regions not covered by the above networks (NEIC ShakeMap)
ALL	All the above

- Restart the ShakeCast Services. To restart the actual services that perform the various ShakeCast functions:

```
cd c:\shakecast\admin
stop_sc_services
start_sc_services
```

- Customize the ShakeCast server for facilities, profiles, users, and notification templates. Consult ShakeCast documentation and tutorial videos on the ShakeCast download page in configuring ShakeCast server.

2.4 Uninstalling ShakeCast

You may uninstall the ShakeCast Server Software by:

- Stop and uninstall the services:

```
cd c:\shakecast\admin
stop_sc_services
remove_sc_services
```

2. Remove ShakeCast:

`c:\shakecast\Uninstall`

or use **Add/Remove Programs** in the Control Panel.

3. If desired, uninstall Perl, PHP, MySQL, and Apache by using Add/Remove Programs in the Control Panel.

2.5 Setup

Initial setup involves the following steps: (1) populating a database of facility locations and types; (2) assigning fragilities using specific ShakeMap metrics (for example, intensity, peak or spectral acceleration) and the corresponding likely “green,” “yellow,” and “red” damage states (“damage unlikely,” “damage possible,” and “damage likely” thresholds, for example); (3) specifying who receives notifications by contact information for facility managers and response personnel (email, cell phone); and (4) selecting under which circumstances the alerts are sent (for example, “damage possible” at specific facilities). In addition, the user can customize the content of the summary report that is delivered internally; for example, a list of facilities based on their likely damage state, and organization-specific links and images.

Example user and earthquake data, tutorials, and documentation are provided with the installation package.

3. ShakeCast User Web Interface

This section describes the User Web Interface of ShakeCast. The User Web Interface is called the “ShakeCast Portal” (fig. 3.1) and is used for all interaction with the ShakeCast system, such as reviewing ShakeCast damage assessment summary for facilities affected by earthquakes, applying for a ShakeCast user account, or signing up for automatic ShakeCast notifications on facilities likely affected after earthquakes.

- The ShakeCast Portal runs on any of the popular Web browsers connected to the Internet,
- Accesses all processed ShakeMaps for both actual and scenario earthquakes,
- Displays all pertinent information associated with facilities including facility parameters, intensity measures, and damage estimates,
- Allows management of automatic ShakeCast notifications for both message formats and facilities of interest, and
- Provides access to ShakeCast Web GIS interface.
- Further, for users with administrative privileges, an additional **Administration Panel** link will also become available.

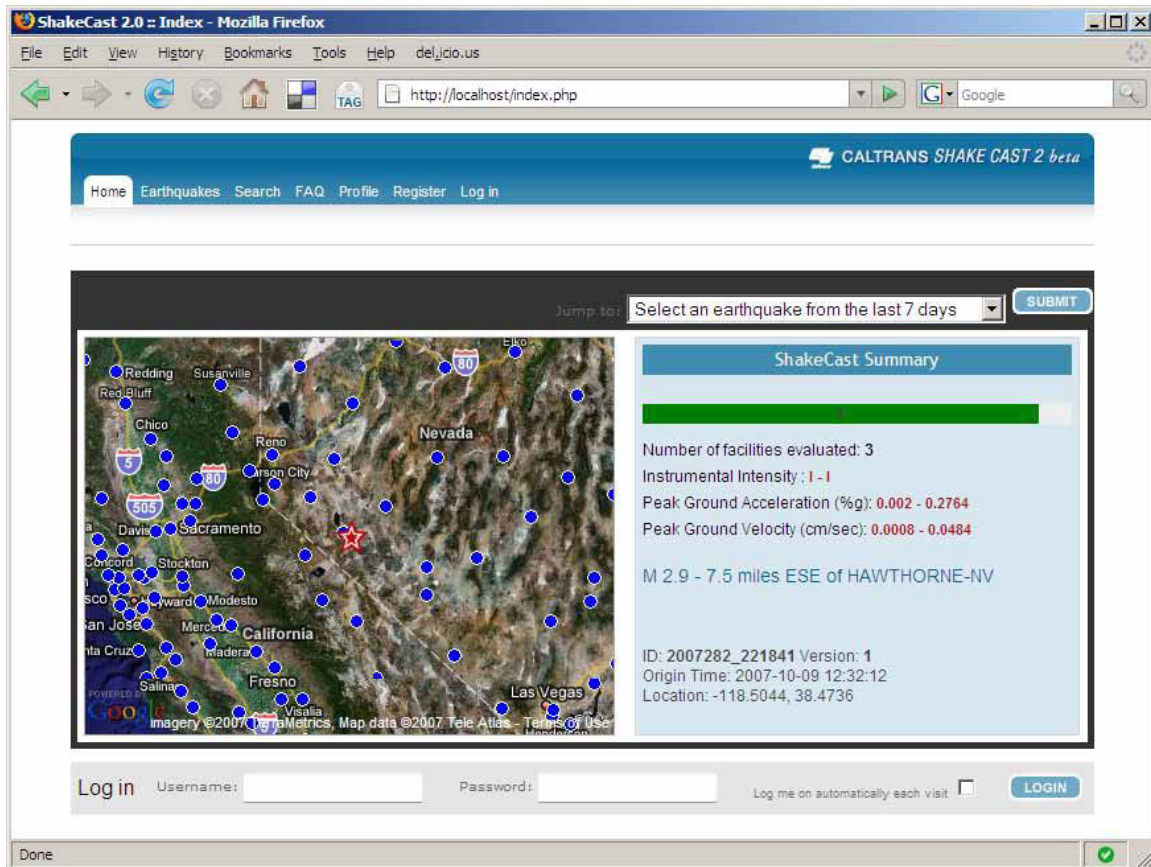


Figure 3.1 Default Web page of the ShakeCast Portal.

3.1 System Requirements

The ShakeCast Portal is implemented with common Web technologies, (PHP, Javascript, and AJAX, etc.), and is compliant with the HTML 4 specifications. The Portal runs on any browser with HTML Strict DTD support, which includes Microsoft's Internet Explorer 7 and up, as well as Firefox. If you do not have one of these browsers, they are available for free download from the Microsoft and Mozilla websites. The ShakeCast Portal is supported for Windows 98, Windows 2000, Windows XP, Mac OS X, Linux, Sun Solaris, and other UNIX-based operating systems.

If operated from behind a firewall or proxy server, the ShakeCast Portal will operate properly only if the firewall allows HTTP requests to Port 80. If the Portal is repeatedly unable to connect to the ShakeCast and Google Map GIS servers, then you should contact your system administrator for assistance. The firewall opening request should specify the source IP addresses (default earthquake.usgs.gov) allowed to connect to the Portal interface.

3.2 Log in Procedure

In order to log in, you must be a registered ShakeCast user. Registering can be accomplished by clicking on the **Register** tab on the ShakeCast Portal front page. See Section 3.11 for further information on registration. Note that only registered users can modify their personal preferences for receiving ShakeCast notifications.

Logging in requires you to provide a user-id and password. Both user-id and password are case sensitive. If you forget your password, click on the "I forgot my password" link and fill in the information requested; your new password will be then be emailed to you.

If the user-id and password are entered correctly, both the **Register** and **Log in** links at the Portal will be replaced with the **Log out** link with the user-id indicated.

3.3 Log out Procedure

To log out of ShakeCast Portal, you must either click on the **Log out** link from the Portal, which will close your active session with the server but leave the Portal browser open, or close the browser window/quit the application, which also will close the active session.

3.4 Front Page of ShakeCast Portal

The ShakeCast Portal front page is shown in figure 3.1. The Portal window is partitioned into a number of components, each serving a different purpose:

- Primary navigation links: a horizontal panel located beneath the organization's logo and ShakeCast banner contains several primary navigation links that allow a user to perform operations or access additional information.
- System message: an area between the primary navigation links and the ShakeCast summary panel that displays event specific information. A typical system message is a banner indicating a scenario earthquake and crucial comments manually entered by an administrator.
- Recently processed earthquake selector: a pull-down menu that allows a user to view the ShakeCast summary for recently processed earthquakes.
- ShakeCast facility/ShakeMap overview: an area in the middle left of the ShakeCast summary panel that displays an overview map with both the ShakeMap and facility layers.

- ShakeCast facility summary: an area in the upper right of the ShakeCast summary panel that displays the number of facilities evaluated, facility potential damage estimates, and the units and the range of ground shaking intensity measures extracted from ShakeMap.
- ShakeCast event summary: an area in the lower right of the ShakeCast summary panel that displays the key source parameters of the earthquake evaluated. The list of parameters includes the event ID, ShakeMap version number, magnitude, location, and origin time.

3.5 Primary Navigation Link Tabs

The Primary navigation link tabs currently have the following links in a panel on top of the ShakeCast Portal. Clicking one will invoke the described operation:

- Home: directs the browser window back to the default page of the ShakeCast portal.
- Earthquakes: directs the browser window to the ShakeCast listing of processed ShakeMaps.
- Search: directs the browser window to the ShakeCast search function for information regarding facility inventories and processed ShakeMaps.
- FAQ: directs the browser window to a list of answers to common problems ShakeCast users have encountered.
- Profile: directs the browser window to allow ShakeCast users to manage personal information and notification preferences.
- Register: directs the browser window to the user registration page that allows a non-user to sign-up for an account.
- Administration Panel: directs the browser window to the restricted section for system maintenance and management. This feature is only visible and available to ShakeCast users with administrative privileges.
- Log In/Log Out: the Log In link appears when a user first accesses the page without signing in. It directs the browser window to allow a user to enter information of username and password or to retrieve a lost password. The **Log Out** link terminates the current Log In session and redirects the browser window to the default portal page.

3.6 Listing of the ShakeCast Summary for Earthquakes

The ShakeCast summary of affected facilities for earthquakes is accessed via the Earthquake link (fig. 3.2). This feature allows a ShakeCast user to view facility damage assessment for past earthquakes. The list of processed earthquakes is divided into three categories: (1) Latest Earthquake, (2) Earthquake Archive, and (3) Scenario earthquakes.

No. Facility Evaluated	Magnitude	Earthquake	Location	Event ID	Last Update
3	2.9	7.5 miles ESE of HAWTHORNE-NV (Version 1)	38.4736, -118.5044	2007282_221841	Wed Oct 10, 2007 5:51 am
4	3.48	7.5 miles ESE of HAWTHORNE-NV (Version 1)	38.4716, -118.5044	2007282_221806	Wed Oct 10, 2007 1:12 am
4	3.79	7.5 miles ESE of HAWTHORNE-NV (Version 5)	38.4801, -118.5002	2007282_221779	Tue Oct 09, 2007 10:04 pm
4	3.18	8.2 miles ESE of HAWTHORNE-NV (Version 1)	38.4601, -118.5	2007282_221782	Tue Oct 09, 2007 7:34 pm
12	3.5	2.9 mi N of Chatsworth, CA (Version 4)	34.2982, -118.6117	CI 14313828	Thu Oct 04, 2007 2:05 am
4	2.94	47.4 miles SW of LAS_VEGAS-NV (Version 1)	35.7503, -115.8148	2007271_220917	Tue Oct 02, 2007 11:36 pm
0	5.9	NEAR THE COAST OF ECUADOR (Version 1)	-3.8822, -79.1707	US 2007htaj	Tue Oct 02, 2007 11:33 pm
0	5.7	SOUTHERN SUMATRA, INDONESIA (Version 1)	-4.5294, 101.1811	US 2007hzah	Tue Oct 02, 2007 11:27 pm
0	8	Off Coast of Central Peru (Version 4)	-13.32, -76.51	US 200708152340	Fri Sep 28, 2007 8:22 pm
0	6	Big Island Region, Hawaii (Version 4)	20.129, -155.983	US 200610151714	Fri Sep 28, 2007 8:21 pm
0	6.7	Big Island Region, Hawaii (Version 4)	19.8777, -155.935	US 200610151707	Fri Sep 28, 2007 8:21 pm

Figure 3.2 The Earthquake page listing the events processed by the ShakeCast system and the number of evaluated facilities in reverse chronological order.

- **Latest Earthquake:** displays a table listing all versions of published ShakeMaps for the most recently processed earthquake. As a common earthquake refining process, the source parameters for a significant earthquake and associated ground motion estimates are constantly updated as more information becomes available. The ShakeCast system tracks version changes of ShakeMap for an earthquake and re-evaluates facility damage assessments accordingly.
- **Earthquake Archive:** displays a table listing previously processed ShakeMaps for actual earthquakes and their facility damage assessment.
- **Scenarios:** displays a table listing previously processed scenario ShakeMaps and their facility damage assessment. ShakeCast scenarios also include converted actual ShakeMaps for the purpose of local testing.
- All columns can be sorted by selecting their respective headers.

3.7 ShakeCast Facility Damage Assessment

The ShakeCast facility damage assessment view is the center piece of the Web portal. ShakeCast users interact with the view in either table or map mode.

- **Table mode:** displays facility damage assessment in a number of paged tables connected with navigation links (fig. 3.3). Each row of the table represents a ShakeCast damage assessment for one facility. It consists of facility information, damage state estimate, and ground motion estimates at the location of the facility. To view the facility on a map, click the facility row to enable the mapping inset. The mapping inset is a floating pane that can be dragged on top of the earthquake table page. To disable the inset, click on the “Close” button on the upper-right corner of the mapping inset.

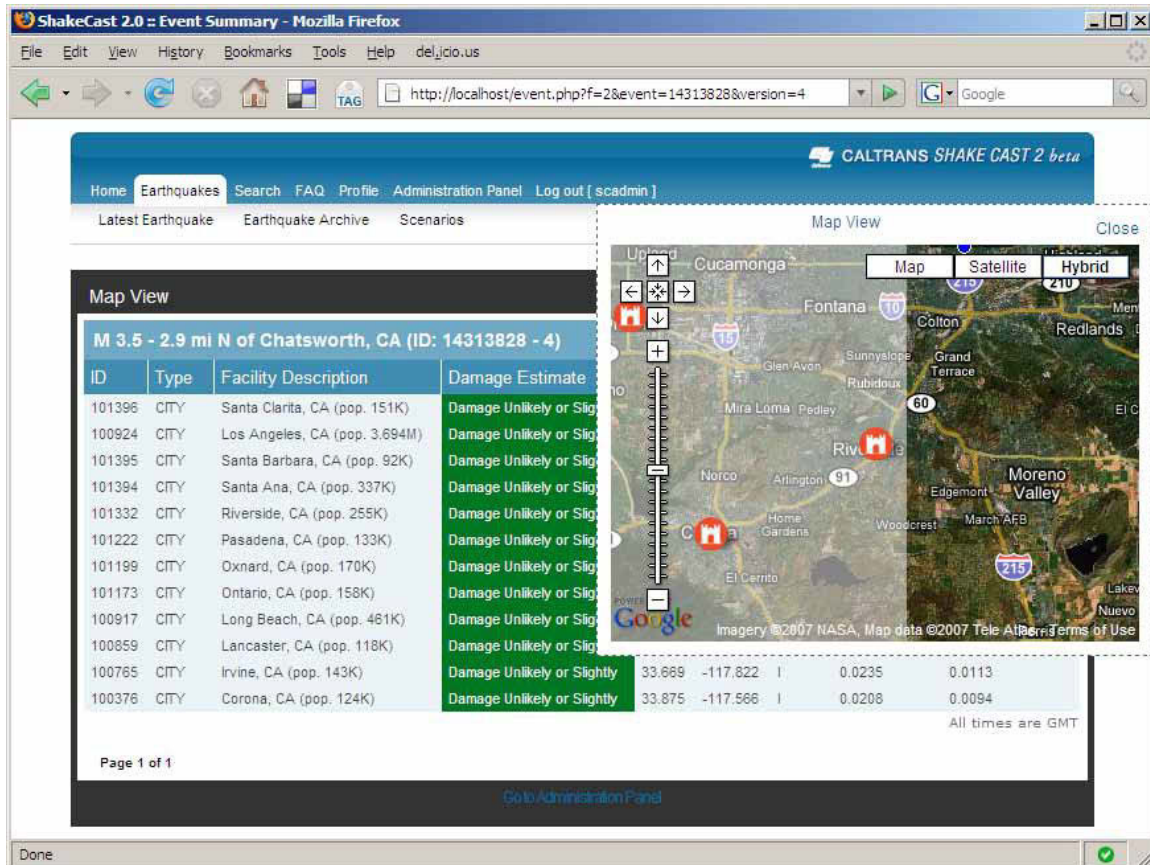


Figure 3.3 The Event page displaying in table mode. Facilities with damage estimates are listed in paged tables with navigation links. Each row of the table represents one facility and contains information regarding facility description, damage estimate, and ground shaking estimates for the site for all available metrics.

- **Map mode:** displays facility damage assessment via a Web based mapping interface (fig. 3.4), currently the Google Maps interface. Facilities are presented in both images and list items with facility-type filtering. The facility markers within the mapping area become visible at proper zoom level and are color-coded corresponding to damage estimates. To view the ground motion measures of a facility, click the facility marker in the mapping area to display the parametric values.

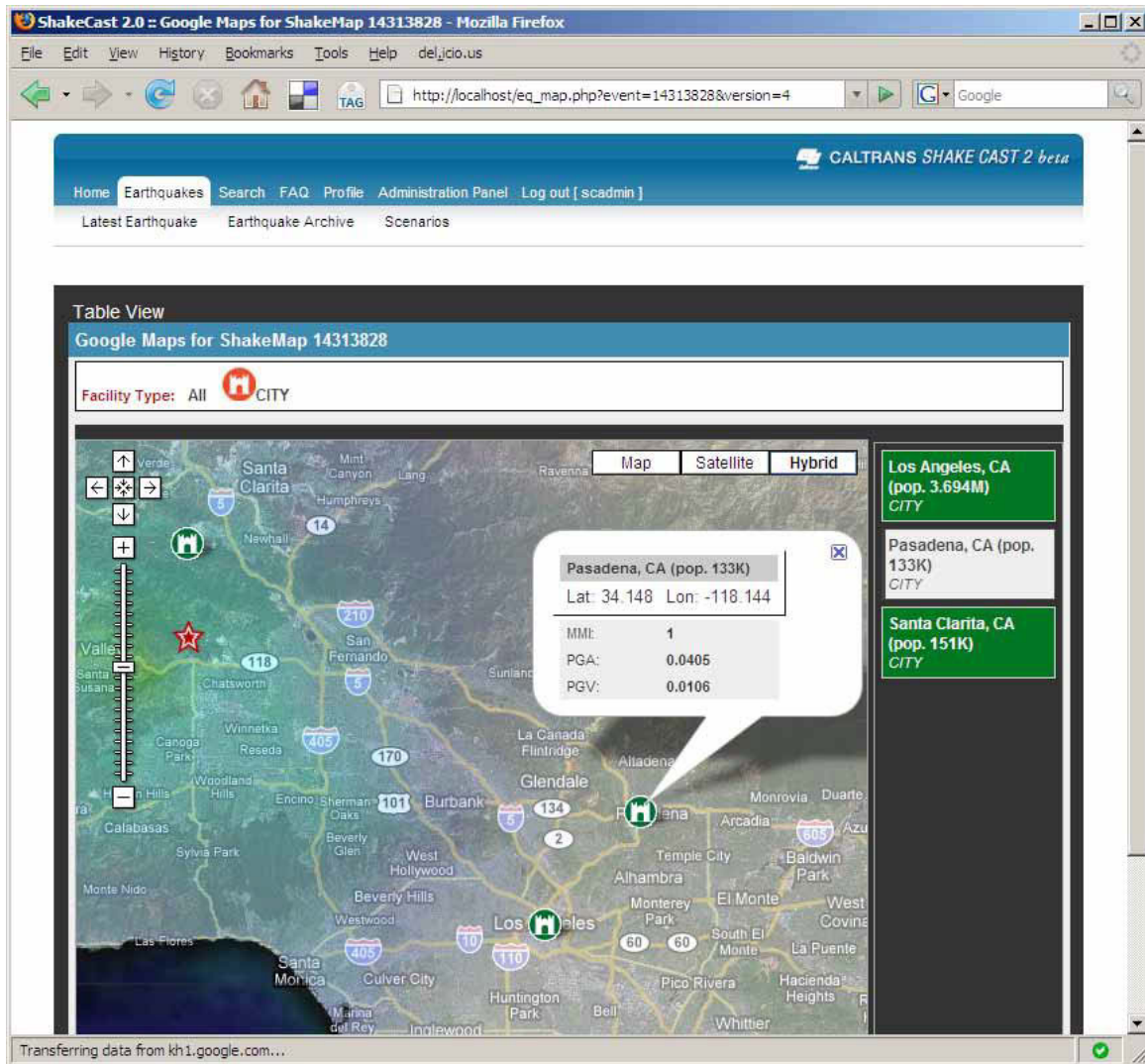


Figure 3.4 The Event page displaying in map mode. The map display is divided into three regions: (1) facility type selector located on top of the display and used to turn on/off facilities of certain type; (2) facility list panel to the right of the display showing a list of facilities located within the mapping area with color-coded damage estimates; and (3) the interactive mapping area displaying the facility locations with the ShakeMap image overlay. The facility markers are in color-coded damage levels and users can pan, zoom, and click on the facilities to reveal shaking parameters.

3.8 Search Facilities

The search function shown in figure 3.5 is designed to retrieve facility information inside the ShakeCast database. The search result contains facility information, fragility settings including metrics and ranges of threshold, and damage estimates from all previously processed ShakeMaps.

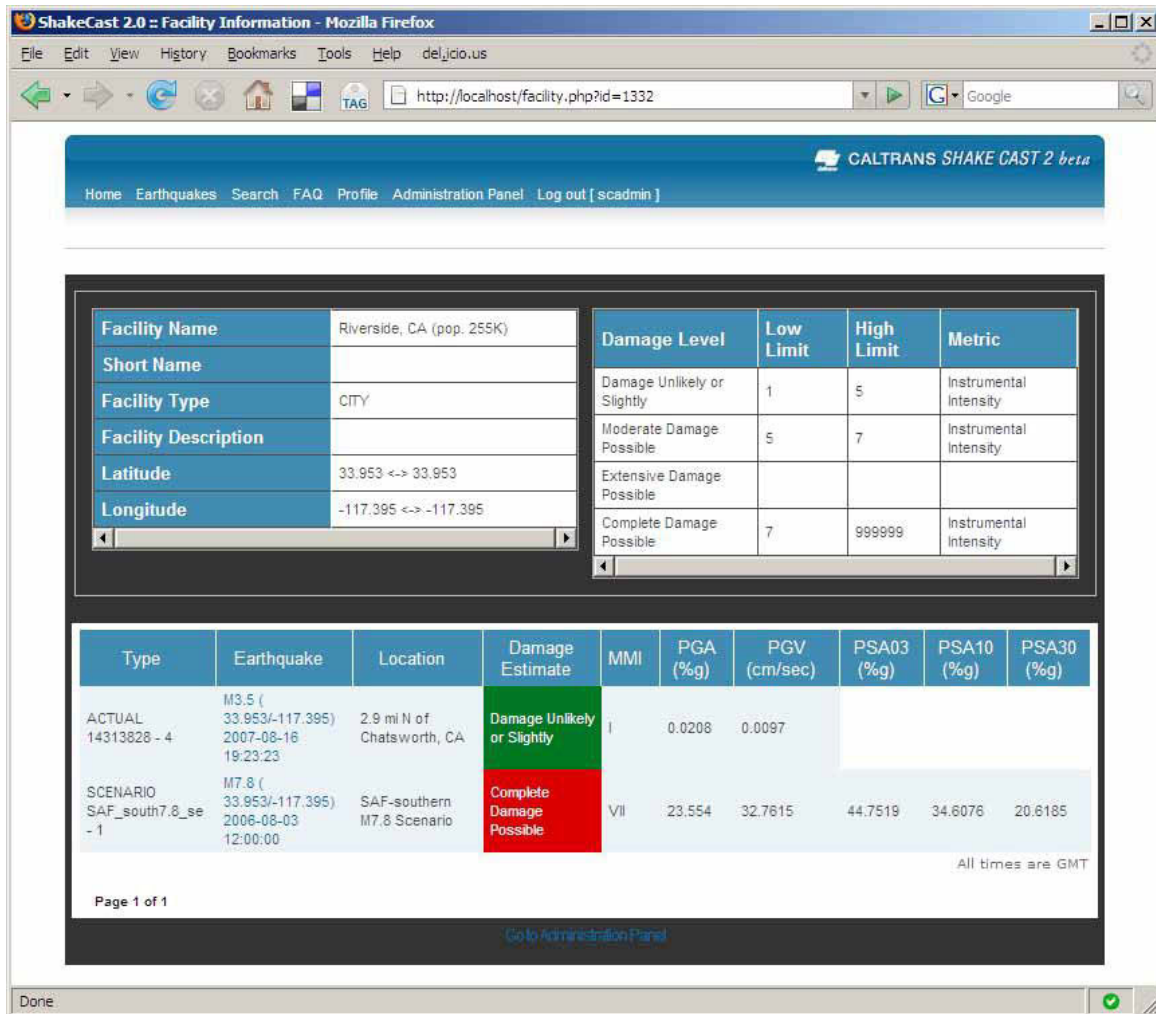


Figure 3.5 The search result of a facility displaying parameters for the facility and the history of damage estimates from previous earthquakes.

3.9 Frequently Asked Questions (FAQ)

The FAQ page is intended to answer some of the more commonly asked questions. Users should contact the ShakeCast administrator for further questions and bug reports.

3.10 User Profile Management

ShakeCast users manage their registered information, delivery methods for notifications, and notification profiles from the Profile page. This page view consists of three editing panels: (1) General Settings; (2) Email List; and (3) Notification Profiles.

- **General Settings:** displays the password and contact information editable by the user (fig. 3.6). The new password will take effect after the current active session is closed, either by closing the browser window or by logging out of the ShakeCast system.

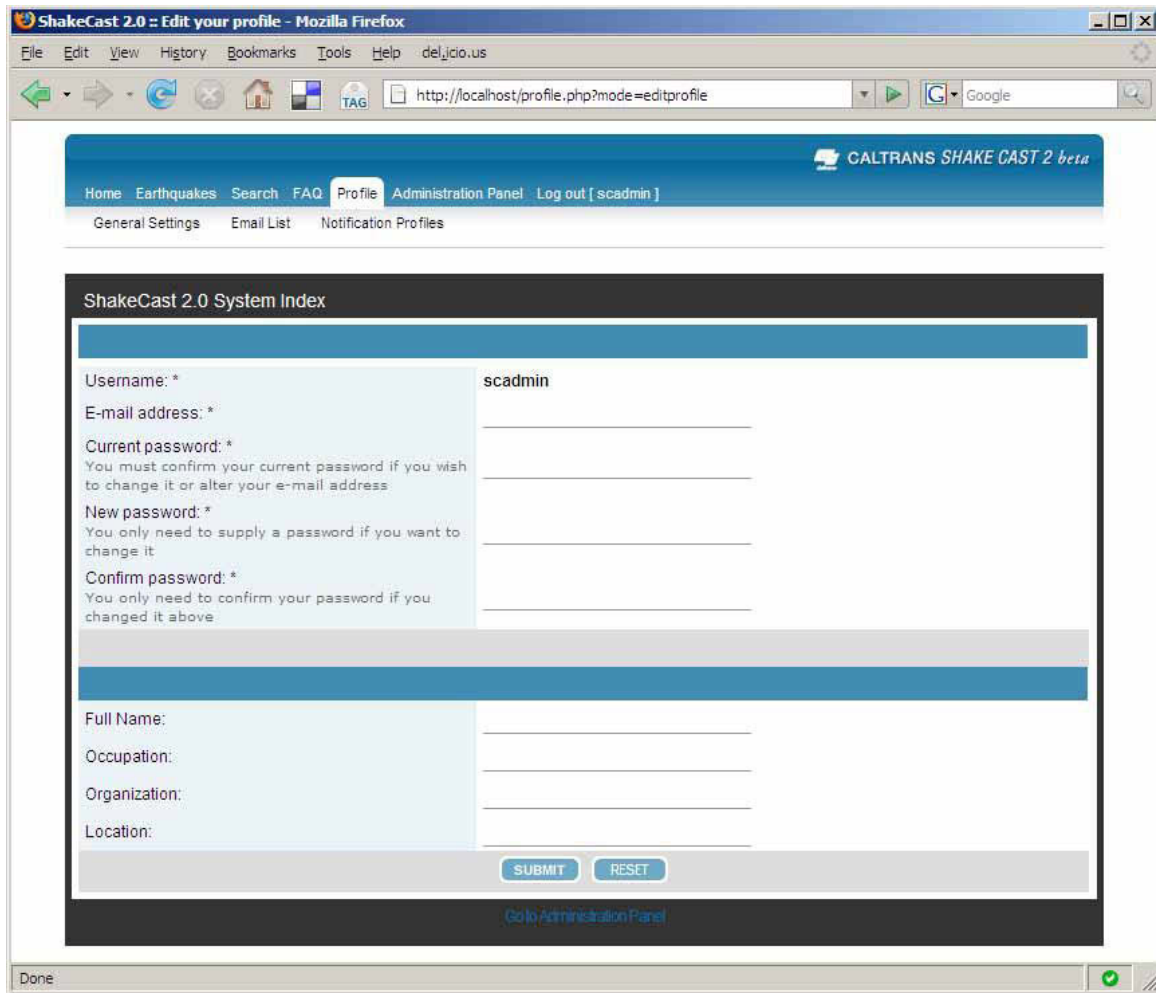


Figure 3.6 The General Settings page displaying editable information for a registered ShakeCast user. The user can use this form to update his/her password and contact information.

- **Email List:** displays an editable list of addresses that the ShakeCast user registered with the system (fig. 3.7). A user can register up to three different addresses for receiving content-rich HTML notification messages, plain text email notifications, or short text paging messages. The default email address will be used for receiving ShakeCast notifications if no custom addresses are specified in this panel. All newly registered delivery addresses are activated by either the user or system administrator. User activation is completed by clicking on an activation link in the confirmation message sent to the new delivery address. Before a delivery address is activated, a lock symbol will appear in the panel and no ShakeCast notifications will be delivered to that address.

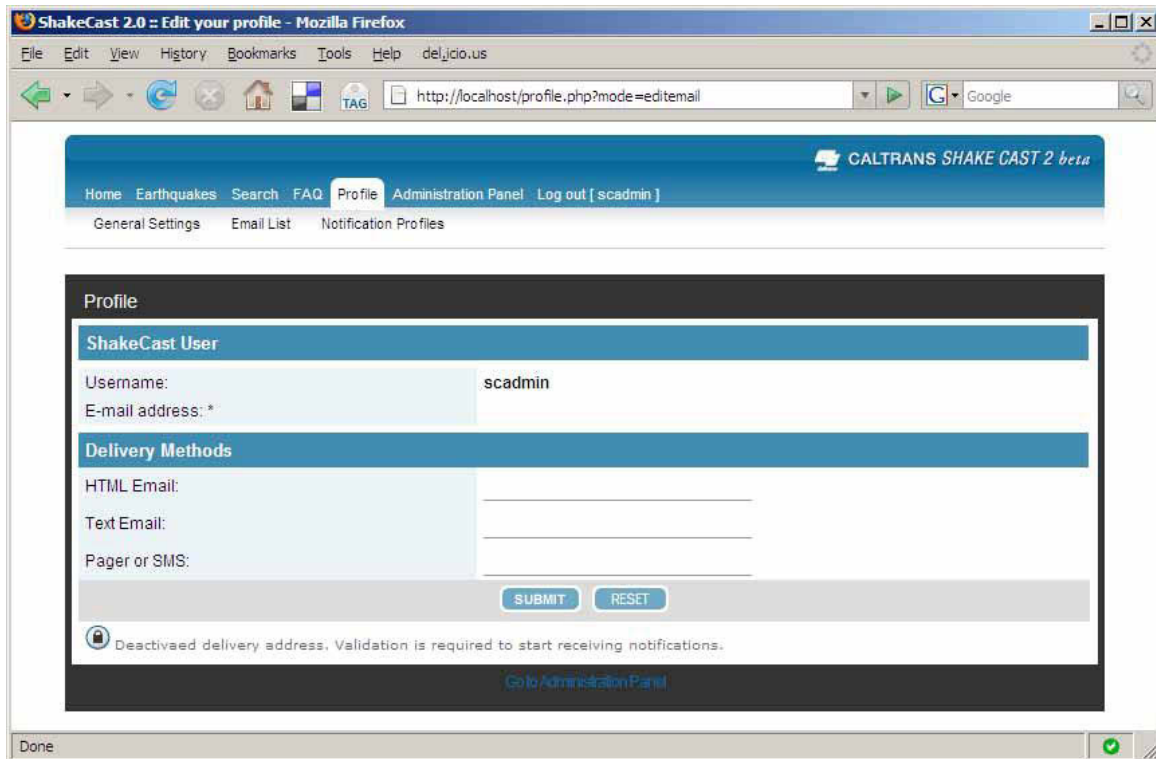


Figure 3.7 The Delivery Methods page displaying user defined email addresses for receiving ShakeCast notification. All new delivery addresses require activation before they can be used to receive notifications.

- **Notification Profiles:** displays a list of selectable notification profiles that are available to the user (fig. 3.8). To add a profile to a user's notification preference, click on the profile to highlight the selection. The coverage area will be shown in the map area. Uncheck a profile from the list to remove it from a user's preference. At the end of profile selections, the user will need to click on the button "Update Notification Profiles" to submit the changes to the ShakeCast database.

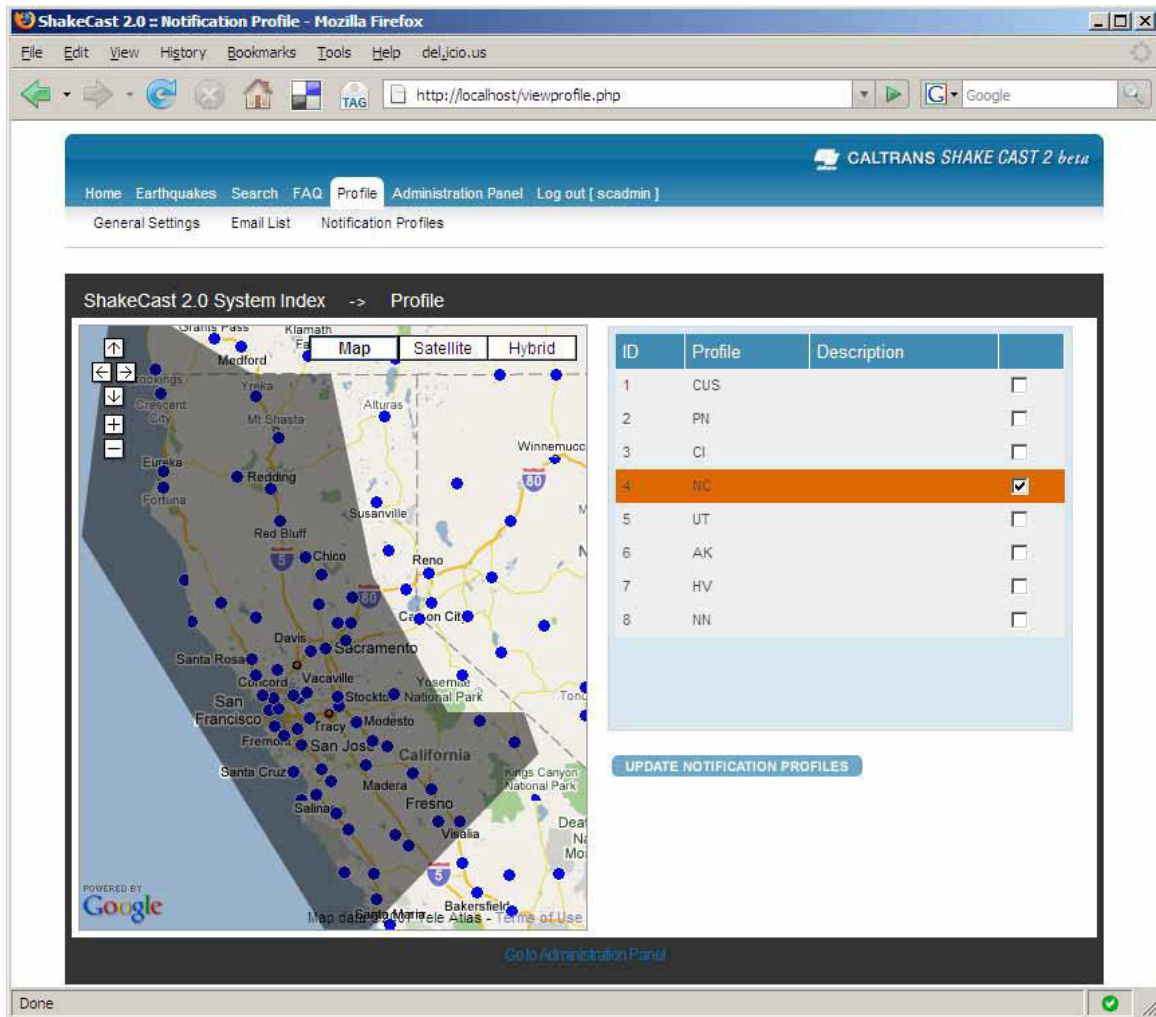


Figure 3.8 The Notification Profiles page displaying a list of predefined notification profiles to the user. A user can subscribe or unsubscribe a profile by checking and unchecking the profile in the table. Changes will take effect after the user submits the form.

3.11 User Registration

By default, a ShakeCast system is preconfigured with restricted access to registered users. The registration process is typically a two step process. In the first step a new user submits contact information to sign up for a new account as shown in figure 3.9 and will receive a confirmation email message for the submitted request. After the ShakeCast administrator receives and approves the request, the user will receive a second approval email message. To activate the account and to log in for the first time, click on the link provided inside the approval message. If a user account is created by an administrator, the new user will simply receive one confirmation email message for account activation.

ShakeCast 2.0 :: Register - Mozilla Firefox

File Edit View History Bookmarks Tools Help del.icio.us

http://localhost/profile.php?mode=register&agreed=true

CALTRANS SHAKE CAST 2 beta

Home Earthquakes Search FAQ Profile Register Log in

General Settings Email List Notification Profiles

ShakeCast 2.0 System Index

Username: *

E-mail address: *

Password: *

Confirm password: *

If you are visually impaired or cannot otherwise read this code please contact the Administrator for help.

1H5FF9

Confirmation code: *

Enter the code exactly as you see it. The code is case sensitive and zero has a diagonal line through it.

Full Name:

Occupation:

Organization:

Location:

SUBMIT RESET

Done

Figure 3.9 The Registration page displaying a form in which the prospective user submits contact information for review. Depending on system configuration, the user will receive one confirmation message for submittal and another for account activation.

4. ShakeCast Administrator Web Interface

This section describes the Administrator Web Interface of ShakeCast. The ShakeCast interface is designed for an administrator to perform common tasks ranging from management of both facility and user inventory to system wide maintenance and configuration. Access to the administrative page is restricted to ShakeCast users with administrative privileges. The range of tasks that can be performed from the interface includes: (1) earthquake/ShakeMap management; (2) system configuration; (3) facility management; (4) notification/profile management; and (5) user account and notification management.

The administrative page view displays a list of system management tasks in the left panel and the work area of the selected task in the right panel. Figure 4.1 shows the default page view when the page is first accessed. The right panel shows the current status of the ShakeCast system: (1) network connection with the upstream USGS server for ShakeMap RSS data feed; (2) system services and summary of process logs; (3) latest processed ShakeMap and notifications; and (4) code version of the current system and available script updates. For each of the first three server system functions, there is a color indicator in either green or red that reflects the status of the function.

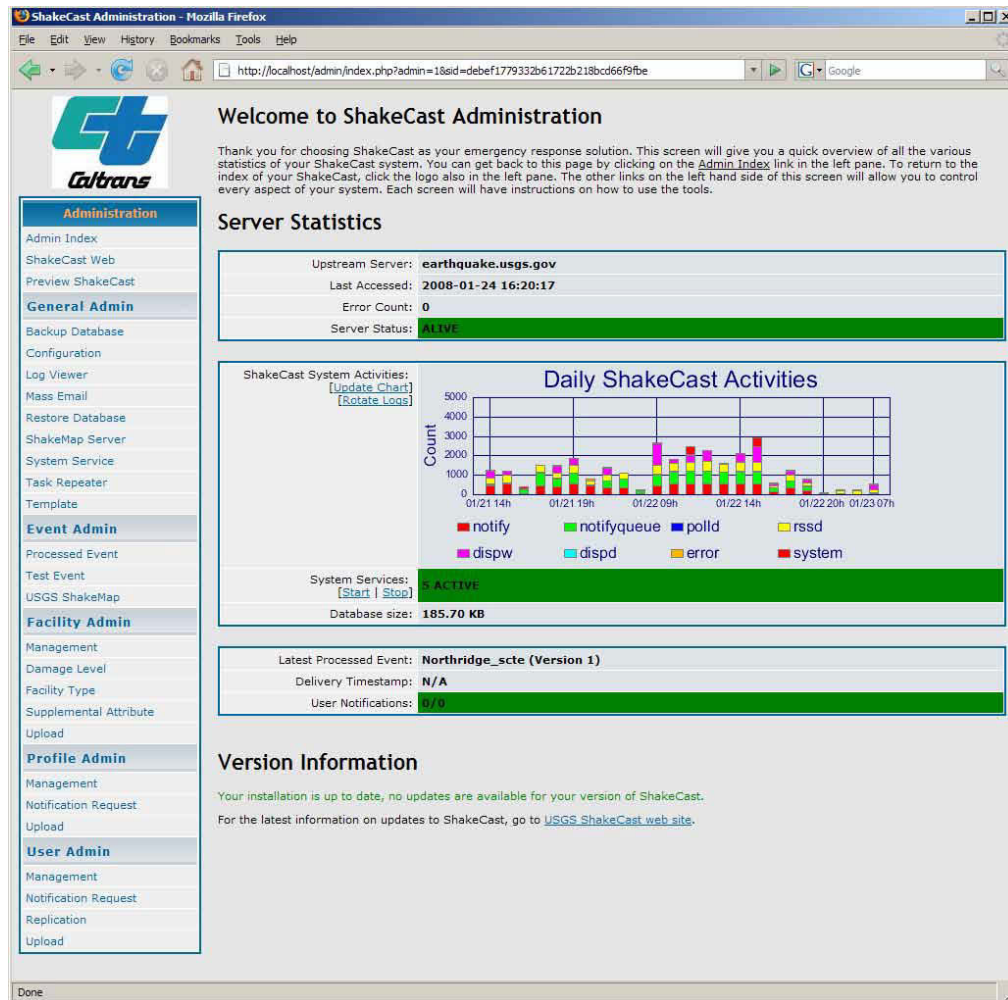


Figure 4.1 Default Web page of the ShakeCast administration interface.

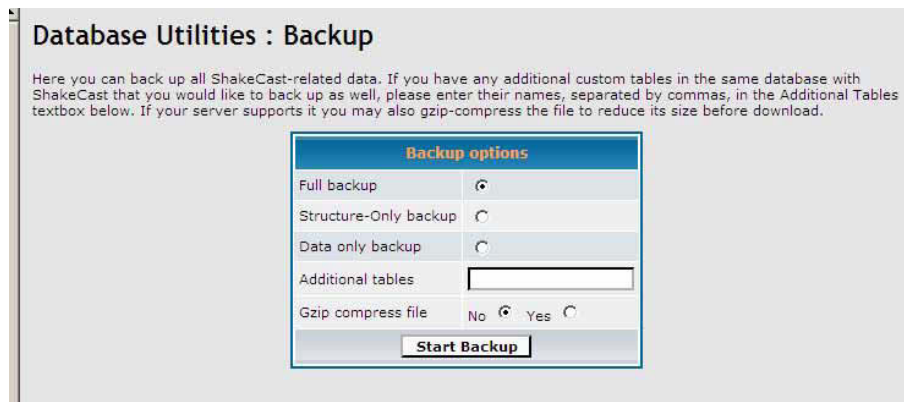
Depending on the level of user privilege the ShakeCast system is configured, the administrator may or may not be able to perform all ShakeCast functions from the administrator Web interface. These limitations apply specifically to ShakeCast functions that require administrator privileges on the local operating system. The ShakeCast administrator Web interface does not cover management for system level services and supporting software. There are currently five ShakeCast daemon services (dispatch, polling, RSS, notify queue, notify processes) and their configuration files that require direct access to the operating system. In addition to the ShakeCast system services, the same restriction also applies to supporting software including the Apache Web server and MySQL database applications. An administrator will need to log on to the server system where the ShakeCast system resides to make changes to the configuration files of applications and to start and stop ShakeCast system processes and supporting software.

4.1 General Administration

The general administration section allows a ShakeCast administrator to manage system wide tasks in six different categories: (1) Backup Database; (2) General Configuration; (3) Log Viewer; (4) Mass Email; (5) Restore Database; (6) ShakeMap Server; (7) System Service; (8) Task Repeater; and (9) Template.

4.1.1 Backup Database

This page allows an administrator to perform backup of the ShakeCast database, consisting of 70 tables. The backup options can be a combination of table structure and data as shown in figure 4.2. The output format is a single file in either plain text or compressed format. The backup copy can be used to restore the system database using the ‘Restore Database’ function described later.



Database Utilities : Backup

Here you can back up all ShakeCast-related data. If you have any additional custom tables in the same database with ShakeCast that you would like to back up as well, please enter their names, separated by commas, in the Additional Tables textbox below. If your server supports it you may also gzip-compress the file to reduce its size before download.

Backup options	
Full backup	<input checked="" type="radio"/>
Structure-Only backup	<input type="radio"/>
Data only backup	<input type="radio"/>
Additional tables	<input type="text"/>
Gzip compress file	No <input type="radio"/> Yes <input checked="" type="radio"/>
<input type="button" value="Start Backup"/>	

Figure 4.2 The database backup page has three backup options: full, structure-only, or data-only. After submitting the form, the administrator can specify the filename and location of the database backup file.

4.1.2 General Configuration

This page displays a list of configurable options of the system. These options include configurations of system identity and user page, session management, and external SMTP server.

System identity. The hostname and port fields describe the URL that a ShakeCast user will use to access the system (fig. 4.3). Each hostname requires a unique API key from the Google Maps server. User-related settings include account activation, access control, and Web page style.

Figure 4.3 The general configuration page handling system-wide options regarding system identity and policy settings.

Cookie settings. ShakeCast implements session control via a cookie stored on the user's Web browser during log-in. The administrator can use this setting (fig. 4.4) to configure the time period for each successful log-in.

Figure 4.4 The cookie settings determining the time window for persistent log-in and system identification on the remote system.

Email settings. This form contains information on the Email server (fig. 4.5) that the ShakeCast system or administrator uses to send email to the end users. This configuration also updates the settings of SMTP server information in “sc.conf” that the ShakeCast system uses to send email notifications. A utility script “sync_conf.pl” is included for synchronization of configuration settings.

Figure 4.5 The Email Settings Block holding information of the email server for all email messages sent from the administrative interface.

4.1.3 Log Viewer

Figure 4.6 displays a list of log files that are available for viewing inside the ShakeCast log directory. The log directory is configurable under the **System Service** link described later in this section. Each log file row contains information regarding the filename, file size, and other ShakeCast services that are related to the log file. The only available function for a log file is **View**.

Log File Viewer			
Here you can view log entries of ShakeCast related log files under the ShakeCast log directory. Service filter is designed for filtering specific system service of ShakeCast process logs and does not apply to Apache or other log files.			
Log File	File Size	Description by Service	Action
sc.log	6.68 MB	LogFile Logrotate_logfile Poller_LOG rss_LOG Dispatcher_LOG	View
sc_access.log	2.21 MB	Logrotate_logfile	View
sc_error.log	126.42 KB	Logrotate_logfile	View
slow-query.log	1.67 MB		View

Figure 4.6 The ShakeCast Log File Viewer page listing available log files for viewing.

The administrator can click on the **View** link to review the content of the selected log file (fig. 4.7). By default, up to 500 most recent entries of the selected log file will be displayed in the view pane in ascending order. There are three viewing options on the bottom of the view pane for fine-tuning the listing order of log entries, filtering of ShakeCast services, and changing the number of displayed log entries.

Log File Viewer: sc.log

Here you can view log entries of ShakeCast related log files under the ShakeCast log directory. Service filter is designed for filtering specific system service of ShakeCast process logs and does not apply to Apache or other log files.

Index	Log Entry
1>	2008-01-24 09:39:28 notify[5256]: 0 <GRIDS> notification(s) attempted; 0 accepted
2>	2008-01-24 09:39:28 notify[5256]: 0 <DAMAGE> notification(s) attempted; 0 accepted
3>	2008-01-24 09:39:28 notify[5256]: 0 <EVENTS_PROFILE> profile notification(s) attempted; 0 accepted
4>	2008-01-24 09:39:28 notify[5256]: 0 <PRODUCTS_PROFILE> profile notification(s) attempted; 0 accepted
5>	2008-01-24 09:39:28 notify[5256]: 0 <GRIDS_PROFILE> profile notification(s) attempted; 0 accepted
6>	2008-01-24 09:39:28 notify[5256]: 0 <DAMAGE_PROFILE> profile notification(s) attempted; 0 accepted
7>	2008-01-24 09:39:28 notify[5256]: 0 notification(s) processed
8>	2008-01-24 09:39:56 rssd[1208]:
9>	2008-01-24 09:39:56 rssd[1208]: server->send(http://earthquake.usgs.gov/eqcenter/shakemap/shakerss.php)
498>	2008-01-24 09:55:08 notifyqueue[2968]: last grid seq = 451; max seq = 451
499>	2008-01-24 09:55:08 notifyqueue[2968]: no new grids
500>	2008-01-24 09:55:08 notifyqueue[2968]: 0 total request(s) queued

Reverse Listing: ☐ Yes ☒ No | Service Filter: ▼ # Lines: 500 Lines Submit

- Dispatcher
- Poller
- Notify Queue
- Notifier
- RSS

All times are GMT

Figure 4.7 The ShakeCast Log File Viewer page for a selected log file. Selectable viewing options are located at the bottom of the view pane and consist of three options: Reverse Listing, Service Filter, and # Lines.

4.1.4 Mass Email

This page displays a form (Figure 4.8) for the administrator to compose an email message for delivery to the registered users.

3. Server ID 1302 is the upstream USGS Web server that hosts ShakeMap products for real time notifications. The USGS Web server consists of a cluster of servers, and the content of each server is cached by a commercial vender (Alkamai) for the purpose of rapid dissemination of information and robustness.

The new ShakeCast system also supports the server-client configuration of the original ShakeCast system. The administrator can consult documentation of Version 1 for details. Available functions for each server are **Edit**, **Delete**, and **Password**.

ShakeCast Server Administration

From this control panel you can add, edit, and remove servers.

ID	DNS Address	Organization	Last Heard From	Status	Error Count	Upstream	Downstream	Poll	Query	Self	Action
1	localhost		2007-11-07 02:17:02	ALIVE	0	1					Edit Delete Password
1000	localhost		2006-12-08 16:21:58	ALIVE	0					1	Edit Delete Password
1302	earthquake.usgs.gov		2007-11-07 16:53:26	ALIVE	0	1	0	0	1	0	Edit Delete Password

[Add new server](#)

Figure 4.10 The ShakeCast Server Administration page listing available servers and their current status. The system comes with three default server settings and should not be altered.

Edit. The server form (fig. 4.11) contains server related information including identification and permitted functions.

Server Settings

ID*

DNS Address*

Organization

Upstream ☒ Yes

Downstream ☐ Yes

Poll ☐ Yes

Query ☐ Yes

Figure 4.11 The Server Settings page for adding and editing servers to the ShakeCast database.

Delete. Remove information on the server entry from the database.

Password. Configure a password for accessing the designated server as shown in figure 4.12. Neither Server ID 1000 (local system) nor 1302 (USGS Web server) require a password for access. The system has a preconfigured password for incoming password for Server ID 1 (injection system). Any changes to the incoming password for a server will update the password file “sc-servers” for authentication by the Apache Web server.

Server Password Settings	
Server	localhost (ID: 1)
Password	<input type="password"/>
Re-type Password	<input type="password"/>
<input type="button" value="Update Outgoing Password"/> <input type="button" value="Update Incoming Password"/>	

Figure 4.12 The Server Password Configuration page. It is reserved primarily for backward compatibility with the Version 1 ShakeCast system.

4.1.7 System Service

This page displays a list of configurable options for the system that dictates the behaviors of both ShakeCast system services and command line utilities. Changes of system service settings will be carried over to the plain file equivalent “sc.conf” file under the ShakeCast configuration directory. The only exception is the access and authentication information for the ShakeCast database, which is kept solely in the “sc.conf” file. It is recommended to restart ShakeCast services to force reload of configurations on changes specific to the system services.

Warning: Misconfigured system options will result in failed ShakeCast system services and utilities.

General system service settings. Figure 4.13 shows systemwide configurations for the ShakeCast installation. These options include directories for ShakeCast root, data, notification template, log file, etc. Additional run-time information includes logging level, and user and group ID, if applicable. Each hostname requires a unique API key from the Google Maps server. The “Threshold” field is a new option that only applies to system version 2.0.1 and later. It is an option to trigger ShakeCast processes for ShakeMap updates only if changes of ground motion measures exceed the specified threshold in percentage ratio. The “Threshold” option is disabled if the field is left blank.

System Service Configuration

The form below will allow you to customize all the system service options of the ShakeCast system. Use the related links on the left hand panel for configurations of specific inventory groups.

Warning: Make sure to restart system services after making changes to the settings. Incorrect settings can cause break down of system services.

General System Service Settings	
These details define how system services function on the local system. In most cases the default values for the system service settings should be sufficient, but if you need to change them do so with care.	
Root Directory	c:/shakecast/sc
Data Root Directory	c:/shakecast/sc/data
Notification Template Directory	c:/shakecast/sc/templates
Log File Directory	c:/shakecast/sc/logs
Log File	sc.log
Threshold Exceed % changes in metric vlaues between two ShakeMap updates	
Log Level	4
User ID	www
Group ID	www

Figure 4.13 The General System Service Settings page handling system-wide options regarding all ShakeCast system services and command line utilities.

Local injection server settings. The form (fig. 4.14) contains information on the local server for injecting ShakeMaps into the database and triggering ShakeCast processes. Changes to the settings of the local injection server are usually not needed.

Local Injection Server Settings	
Local server destination must be defined as part of the automatic process of ShakeMaps.	
Local Server ID	1
Hostname	localhost
Password	scadmin

Figure 4.14 The Local Injection Server Settings determining the destination server and authentication information on the remote system.

Web server access control. This form contains information of the Apache Web server (fig. 4.15) which the ShakeCast system or administrator uses to generate password entries for access control. By default, the ShakeCast system is preconfigured with access control for server-to-server communications (including the default local server). User authentication is by default handled by the portal page. To enable or disable the access control settings, the administrator will need to edit the Apache configuration file directly.

Web Server Access Control	
Supplemental information for the Apache Web Server and its authentication schemes. By default, authentication is required for server-to-server communication and not required for user access (authenticated via the PHP Web Interface). No restart of system services is needed.	
HtPassword Path	C:/Program Files/Apache Group/Apache2/b
Server Password File	c:/shakecast/sc/userdb/sc-servers
User Password File	c:/shakecast/sc/userdb/sc-users

Figure 4.15 The Web Server Access Control holding information of the Apache Web server for access control.

Dispatcher service. This form contains information of the ShakeCast Dispatcher Service (fig. 4.16). The Dispatcher Service is a background process that manages worker processes for both incoming and outgoing service requests.

Dispatcher Service	
The Dispatch Daemon (dispd) queues and dispatches requests to either get files from remote servers (including local server) or send new events, shakemaps, or products to remote servers. Restart of service is required.	
Autostart	<input checked="" type="radio"/> Yes <input type="radio"/> No
Log File	c:/shakecast/sc/logs/sc.log
Logging Level	1
Maximum Number of Workers	20
Minimum Number of Workers	2
Polling	1
Port	53456
Prompt	dispd>
Request Port	58164
Service Name	dispd
Service Title	ShakeCast Dispatcher
System Polling	1
Worker Port	58163
Worker Timeout	3600

Figure 4.16 The Dispatcher Service holding information of the ShakeCast Dispatcher process.

Polling service. This form contains information of the ShakeCast Polling Service (fig. 4.17). The Polling Service is a background process that routinely polls ShakeMap information from remote ShakeCast servers specified in the “ShakeMap Server” block described earlier in this section.

Polling Service	
The Polling Daemon (polld) polls from a list containing all the servers that should be polled for new data (non-RSS). Each of these servers is polled in turn and, if there are any errors, an empty list is returned. Restart of service is required.	
Autostart	<input checked="" type="radio"/> Yes <input type="radio"/> No
Log File	c:/shakecast/sc/logs/sc.log
Log Level	2
Message Level	2
Polling	120
Port	53457
Prompt	polld>
Service Name	polld
Service Title	ShakeCast Polling Daemon
System Polling	10

Figure 4.17 The Polling Service holding information of the ShakeCast Polling process.

Notification queuing service. This form contains information of the ShakeCast Notification Queuing Service (fig. 4.18). The Notification Queuing Service is primarily a background process but can be invoked from the command line. The process scans the database at the specified Scan Period (in seconds) for new ShakeMaps and creates notification queues based on the notification requests stored in the database.

Notification Queuing Service	
The Notification Queuing Daemon (notifyqueue) scans for notifications and queue them. Restart of service is required.	
Log Level	2
Scan Period	60
Service Title	ShakeCast Notification Generator
System Polling	10

Figure 4.18 The Notification Queuing Service holding information of the ShakeCast Notification Queuing process.

Notification service. This form contains information of the ShakeCast Notification Service (fig. 4.19). Like the Notification Queuing Service, the Notification Service is primarily a background process but can be invoked from the command line. The process scans the database at the specified Scan Period (in seconds) for new notification queues then assembles and delivers notifications to users who subscribe to ShakeCast notifications.

Notification Service	
The Notification Daemon (notify) scans for notifications and deliver them. Restart of service is required.	
Log Level	2
Scan Period	60
Service Title	ShakeCast Notification Distributor
System Polling	10

Figure 4.19 The Notification Service holding information of the ShakeCast Notification process.

RSS service. This form contains information of the ShakeCast RSS Service (fig.e 4.20). The RSS Service is a background process that routinely polls ShakeMap information from the USGS Web Server specified in the “ShakeMap Server” block described earlier this section. In addition to daemon specific information, the administrator can configure the service in the field “ShakeMap Originator Region” to retrieve region specific ShakeMaps. Table 2.1 lists available network codes for ShakeMaps. The field “Earthquake Time Window” is an optional filter that excludes ShakeMaps from being processed if the origin time of the event falls outside the active time window (in days).

RSS Service	
The RSS Daemon (rssd) polls from a list containing all the servers that contains ShakeMap RSS-feed. Each of these servers is polled in turn and, if there are any errors, an empty list is returned. Restart of service is required.	
Autostart	<input checked="" type="radio"/> Yes <input type="radio"/> No
Log File	c:/shakecast/sc/logs/sc.log
Logging Level	1
Message Level	2
Polling	60
Port	53458
Prompt	rssd>
Service Name	rssd
Service Title	ShakeCast RSS Daemon
System Polling	10
ShakeMap Originator Region	ALL
Earthquake Time Window	

Figure 4.20 The RSS Service holding information of the ShakeCast RSS process.

Notification SMTP settings. This form contains information of the email server (fig. 4.21) that the ShakeCast system services use to send email to the end users. A utility script “sync_conf.pl” is included for synchronization of configuration settings.

Notification SMTP Settings	
Email Header From Field	klin@usgs.gov
Email Header Envelope From Field	klin@usgs.gov
SMTP Server Address	gscodenh01.cr.usgs.gov
Default Email Template	default.txt
Default Script Template	default.pl
SMTP Username	
SMTP Password	

Figure 4.21 The NotificationSMTPSettingsService holding information of the email server for all email messages sent by the ShakeCast system services.

Logrotate and logstats settings. This form contains information of both the logrotate and logstats ShakeCast utilities (fig. 4.22). Both command line utilities are ShakeCast add-ons and do not interfere with the core system services. The administrator can invoke the utilities from the DOS Window command line, the ShakeCast administrator default page, or the “Task Repeater” page (described next) as a scheduled task.

Logrotate and Logstats Settings	
These details define how both logrotate and logstats function on the local system. In most cases the default values for the system service settings should be sufficient.	
Logstats Output Directory	c:/shakecast/sc/docs/images
Log Files for Processing	c:/shakecast/sc/logs/sc.log c:/shakecast/sc
Log File Rotating Period	1 week
Log File Maximum File Size	100 M
Number of Rotating Log Files	5
Compressing Log Files	<input checked="" type="radio"/> Yes <input type="radio"/> No
Process Status File	c:/shakecast/sc/logs/logrotate.status

Figure 4.22 The Logrotate and Logstats Settings holding information of both the logrotate and logstats ShakeCast utilities.

4.1.8 Task Repeater

Figure 4.23 displays a list of scheduled tasks on the local ShakeCast system. The Task Repeater page converts a ShakeCast task request into a Windows Scheduled Task via the system function “schtasks.” Thus, in order to schedule a ShakeCast task, the administrator will need both the username and password on which the ShakeCast software is installed. The available functions for the page are **Run**, **Delete**, and **Add**.

Task Repeater

Here you can view scheduled tasks of your local system. Repeatable tasks from this interface are limited to ShakeCast utilities: heartbeat, logrotate, and logstats. Execution time of a task is based on the clock setting of your local system.

Status	Task Name	Next Run Time	Repeat	Description	Action
	daily	15:30:00, 1/24/2008	Daily	C:\daily.bat	Delete
	heartbeat	08:18:00, 1/25/2008	Daily	perl c:\shakecast\sc\bin\heartbeat.pl	Run Delete
	logrotate	07:40:00, 1/25/2008	Daily	perl c:\shakecast\sc\bin\logrotate.pl	Run Delete
	logstats	07:30:00, 1/25/2008	Daily	perl c:\shakecast\sc\bin\logstats.pl	Run Delete

[Add Task](#)

Figure 4.23 The ShakeCast Task Repeater page listing scheduled tasks on the local system and their run-time information.

Run. Execute the selected task immediately.

Delete. Remove the selected task from the local system.

Add. The editable form shown in figure 4.24 allows the ShakeCast administrator to schedule new tasks on the local system. Tasks available to schedule include heartbeat, logrotate, logstats, shake_fetch, and tester. Only one scheduled task is permitted for a unique task type. Additional command line options are needed for both shake_fetch and tester tasks. See Section 6.9 on required parameters for shake_fetch and Section 6.11 for tester.

Task Repeater

Here you can view scheduled tasks of your local system. Repeatable tasks from this interface are limited to ShakeCast utilities: heartbeat, logrotate, and logstats. Execution time of a task is based on the clock setting of your local system.

Add Task

Task Name:

Command Line Parameters:

Event options are required for both shake_fetch and tester

Next Run Time:

Repeat:

Username:

Password:

[Submit](#)

Figure 4.24 The Task Repeater Add page. The administrator can create scheduled tasks from five ShakeCast service utilities: heartbeat, logrotate, logstats, shake_fetch, and tester.

4.1.9 Template

Figure 4.25 displays a list of configurable notification templates that are available for the system. The templates are categorized in six different notification types, and each notification type consists of five different delivery methods—a total of 30 template variations. The six notification types are “Cancel Event,” “New Event,” “Updated Event,” “New Product,” “Facility Shaken,” and

“Facility Damage.” The five different delivery methods are “Pager”, “HTML Email”, “Text Email”, “Voice”, and “Script.” In addition to the default template, the administrator can create custom templates for any template variant. Each defined template is divided into three sections, the header, body, and footer, and files reside in the “templates” directory. This configuration does not apply to the ShakeCast Web pages. The available functions for each defined template are: **View**, **Edit**, and **Delete**.

ShakeCast Template Administration

From this control panel you can add, edit, and remove templates.

Notification Type	Message Type	File Name	Description	Action
Cancel Event	Text Email	default		View Edit Delete
New Event	Pager	default		View Edit Delete
New Event	Text Email	default		View Edit Delete
New Event	HTML Email	default		View Edit Delete
New Event	Script	default		View Edit Delete
Updated event	Pager	default		View Edit Delete
Updated event	Text Email	default		View Edit Delete
Updated event	HTML Email	default		View Edit Delete
Facility Shaken	Text Email	default		View Edit Delete
Facility Shaken	HTML Email	default		View Edit Delete
Facility Shaken	Script	default		View Edit Delete
New Product	Text Email	default		View Edit Delete
New Product	HTML Email	default		View Edit Delete
Facility Damage	Pager	default		View Edit Delete
Facility Damage	Text Email	default		View Edit Delete
Facility Damage	HTML Email	default		View Edit Delete
Facility Damage	Script	default		View Edit Delete

[Add new template](#)

Figure 4.25 The ShakeCast Template Administration page listing available templates for sending notifications.

View. Show the content of the selected template (fig. 4.26).

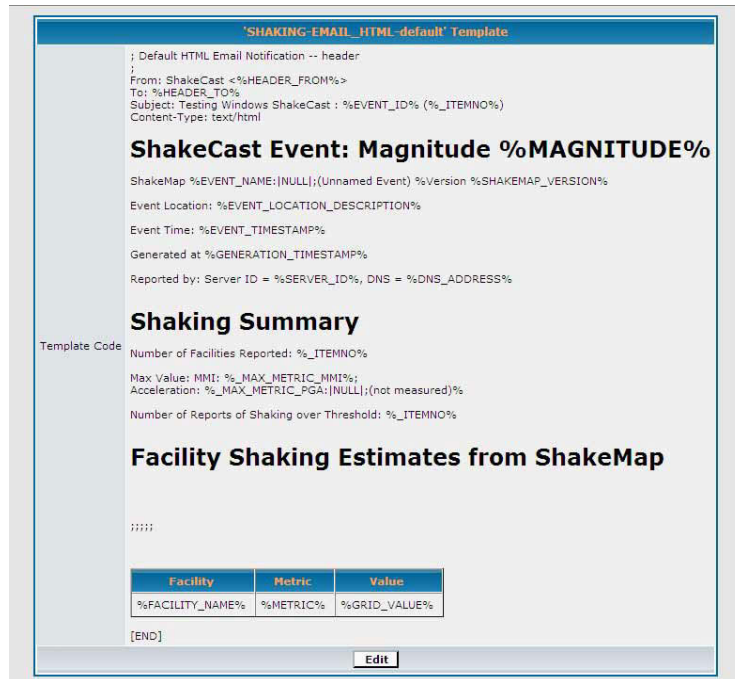


Figure 4.26 The ShakeCast Template Preview page. Each template file consists of three segment files: the header, body, and footer. It displays the layout and keywords embedded in the template file after joining the three individual segments.

Edit. The editable form shown in figure 4.27 allows the ShakeCast administrator to create/edit both existing and new templates. A template variant only allows for one “default” template. Custom templates can be created by giving the template a new template name and filename other than “default.”

Delete. Remove information on the template entry from the database and the local file system.

'SHAKING-EMAIL_HTML-default' Template

Name*

File Name*

Description

Header Section

```

; Default HTML Email Notification -- header
;
From: ShakeCast <%HEADER_FROM%>
To: %HEADER_TO%
Subject: Testing Windows ShakeCast : %EVENT_ID% (%_ITEMNO%)
Content-Type: text/html

<font size=+2><b>ShakeCast Event: Magnitude
%MAGNITUDE%</b></font><br>
ShakeMap %EVENT_NAME|[NULL]|(Unnamed Event) %Version
%SHAKEMAP_VERSION%<br>
Event Location: %EVENT_LOCATION_DESCRIPTION%<br>
Event Time: %EVENT_TIMESTAMP%<br>
Generated at %GENERATION_TIMESTAMP%<br>
Reported by: Server ID = %SERVER_ID%, DNS = %DNS_ADDRESS%

```

Body Section

```

<tr>
<td>%FACILITY_NAME%
<td>%METRIC%
<td>%GRID_VALUE%
</tr>

```

Footer Section

```

</table>
[END]

```

Figure 4.27 The ShakeCast Template Edit page. The administrator can copy and paste a custom design into the editable box for each segment. If given a custom template name other than “default,” the system will create custom template files based on the given template name and register them in the database.

4.2 Event Administration

The **Event Administration** section allows a ShakeCast administrator to manage ShakeMap events in three different categories: (1) processed ShakeMap events; (2) ShakeCast test events; and (3) additional ShakeMap inventory on the USGS Web site.

4.2.1 Processed Event

This page displays a list of both actual and scenario ShakeMaps (fig. 4.28) that have been processed by ShakeCast and are present in the database. Available functions for each processed event are **Re-Alert**, **Comment**, and **Delete**.

Re-Alert. The **Re-Alert** function triggers the ShakeCast notification process to re-send notifications to ShakeCast users who were on the recipient list. The list of recipients and facilities is based on the time the event was processed.

ShakeCast Processed Event List						
From this control panel you can add, edit, and remove test events.						
Event ID	Timestamp	Magnitude	Latitude	Longitude	Location Description	Action
2007285_222046 -1	2007-10-12 02:38:43	3.14	38.6006	-118.4494	10.9 miles ENE of HAWTHORNE-NV	Re-Alert Comment Delete
2007282_221806 -1	2007-10-09 13:12:01	3.48	38.4716	-118.5044	7.5 miles ESE of HAWTHORNE-NV	Re-Alert Comment Delete
2007282_221782 -1	2007-10-09 13:12:01	3.18	38.4601	-118.5	8.2 miles ESE of HAWTHORNE-NV	Re-Alert Comment Delete
2007282_221841 -1	2007-10-09 12:32:12	2.9	38.4736	-118.5044	7.5 miles ESE of HAWTHORNE-NV	Re-Alert Comment Delete
2007282_221779 -5	2007-10-09 12:13:15	3.79	38.4801	-118.5002	7.5 miles ESE of HAWTHORNE-NV	Re-Alert Comment Delete
2007hzah_1	2007-10-02 03:43:39	5.7	-4.5294	101.1811	SOUTHERN SUMATRA, INDONESIA	Re-Alert Comment Delete
2007271_220917 -1	2007-09-28 00:23:21	2.94	35.7503	-115.8148	47.4 miles SW of LAS_VEGAS-NV	Re-Alert Comment Delete
2007htai_1	2007-09-26 04:43:16	5.9	-3.8822	-79.1707	NEAR THE COAST OF ECUADOR	Re-Alert Comment Delete
14325560_7	2007-09-25 22:38:23	3.9	33.7372	-117.4705	9.4 mi WNW of Lake Elsinore, CA	Re-Alert Comment Delete
2007268_220640 -1	2007-09-25 06:06:17	3.02	39.0415	-118.555	32.2 miles SSE of FALLON-NV	Re-Alert Comment Delete
14325120_4	2007-09-23 08:13:41	3.5	32.693	-116.0592	4.8 mi SW of Ocotillo, CA	Re-Alert Comment Delete
2007263_220225 -1	2007-09-20 08:49:29	3.67	40.5031	-115.7391	22.7 miles S of ELKO-NV	Re-Alert Comment Delete
2007256_219568 -1	2007-09-13 10:43:30	3.36	40.7815	-116.9227	9.6 miles N of BATTLE_MOUNTAIN-NV	Re-Alert Comment Delete
2007256_219567 -1	2007-09-13 10:30:49	3.37	40.6598	-116.7925	7.4 miles E of BATTLE_MOUNTAIN-NV	Re-Alert Comment Delete

Figure 4.28 The ProcessedEventList page listing all previously processed ShakeMaps for the local system. From here the administrator can view, re-alert, comment, or delete any processed ShakeMap events.

Comment. The **Comment** function (fig. 4.29) allows a ShakeCast administrator to attach additional information to a processed event, via email notification and (or) Web posting. The target of email comment only applies to the list of recipients who received ShakeCast notifications for the specified event.

Comment Event via Email/Web Page

Here you can comment and email a message to either all of your users whom received ShakeCast notifications for the event. To do this, an email will be sent out to the administrative email address supplied, with a blind carbon copy sent to all recipients. If you are emailing a large group of people please be patient after submitting and do not stop the page halfway through. It is normal for a mass emailing to take a long time and you will be notified when the script has completed.

Comment Target : ☐ Email ☐ Web Page

Compose

Recipients Notified ShakeCast Users for this event

Subject Re: ShakeCast Notification for Event 2007285_23

Message

Figure 4.29 The Event Comment page allowing the administrator to add additional information for the specified event for ShakeCast users whom are the recipients of notifications and/or on the ShakeCast portal page for the event.

Delete. The **Delete** function removes all processed information for the specified event including event information, metrics, and notifications from the database. This function is typically used to remove unwanted events from the database and to reprocess selected ShakeCast events. This function does not remove ShakeMap products from the ShakeCast download directory.

4.2.2 Test Event

This page displays a list of processed ShakeMaps that are available for the purpose of local testing (fig. 4.30). To trigger a test event, click on the links in the **Action** column to simulate either a new or an updated event. Notifications generated from test events are sent to ShakeCast users whose notification profiles are configured to also receive test events. To add a processed ShakeCast event to the test event list, click on the “Add new test event” button on the bottom of the page and select an event from a list of processed ShakeCast events. To remove a test event, delete the event from the ShakeCast test event directory on the local file system.

ShakeCast Test Event List						
From this control panel you can add, edit, and remove test events.						
Event ID	Mangitude	Latitude	Longitude	Location Description	Action	
SanGregorio_3_se_scte	7.44	36.805	-122.162	SGF_SGS+SGN	Version 1	Version N+1
200708152340_scte	8	-13.32	-76.51	Off Coast of Central Peru	Version 1	Version N+1
200610151714_scte	6	20.129	-155.983	Big Island Region, Hawaii	Version 1	Version N+1
200610151707_scte	6.7	19.8777	-155.935	Big Island Region, Hawaii	Version 1	Version N+1
200605262253_scte	6.3	-7.955	110.43	Yogyakarta, Indonesia	Version 1	Version N+1
200602222219_scte	7	-21.259	33.48	Mozambique	Version 1	Version N+1
200510080350_scte	7.6	34.465	73.584	Kashmir, Pakistan	Version 1	Version N+1
200503281609_scte	8.6	2.069	97.097	Nias, Sumatra	Version 1	Version N+1
200503200153_scte	6.6	33.802	130.209	Fukuoka, Japan	Version 1	Version N+1
200502220225_scte	6.4	30.691	56.794	Dahuiyeh, Iran	Version 1	Version N+1
200412260058_scte	9	3.287	95.972	Banda Aceh, Sumatra, Indonesia	Version 1	Version N+1
200411150906_scte	7.2	4.691	-77.509	Buenaventura, Colombia	Version 1	Version N+1
200410220056_scte	6.6	27.22	120.201	Miitaka, Japan	Version 1	Version N+1

Figure 4.30 The ShakeCast Test Event List page listing available test events residing on the local system. From this interface, an administrator can trigger a local test event or convert a processed ShakeMap into a test event.

4.2.3 USGS ShakeMap

This interface retrieves a list of both actual and scenario ShakeMaps from the USGS Web site that are available for download and process as shown in figure 4.31. The two available options for a ShakeMap event are **Download Only** and **Inject**. The **Download Only** function retrieves all available products for a ShakeMap and stores them in the ShakeCast data directory on the server system. The **Inject** function performs the same **Download Only** function plus an additional ShakeCast process for the ShakeMap event, as for the real-time RSS system process. The **Inject** function is different from the RSS process in that it is not restricted to the ShakeMap region directive of the RSS process and that it can also process scenario ShakeMaps. The ShakeCast administrator should use the **Inject** function with caution since the process treats actual USGS ShakeMaps as real events.

ShakeMap Event List on the USGS web site

From this control panel you can view, download, inject ShakeMaps on the USGS web site.

Actual Events : [S. California](#) | [N. California](#) | [Pacific NW](#) | [Nevada](#) | [Utah](#) | [Hawaii](#) | [Global](#)
Scenario Events : [S. California](#) | [N. California](#) | [Pacific NW](#) | [Nevada](#) | [Utah](#) | [Alaska](#) | [Hawaii](#) | [Global](#)

Event ID	Network	Action
2007imal	global	Download Only Inject
2007288_222252	nn	Download Only Inject
2007ikbb	global	Download Only Inject
93394	ak	Download Only Inject
2007285_222046	nn	Download Only Inject
2007iiaa	global	Download Only Inject
2007iibu	global	Download Only Inject
2007iia5	global	Download Only Inject
2007ihac	global	Download Only Inject
2007iqa7	global	Download Only Inject
2007282_221806	nn	Download Only Inject
2007282_221782	nn	Download Only Inject
2007282_221841	nn	Download Only Inject
2007282_221779	nn	Download Only Inject
2007ifbt	global	Download Only Inject
2007ifbi	global	Download Only Inject
2007ida2	global	Download Only Inject
2007icah	global	Download Only Inject

Figure 4.31 The USGS ShakeMap page listing available ShakeMaps on the USGS Web server for both actual and scenario events. From this interface the administrator can download and inject the ShakeMap directly into the local ShakeCast system. This function overwrites the REGION directive in the system configuration and will process ShakeMaps for actual events as real events. It will skip events that have already been processed.

4.3 Facility Administration

The **Facility Administration** section handles facility-specific interaction with the ShakeCast system. This management section is divided into five categories: (1) Damage Level; (2) Facility Type; (3) Facility Management; (4) Supplemental Attributes; and (5) Upload. Changes made in the four categories have different scopes of influence. The **Damage Level** settings apply to all facilities in the ShakeCast database. Settings for both **Facility Type** and **Supplemental Attributes** are defined for specific structure types. Finally, **Facility Management** allows management of facility-specific information. It is worth noting that any changes made to **Damage Level** and **Facility Type** will not affect corresponding settings for existing facilities inside the database and will only apply to new facilities. In addition to manual editing of facility settings, the administrator can use the “manage_facility.pl” tool to refresh settings of all facilities via batch processing.

4.3.1 Damage Level

This page displays a list of available damage state descriptions for facilities (fig. 4.32). The ShakeCast system is preconfigured with a four-level damage classification. The number of damage levels is flexible and the ShakeCast administrator can create additional damage states for custom needs. Although defined damage levels are available to all facilities for damage assessment, it is not necessary to specify the range of ground intensity measures for all damage levels for a given

facility. Unspecified damage levels of a facility will simply not be used to measure the damage state for the facility.

ShakeCast Damage Level Administration

From this control panel you can add, edit, and remove damage levels.

Damage Level	Name	Description	Severity Rank	Max Severity	Action
GREEN	Damage Unlikely or Slightly	Damage is not likely to the facility.	100		Edit Delete
YELLOW	Moderate Damage Possible	This facility has possibly suffered damage.	200		Edit Delete
ORANGE	Extensive Damage Possible	This facility has possibly suffered extensive damage.	300		Edit Delete
RED	Complete Damage Possible	This facility has probably suffered damage.	400	Yes	Edit Delete
Add new damage level					

Figure 4.32 The Damage Level Administration page listing defined damage levels on the local server. The ShakeCast system has prebuilt four damage level settings that match the HAZUS damage level settings. If custom damage levels are added to the system, the administrator should recheck the integrity of the default fragility settings for existing facilities.

4.3.2 Facility Type

This page displays a list of available definitions for structure types of facilities (fig. 4.33). Each facility type includes a set of optional fields of default fragility settings. The ShakeCast system comes with default fragility settings for 128 choices of HAZUS model building type and code era (see the document “HAZUS Damage Level” for detailed definitions). The database also contains definitions of common geotechnical structures, but includes no fragility settings. ShakeCast users can define custom structure types for their facilities. To define damage states for a given facility type as shown in figure 4.34, the ShakeCast administrator will need to provide the range of high and low values of the described damage level and the metric of ground intensity measure.

ShakeCast Facility Type Administration

From this control panel you can add, edit, and remove facility type specific parameters and fragilities.

Facility Type	Name	Description	Action
C1HH	C1H High Code	C1H High Code	Edit Delete
C1HM	C1H Moderate Code	C1H Moderate Code	Edit Delete
C1HL	C1H Low Code	C1H Low Code	Edit Delete
C1HP	C1H Pre Code	C1H Pre Code	Edit Delete
C1MH	C1M High Code	C1M High Code	Edit Delete
C1MM	C1M Moderate Code	C1M Moderate Code	Edit Delete
C1ML	C1M Low Code	C1M Low Code	Edit Delete
C1MP	C1M Pre Code	C1M Pre Code	Edit Delete
C1LH	C1L High Code	C1L High Code	Edit Delete
C1LM	C1L Moderate Code	C1L Moderate Code	Edit Delete
C1LL	C1L Low Code	C1L Low Code	Edit Delete
C1LP	C1L Pre Code	C1L Pre Code	Edit Delete
C2HH	C2H High Code	C2H High Code	Edit Delete
C2HM	C2H Moderate Code	C2H Moderate Code	Edit Delete
C2HL	C2H Low Code	C2H Low Code	Edit Delete

Figure 4.33 The Facility Type Administration page of the ShakeCast administration interface. The ShakeCast comes with more than 150 predefined common facility types. Custom defined facility types can be added from this interface.

ShakeCast Facility Type Administration

From this control panel you can add, edit, and remove facility type specific parameters and fragilities.

Facility Type Information

Facility Type:

Name:

Description:

Damage Level	Low Limit	High Limit	Metric
Damage Unlikely or Slightly	<input type="text" value="0"/>	<input type="text" value="25"/>	<input type="text" value="Peak Ground Acceleration (%g)"/>
Moderate Damage Possible	<input type="text" value="25"/>	<input type="text" value="71"/>	<input type="text" value="Peak Ground Acceleration (%g)"/>
Extensive Damage Possible	<input type="text" value="71"/>	<input type="text" value="155"/>	<input type="text" value="Peak Ground Acceleration (%g)"/>
Complete Damage Possible	<input type="text" value="155"/>	<input type="text" value="99999"/>	<input type="text" value="Peak Ground Acceleration (%g)"/>

Figure 4.34 The Facility Type Editing page. ShakeCast comes with default fragility settings for common building types, code level, and code era. Custom fragility settings can be added via the facility type editing page.

4.3.3 Management

This page displays a list of user-defined facilities populated in the ShakeCast database (fig. 4.35). From this view the administrator can create new facilities and manage information of

existing ones. When updating the facility inventory, the administrator can also remove the system cache of facility image tiles by checking the “Clear Cache” checkbox. The button **Export Facility** will convert the current facility inventory into a standard CSV formatted text files including fragility settings and facility specific attributes. The format of the file is described in detail in Section 6.5. An exported facility file can be imported back to the ShakeCast database via either the **Upload** function (described later this section) or the command line utility “manage_facility.pl” (see Section 6.5).

Required fields for a user-defined facility include facility name, facility type, and location in latitude and longitude (fig. 4.36). Facility location can be either a point location or a rectangular area. Fragility settings for a facility are needed for damage estimates. Custom fragility settings for a facility, either in values and (or) choices of metric, will override the default settings for the given facility type. For ShakeCast systems with large inventories of facilities, the administrator can use either the **Upload** function or the system utility “manage_facility.pl” to populate new facilities and to update/remove existing ones.

ShakeCast Facility Administration

From this control panel you can add, edit, and remove facilities. Predefined facility fragility setting values include 15% amplitude adjustment from mean to peak values.

ID	Type	Facility Name	Description	Latitude	Longitude	Action	Select
13174	ERTH	1-13 FERN LAKE	STATUS=JURIS, OWN=SONOMA DEVELOPMENTAL CENTER, PH=707-938-6000, HGH= 40, CAP= 241	38.343 <-> 38.343	-122.53 <-> -122.53	Edit	<input type="checkbox"/>
13175	ERTH	1-14 VETERANS HOME	STATUS=JURIS, OWN=STATE DEPT OF VET AFFAIRS, PH=707-944-4600, HGH= 47, CAP= 39	38.392 <-> 38.392	-122.377 <-> -122.377	Edit	<input type="checkbox"/>
13176	ERTH	1-16 MOUNT STONEMAN	STATUS=JURIS, OWN=CALIFORNIA DEPARTMENT OF CORRECTIONS, PH=916-358-2669, HGH= 43, CAP= 33	38.698 <-> 38.698	-121.15 <-> -121.15	Edit	<input type="checkbox"/>
13177	ERTH	1-18 SUTTENFIELD	STATUS=JURIS, OWN=STATE OF CALIFORNIA, PH=707-938-6000, HGH= 76, CAP= 600	38.355 <-> 38.355	-122.512 <-> -122.512	Edit	<input type="checkbox"/>
13178	ERTH	1-21 RECTOR CREEK	STATUS=JURIS, OWN=STATE DEPT OF VET AFFAIRS, PH=707-944-4600, HGH= 164, CAP= 4587	38.442 <-> 38.442	-122.345 <-> -122.345	Edit	<input type="checkbox"/>
13221	ERTH	1-90 RED LAKE	STATUS=JURIS, OWN=CALIFORNIA DEPARTMENT OF FISH & GAME, PH=530-757-8412, HGH= 35, CAP= 1410	38.7 <-> 38.7	-119.968 <-> -119.968	Edit	<input type="checkbox"/>

☐ Clear Cache

Figure 4.35 The Facility Administration page displaying a list of user-defined facilities on the local system. Available options for facility management are **Add**, **Edit**, or **Delete**.

ShakeCast Facility Administration

From this control panel you can add, edit, and remove facilities. Predefined facility fragility setting values include 15% amplitude adjustment from mean to peak values.

Edit Facility Information

Facility Name

Short Name

Facility Type

Facility Description

Latitude

Longitude

Damage Level	Low Limit	High Limit	Metric
Damage Unlikely or Slightly	<input type="text" value="1"/>	<input type="text" value="5"/>	<input type="text" value="Instrumental Intensity"/>
Moderate Damage Possible	<input type="text" value="5"/>	<input type="text" value="7"/>	<input type="text" value="Instrumental Intensity"/>
Extensive Damage Possible	<input type="text"/>	<input type="text"/>	<input type="text" value="Instrumental Intensity"/>
Complete Damage Possible	<input type="text" value="7"/>	<input type="text" value="999999"/>	<input type="text" value="Instrumental Intensity"/>

Facility Attribute

ADMIN_REGION

Figure 4.36 The Facility Editing page displaying a form containing facility-specific information and optional fragility-setting information, either default or custom values.

4.3.4 Supplemental Attribute

This page displays a list of defined attributes associated with structure types. The supplemental attribute block is a free-form field and multiple fields are permitted. It is designed to store specific information for facility types that are not commonly shared among facilities.

4.3.5 Upload

This page displays a dialog for the administrator to upload a facility file into the database as shown in figure 4.37. A facility file can be generated from the ShakeCast facility export function or from common spreadsheet applications such as Excel. This interface uses the “manage_facility” utility to process uploaded facility data. Available process options are Replace, Insert, Delete, Update, and Skip. Detailed descriptions of these options and input file formats are included in Section 6.5.

Facility Database Utilities : Upload

This will perform a full update of related tables from a saved file. You may upload a comma separated inventory file and it will automatically be imported. **WARNING:** This will overwrite any existing data. The upload may take a long time to process, so please do not move from this page until it is complete.

Select a file

Process mode - default Replace

Process mode - default Replace

Replace - Insert new facilities and replace existing ones.

Insert - Insert new facilities.

Delete - Delete facilities.

Update - Update existing facilities.

Skip - Insert facilities not in the database.

Browse... Start Upload

Figure 4.37 The Facility Upload page. The source of facility file can be from a previously exported facility file or in a standard facility CSV file. This interface uses the “manage_facility” utility to process uploaded facility data. Available process options are Replace, Insert, Delete, Update, and Skip.

4.4 Profile Administration

A ShakeCast profile can be viewed as a pseudo user who represents a group of users with shared notification requests but different delivery methods. ShakeCast notification profiles are optional for setting up notification for systems with relatively small facility inventory or with a number of users. For larger systems, notification profiles provide an efficient method to limit the growth of the database and to maintain performance of notification processing by aggregating common notifications.

The profile administration section handles management of profiles with respect to both facilities and notification requests. This management section is divided into three categories: (1) management of profile geometry polygons for facility association; (2) notification request for profile; and (3) upload of profiles. As for facility management, there is a command line counterpart of the Web interface, “manage_profile.pl.” For systems with large inventory, the administrator can use the “manage_profile.pl” tool to refresh settings of all profiles via batch processing.

ShakeCast Profile Administration

From this control panel you can add, edit, and remove profile specific parameters and attributes.

ID	Profile Name	Description	Action
17	CUS	Contiguous US	Edit Delete
18	CI	Southern California	Edit Delete
19	NC	Northern California	Edit Delete
20	PN	Pacific Northwest	Edit Delete
21	AK	Alaska Region	Edit Delete
22	UT	Utah Region	Edit Delete
23	HV	Hawaii Region	Edit Delete
24	NN	Nevada Region	Edit Delete

Add new profile

Figure 4.38 The Profile Administration page listing defined profiles on the local system that are available to the ShakeCast users for subscription.

4.4.1 Management

This page displays a list of defined profiles to which a user can subscribe for notification requests (fig. 4.38). Each profile consists of a geometric polygon outlining the region of interest and a set of notification requests for the enclosed facilities. The administrator defines the polygon via the interactive map and with the additional options for selecting rectangular and circular regions (fig. 4.39). Upon submitting the form, a list of facilities enclosed by the geometric boundaries will be assigned to the profile. The list of facilities for a profile is not restricted to the facilities enclosed inside the polygon and can be edited later.

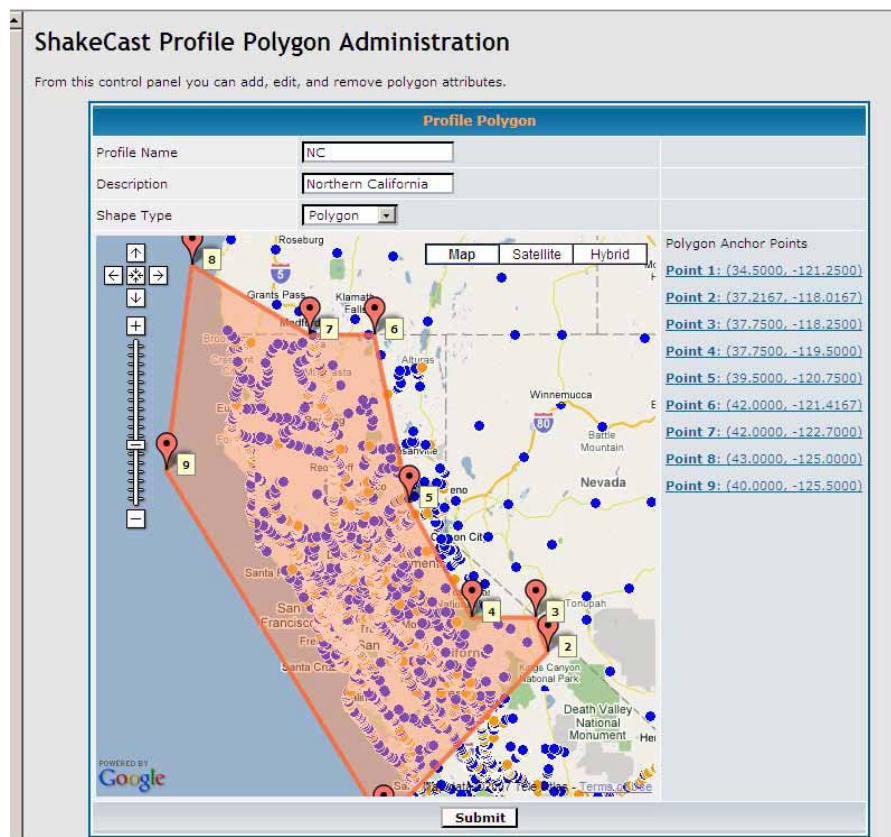


Figure 4.39 The profile polygon page displaying a Google Maps-based GIS interface of a defined polygon for the profile. The administrator can modify the boundaries of the polygon or switch to other geometric forms, including rectangular and circular boundaries.

4.4.2 Notification Request

This page displays a list of available notification requests configured for each profile (fig. 4.40). From this view the administrator can select a profile and edit or remove its notifications.

Profile Notification Request Administration				
From this control panel you can add, edit, and remove profile notification settings				
ID	Profile Name	Description	Notification Settings	Action
17	CUS	Contiguous US	6	Edit Delete
18	CI	Southern California	6	Edit Delete
19	NC	Northern California	6	Edit Delete
20	PN	Pacific Northwest	0	Edit Delete
21	AK	Alaska Region	0	Edit Delete
22	UT	Utah Region	0	Edit Delete
23	HV	Hawaii Region	0	Edit Delete
24	NN	Nevada Region	6	Edit Delete

Figure 4.40 The Profile Notification Request Administration summary page listing available profiles and their notification request settings. The administrator can edit or delete notification request settings associated with a profile from this interface.

When creating a notification request, there are six different notification types to choose from as shown in Figure 4.41. The notification types include “New Event,” “Cancel Event,” “Update Event,” “New Product,” “Facility Shaken,” and “Facility Damage.” It is permitted to define more than one notification request of the same type for a profile. Multiple notification requests can be aggregated into groups as a combined message during the dissemination of notifications, based on users’ requests.

Profile Notification Request Administration													
From this control panel you can add, edit, and remove profile notification settings													
Notification request for Profile: CUS (ID: 17)													
ID	Type	Event Type	Delivery	Template	Limit Value	Damage Level	Product	Metric	Disable	Aggregate	Aggregation Group	Facility	Action
40	Facility Damage	All Types	HTML Email			Damage Unlikely or Slightly				Yes	CITY	10018	Edit Delete
42	Facility Damage	All Types	HTML Email			Complete Damage Possible				Yes	CITY	10018	Edit Delete
41	Facility Damage	All Types	HTML Email			Moderate Damage Possible				Yes	CITY	10018	Edit Delete
37	New Event	All Types	HTML Email									10018	Edit Delete
38	New Product	All Types	HTML Email				GRID_XML					10018	Edit Delete
39	Facility Shaken	All Types	HTML Email		1			Instrumental Intensity		Yes		10018	Edit Delete

Add a Notification Request:

All times are GMT

Figure 4.41 The Notification Request summary page listing defined notification request settings for a profile. The administrator can add, edit or delete specific notification request settings. Facility-based notification requests will affect all facilities enclosed by the profile polygon.

Inside the Notification Request summary view, the available functions are **Add**, **Edit**, **Delete**, and **Facility** selection. To add a new request, use the drop-down menu on the lower left corner of the form to create and configure the request (fig. 4.42). The **Delete** function removes the selected notification request from the database.

All notification request types require information of notification type, event type, and delivery method. For “New Product” type, an additional field of product type is needed. For “Facility Damage” type, the additional required field is damage level. For “Facility Shaken” type, the administrator needs to specify both the metric and the limit value of shaking threshold.

Notification request for Profile: CUS (ID: 17)	
Type: *	Facility Damage
Event Type:	All Types
Delivery: *	HTML Email
Template:	
Damage Level	Damage Unlikely or Slightly
Disable	<input type="checkbox"/>
Aggregate	<input checked="" type="checkbox"/>
Aggregation Group	CITY
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

Figure 4.42 The Notification Request editing page displaying a configurable form for the specified request type. Available notification request types are: “New Event,” “Cancel Event,” “Update Event,” “New Product,” “Facility Shaken,” and “Facility Damage.”

To fine tune the list of facilities for a profile, the administrator can click on the facility link inside the **Notification Request** summary page (fig. 4.43). The profile-facility association view is a set of paged tables with included facilities marked by check marks. The administrator can switch between the subscribed list and the full list of facilities to add and remove facilities from the list. The facility inventory is updated for the profile after the administrator submits the changes.

n add, edit, and remove profile notification settings

Facilities of Notification Request for Profile: CUS (17)					
Subscribed List			Full List		
ID	Type	Facility Name	Latitude	Longitude	Select
1	BRIDGE	Minot Creek	41.5536	-124.0547	<input checked="" type="checkbox"/>
2	BRIDGE	Hunter Creek	41.5581	-124.0589	<input checked="" type="checkbox"/>
3	BRIDGE	High Prairie Creek	41.5683	-124.0689	<input checked="" type="checkbox"/>
4	BRIDGE	Wilson Creek	41.6044	-124.1006	<input checked="" type="checkbox"/>
5	BRIDGE	Smith River (Hiouchi)	41.8064	-124.0822	<input checked="" type="checkbox"/>
6	BRIDGE	Myrtle Creek	41.8017	-124.0556	<input checked="" type="checkbox"/>
7	BRIDGE	Hardscrabble Creek	41.8392	-124.0261	<input checked="" type="checkbox"/>
8	BRIDGE	Smith River	41.8425	-124.0117	<input checked="" type="checkbox"/>
9	BRIDGE	Middle Fork Smith River	41.8578	-123.8853	<input checked="" type="checkbox"/>
10	BRIDGE	Patrick Creek	41.8744	-123.8436	<input checked="" type="checkbox"/>
11	BRIDGE	Middle Fork Smith River	41.88	-123.8272	<input checked="" type="checkbox"/>
12	BRIDGE	Middle Fork Smith River	41.8831	-123.8186	<input checked="" type="checkbox"/>
13	BRIDGE	Middle Fork Smith River	41.8608	-123.8719	<input checked="" type="checkbox"/>
14	BRIDGE	Smith River	41.8797	-124.1369	<input checked="" type="checkbox"/>
15	BRIDGE	Rowdy Creek	41.9283	-124.1417	<input checked="" type="checkbox"/>
16	BRIDGE	Gilbert Creek	41.9819	-124.2031	<input checked="" type="checkbox"/>
17	BRIDGE	Panther Creek	41.5561	-124.0567	<input checked="" type="checkbox"/>
18	BRIDGE	Route 101/169 Separation	41.5228	-124.0342	<input checked="" type="checkbox"/>
19	BRIDGE	Hoppow Creek (W169-N101)	41.5231	-124.0333	<input checked="" type="checkbox"/>
20	BRIDGE	Hoppow Creek (Off-Ramp)	41.5228	-124.035	<input checked="" type="checkbox"/>
21	BRIDGE	Klamath River	41.5181	-124.0314	<input checked="" type="checkbox"/>

Figure 4.43 The profile-facility association page displaying a list of facilities included in the profile. The administrator can toggle between the profile and master facility list to fine tune the list by adding or removing facilities from the interface.

4.4.3 Upload

This page displays a dialog for the administrator to upload a profile file into the database as shown in Figure 4.44. This interface uses the “manage_profile” utility to process uploaded profile data. Available process options are Replace/Update, Insert, and Delete. Detailed descriptions of these options and input file formats are included in Section 6.6.

Profile Database Utilities : Upload

This will perform a full update of related tables from a saved file. You may upload a comma separated inventory file and it will automatically be imported. **WARNING:** This will overwrite any existing data. The upload may take a long time to process, so please do not move from this page until it is complete.

Select a file

Process mode - default Replace/Update

Process mode - default Replace/Update

Replace/Update - Insert new profiles and replace existing ones.

Insert - Insert new profiles.

Delete - Delete profiles.

Browse...

Figure 4.44 The Profile Upload page. This interface uses the “manage_profile” utility to process uploaded profile data. Available process options are Replace/Update, Insert, and Delete.

4.5 User Administration

The user administration section handles tasks of user-specific interactions with the ShakeCast system. Depending on the system configuration, creation of a new user account and notification requests can be initiated by either the end-user or the administrator. Upon a user's request for a new account, the administrator can usually approve or deny the request by responding to the email message sent by the ShakeCast system. This management view allows the administrator to review settings of all user accounts and overwrite any existing settings. The section is divided into four categories: (1) Management; (2) Notification Request; (3) Replication; and (4) Upload. Batch processing for a large number of user accounts and settings of notification requests is available via the ShakeCast utility "manage_user.pl."

4.5.1 Management

This page displays a list of users stored inside the ShakeCast database (fig. 4.45). In addition to the basic user information, the table also shows the user privilege and user status. A "Suspended" user status indicates that the user account exists in the database but the user can neither logon nor receive notifications. To remove a user permanently from the database, the administrator should use the **Delete** function from within this view. There are three available functions for the **Management** view: **Add**, **Edit**, and **Delete**. The **Delete** function removes all information including user data, notification requests, and previous notifications for the selected user from ShakeCast. Both the **Add** and **Edit** functions share the same interface as shown in figure 4.46. The exception is that for **Add** the administrator needs to provide a unique user name for the new user account.



The screenshot shows a web interface titled "User Administration" with a subtitle "Here you can change your users' information and certain options." Below the subtitle is a "Select a User" section with a text input field and a "Look up user" button. Below this is a table with the following data:

Username	Full Name	Email Address	Job Title	Organization	User Level	User Status	Action
scadmin					Administrator	Active	Edit Delete
SteveSahs	Steve Sahs	steve_sahs@dot.ca.gov			User	Active	Edit Delete
MarkYashinski	Mark Yashinski	mark_yashinsky@dot.ca.gov			User	Active	Edit Delete
MikeKeever	Mike Keever	mike_keeve@dot.ca.gov			User	Active	Edit Delete
LorenTurner	Loren Turner	loren_turner@dot.ca.gov			Administrator	Active	Edit Delete
BobTanaka	Bob Tanaka	bob_tanaka@dot.ca.gov			User	Active	Edit Delete

Figure 4.45 The User Administration Summary page displaying a list of ShakeCast users including their privileges and status. The administrator can add, edit, or delete users from this interface.

The user account form consists of four sections regarding information for user log-in, user profile, delivery addresses, and special fields. The user can update information for the first three sections from the user accessible account management page. The administrator-only fields allow both suspension and removal of any user account, including an administrator. The administrator

can also use this form to modify user privileges. It is advisable to limit the number of users with administrative privilege.

User Administration

Here you can change your users' information and certain options.

Registration Information

Items marked with a * are required unless stated otherwise.

Username: *

E-mail address: *

New password: *
You only need to supply a password if you want to change it

Confirm password: *
You only need to confirm your password if you changed it above

Contact Information

Full Name

Occupation

Organization

Location

Delivery Method Information

HTML Email

Text Email

Pager

Special admin-only fields

These fields are not able to be modified by the users. Here you can set their status and other options that are not given to users.

User is active ☒ Yes ☐ No

User Level

Delete this user? ☐ [Click here to delete this user; this cannot be undone.](#)

Figure 4.46 The User Administration Data Editing page displaying a form of editable fields containing contact information, notification preferences, and user status for the specified user.

4.5.2 Notification Request

This function works the same as the Notification Request view for profile management (fig. 4.40). Changes of notification request settings only apply to the selected user and any user-profile association will be nullified.

4.5.3 Replication

This page displays a form with two drop-down lists for both the source and destination for the replication process (fig. 4.47). The ShakeCast replication function allows the administrator to duplicate notification requests of a selected profile or user to a group of users. For better performance of system notifications immediately after earthquakes, the administrator can create a profile for users who share common notification requests. By assigning the user group to a single

profile, the administrator can effectively reduce the processing time and the table size of the notification queue. User replication may be used to produce a template of notification requests for particular users for further customization.

User/Profile Replication Administration

Here you can replicate users' information of notification requests and profiles. An user can not be both the source and destination of replication.

Source User/Profile	Destination Users
User List Profile List	
Select a User	Select a List of Users
	1: Loren Turner 6: Steve Sahs 7: Mark Yashinski 8: Mike Keever 10: Bob Tanaka 11: John OSullivan 12: Pat Hipley 13: Pete Whitfield 14: Martha Merriam 15: Michael B Johnson 16: Nick Burmas 17: Abhijit Naik 18: Allaoua Kartoum 19: Amir Rahbari 20: Brian Jesse 21: Charles Sikorsky 22: Chris Campbell 23: Chuong Ho
Replicate	Reset

Figure 4.47 The User/Profile Replication Administration page displaying two panels for both source and destination of the replication process. The administrator can toggle between user and profile as the source of replication.

4.5.4 Upload

This page displays a dialog for the administrator to upload a user file into the database as shown in figure 4.48. This interface uses the “manage_user” utility to process uploaded user data. Available process options are Replace, Insert, Delete, Update, and Skip. Detailed descriptions of these options and input file formats are included in Section 6.7.

User Database Utilities : Upload

This will perform a full update of related tables from a saved file. You may upload a comma separated inventory file and it will automatically be imported. **WARNING:** This will overwrite any existing data. The upload may take a long time to process, so please do not move from this page until it is complete.

Select a file

Process mode - default Replace

Process mode - default Replace

Replace - Insert new users and replace existing ones.
Insert - Insert new users.
Delete - Delete users.
Update - Update existing users.
Skip - Insert users not in the database.

Browse... Start Upload

Figure 4.48 The UserUpload page. This interface uses the “manage_user” utility to process uploaded user data. Available process options are Replace, Insert, Delete, Update, and Skip.

4.6 Miscellaneous Administration

4.6.1 Web Access to ShakeCast System Version 1

In addition to the standard portal access, the ShakeCast version 2 system also retains the Web directories from the previous version for the purpose of both user and server communications. Access to these pages is restricted and is authenticated through the Apache Web server. The administrator has to edit the files “httpd-sc.conf” and “sc-servers” files to configure user access and password changes. To disable the version 1 Web access, edit the ShakeCast Web configuration file “httpd-sc.conf” under the “conf” directory by commenting out the “scripts/s” and the “scripts/c” sections.

4.6.2 PMA Access

The ShakeCast system has preconfigured an optional installation of **PHPMyAdmin** into the “/pma” directory. The application allows the administrator to interact with the database via the Web interface. To access the interface, the administrator is required to provide the same username and password as for the version 1 Web access and also the username and password to the ShakeCast database. To disable the PMA access, edit the ShakeCast Web configuration file “httpd-sc.conf” under the “conf” directory by commenting out the “pma” section.

4.6.3 Database Configuration

Information regarding access to the ShakeCast database and authentication is stored inside the “sc.conf” configuration file under the “conf” directory. The administrator will also need to update the “sc.conf” file every time access information to the database is changed.

4.6.4 Default Center Location

The default center point for the ShakeCast mapping interface is stored in the file “default-sc.js” under the “docs” directory and is currently set in California. The administrator can edit the content of the file to change the default center location.

5. XML Documents

This Section documents the ShakeCast XML file formats. Extensible Markup Language (XML) is a widely used and easily implemented method of exchanging data between disparate computer systems. The ShakeCast System receives ShakeMap information in XML from the USGS Web server and uses XML to communicate all kinds of information between ShakeCast servers:

- The ShakeCast software itself and data about ShakeCast Servers,
- Data about events (earthquakes) and products (data files) available on the network, and
- Status information that helps the administrators of the ShakeCast servers know if their network is running smoothly.

5.1 ShakeMap RSS Feed XML

RSS, which stands for “Really Simple Syndication” (sometimes called Rich Site Summary), has been adopted by news services, Weblogs, and other online information services to deliver content to subscribers. After subscribing to an RSS feed, you will be notified when new content is available without having to visit the Web site. The USGS ShakeMap RSS data feed contains the following XML:

```
<?xml version="1.0"?>
<?xml-stylesheet href="shake_feed.xsl" type="text/xsl" media="screen"?>
<rss xmlns:geo="http://www.w3.org/2003/01/geo/wgs84_pos#"
xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:eq="http://earthquake.usgs.gov/rss/1.0/" version="2.0">
<channel>
<title>USGS Earthquake ShakeMaps</title>
<description>List of ShakeMaps for events in the last 30
days</description>
<link>http://earthquake.usgs.gov/</link>
<dc:publisher>U.S. Geological Survey</dc:publisher>
<pubDate>Mon, 16 Jul 2007 20:23:29 +0000</pubDate>
<item>
<title>6.7 - NEAR THE WEST COAST OF HONSHU, JAPAN</title>
<description><![CDATA[Date: Mon, 16 Jul 2007
01:13:27 GMT<br />Lat/Lon: 37.574/138.44<br />Depth: 49<br
/>]]></description>
<link>http://earthquake.usgs.gov/eqcenter/shakemap/global/shake/2007ewac/<
/link>
<pubDate>Mon, 16 Jul 2007 01:13:27 GMT</pubDate>
<geo:lat>37.574</geo:lat>
<geo:long>138.44</geo:long>
<dc:subject>6</dc:subject>
<eq:seconds>1184598989</eq:seconds>
<eq:depth>49</eq:depth>
<eq:region>global</eq:region>
<eq:shakethumb>http://earthquake.usgs.gov/eqcenter/images/thumbs/shakemap_
global_2007ewac.jpg</eq:shakethumb>
</item>
</channel>
</rss>
```

5.2 Event XML

A ShakeCast Event is described by Event XML. A sample Event XML is provided.

```
<event event_id="SAF_south7.8_se" event_version="1"
event_status="RELEASED" event_type="SCENARIO" event_name=""
event_location_description="SAF-southern M7.8 Scenario"
event_timestamp="2006-08-03 12:00:00" external_event_id="SAF_south7.8_se"
magnitude="7.8" lat="33.922270" lon="-116.469670" />
```

5.3 Product XML

A ShakeCast Product is described by Product XML. A sample Product XML is provided.

```
<product shakemap_id="SAF_south7.8_se" shakemap_version="1"
product_type="HAZUS" product_status="RELEASED" generating_server="1"
generation_timestamp="2007-02-08 16:07:03" lat_min="32.405603"
lat_max="35.455603" lon_min="-114.769670" lon_max="-119.353003" />
```

5.4 ShakeMap XML

A ShakeCast ShakeMap is described by ShakeMap XML. A sample ShakeMap XML is provided.

```
<shakemap shakemap_id="SAF_south7.8_se" shakemap_version="1"
event_id="SAF_south7.8_se" event_version="1" shakemap_status="RELEASED"
generating_server="1" shakemap_region="ci" generation_timestamp="2007-02-
08 16:07:03" begin_timestamp="2007-02-08 16:07:03" end_timestamp="2007-02-
08 16:07:03" lat_min="32.405603" lat_max="35.455603" lon_min="-119.353003"
lon_max="-114.769670">
<metric metric_name="MMI" min_value="9.4900" max_value="10.0000" />
<metric metric_name="PGA" min_value="9.9989" max_value="10.0002" />
<metric metric_name="PGV" min_value="10.0000" max_value="99.9109" />
<metric metric_name="PSA03" min_value="10.0005" max_value="99.9687" />
<metric metric_name="PSA10" min_value="10.0007" max_value="99.9747" />
<metric metric_name="PSA30" min_value="1.7880" max_value="9.9989" />
</shakemap>
```

5.5 Exposure XML

A ShakeCast Exposure is described by Exposure XML. A sample Exposure XML is provided.

```
<?xml version="1.0" encoding="UTF-8"?>
<exposure>
  xmlns:xlink="http://www.w3.org/1999/xlink"

  code_version="Pager 0.2.0"
  event_id="usneb6_06"
  version="1"
  timestamp="2006-10-11T16:07:03Z"
```

```

source="us"
status="RELEASED">

<event
  type="ACTUAL"
  id="urn:earthquake.usgs.gov:origin:usneb6_06:1"
  magnitude="6.3"
  depth="17.1"
  latitude="-7.955000"
  longitude="110.430000"
  timestamp="2006-05-26T22:54:01GMT"
  description="JAVA, INDONESIA" />

<shakemap
  code_version="3.1.1 GSM"
  id="urn:earthquake.usgs.gov:shakemap:usneb6_06:6"
  version="6"
  timestamp="2006-10-11T16:07:03Z"
  source="us"
  status="RELEASED" />

  <summary type="MMI" units="mmi">
    <bin label="I" value="1" range=".5,1.5) "
keywords="incomplete">
      <measure type="population" value="0" units="people"
source="landscan2005" />
    </bin>
    <bin label="II" value="2" range="1.5,2.5) "
keywords="incomplete">
      <measure type="population" value="0" units="people" />
    </bin>
    <bin label="III" value="3" range="2.5,3.5) "
keywords="incomplete">
      <measure type="population" value="963142" units="people"
/>
    </bin>
  </summary>
</exposure>

```

6. ShakeCast Utilities

This section describes utilities included in the standard ShakeCast distribution. All utilities (even core ShakeCast system services) can be executed directly from the command line and are only available to administrators. Utility such as “tester.pl” can be invoked directly from the Administration Interface for management of ShakeCast test events. As the development of the ShakeCast system continues, more utilities will be added to the existing inventory as part of the update.

In general, the use of utilities is related to one or more of the three objectives: (1) state of the system; (2) system and inventory maintenance; and (3) data input/output. Among utilities described in this section, `heartbeat`, `logrotate`, and `logstate` are state-of-health utilities. The utilities `manage_event`, `manage_facility`, `manage_profile`, and `manage_user` interact directly with the ShakeCast database for the purpose of maintenance. The `scfeed_local`, `shake_fetch`, `tester`, and `template` utilities provide the means for a ShakeCast system to digest special ShakeMaps, conduct local testing/exercise, and generate ShakeCast products that are unique to the local installation.

6.1 heartbeat

6.1.1 Name

`heartbeat.pl` — ShakeCast Heartbeat Generator

6.1.2 Synopsis

`heartbeat.pl`

6.1.3 Description

The **`heartbeat.pl`** utility is used to generate a ShakeCast event XML with event type as `HEARTBEAT`. The output is injected into the ShakeCast system via **`sm_inject.pl`**, and a copy is stored in the ShakeMap data directory. This will trigger an event notification to users whom are subscribed to receive heartbeat events.

The script reads no options from the command line. To create a customized heartbeat event, edit the script located inside the ShakeCast bin directory.

6.2 logrotate

6.2.1 Name

logrotate.pl — ShakeCast Log File Rotation Tool

6.2.2 Synopsis

```
logrotate.pl [ --conf config file ]
```

6.2.3 Description

The **logrotate.pl** utility is used to generate rotating backup files of ShakeCast log files (“sc.log,” “sc_access.log,” and “sc_error.log”). Configurable parameters include `rotate-time`, `max_size`, `keep-files`, `compress`, and `status-file`. The administrator can schedule a routine run of this script for maintenance of ShakeCast log files.

The script reads one optional configuration file from the command line. The default configuration file is “sc.conf.”

rotate-time

Specify the time window for keeping log entries.

max_size

Specify the size limit of log files.

keep-files

Specify the number of backup log files to retain.

compress

Specify the compression option of backup log files.

status-file

Specify the filename of process status.

6.2.4 Options

--conf

Specify the filename of a custom configuration file to read process parameters for `logrotate.pl`.

6.3 logstats

6.3.1 Name

logstats.pl — ShakeCast Chart Generator for System Statistics

6.3.2 Synopsis

```
logstats.pl [ --conf config file ]
```

6.3.3 Description

The **logstats.pl** utility is used to process ShakeCast log files (“sc.log,” “sc_access.log,” and “sc_error.log”) specified in the system configuration file and to generate a set of image files in both histogram and pie charts. The daily activity chart is the default chart displayed in the default page of the Administration Web Interface. The administrator can schedule a routine run of this script to generate new statistics charts.

The script reads one optional configuration file from the command line. The default configuration file is “sc.conf.”

6.3.4 Options

--conf

Specify the filename of a custom configuration file to read process parameters for logstats.pl.

6.4 manage_event

6.4.1 Name

manage_event.pl — ShakeCast Event Management Tool

6.4.2 Synopsis

```
manage_event.pl [ mode ] [ option ... ] event_id [event_id2 ... ]
```

6.4.3 Description

The **manage_event.pl** utility is used to re-alert or delete processed ShakeMap events in the ShakeCast database. It reads one or more event IDs from the command line. Mode is one of `--resend` or `--delete`. The `manage_event.pl` utility will return an error message if you do not specify a mode.

--resend

Reprocess notifications for the ShakeMaps and resend notifications to users who are on the recipient list.

--delete

Delete existing events. All information for the processed ShakeMaps will be removed from the ShakeCast database; it does not affect downloaded products in the file system.

6.4.4 Options

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options.

6.5 manage_facility

6.5.1 Name

manage_facility.pl — ShakeCast Facility Management Tool

6.5.2 Synopsis

```
manage_facility.pl [ mode ] [ option ... ] file.csv [ file2.csv ... ]
```

6.5.3 Description

The **manage_facility.pl** utility is used to insert, update, or delete facility data in the ShakeCast database. It reads data from one or more CSV format files. One or more files must be given on the command line. Multiple files can have different formats. Mode is one of `--insert`, `--replace`, `--delete`, `--update`, or `--skip`. The **manage_facility.pl** utility will operate in replace mode if you do not specify a mode.

--insert

New facility records are inserted. It is an error for the facility to already exist; if it does the input record is skipped.

--replace

New records are inserted. If there is an existing facility it is first deleted, along with any associated attributes and fragility levels. All required facility fields must be supplied.

--delete

Delete existing facilities. All required facility fields must be supplied.

--skip

New facility records are inserted. Records for existing facilities are skipped without generating an error. The summary report will indicate how many records were skipped.

--update

Update existing facilities. If the facility does not already exist an error is issued and the record is skipped.

In this mode the only required fields are `EXTERNAL_FACILITY_ID` and `FACILITY_TYPE`. Any group values are simply added to the existing set of attributes for the facility, unless the new value matches an existing value, in which case the group value is skipped. For metrics, any metric that appears in the input will be completely replaced.

6.5.4 Options

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

--limit=*n*

Terminate the import after *n* errors in input records. Set to 0 to allow an unlimited number of errors.

This limit only applies to errors encountered when processing a data record from the input file. More serious errors, such as omitting a required field, will always cause the entire input file to be skipped.

--quote=*x*

Use *x* as the quote character in the input file. The default quote character is a double-quote ("). This character is also used as the escape character within a quoted string.

--separator=*x*

Use *x* as the field separator character in the input file. The default separator character is a comma (,).

6.5.5 File Format

The **manage_facility.pl** utility reads from one or more CSV-formatted files. By default, fields are separated by commas, and field values that include commas are protected by enclosing them in quotes, but these defaults can be modified; see the **--quote** and **--separator** options above.

The first record in the input file must contain column headers in CSV-format. These headers tell **manage_facility.pl** how to interpret the rest of the records. Each header field must specify a facility field, a facility metric field, or a group field. The header fields are not case sensitive; `facility_name` and `FACILITY_NAME` are equivalent. Fields can appear in any order.

6.5.5.1 Facility Fields

The following facility names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description on the USGS Web site for a more detailed description of the structure of the ShakeCast Database.

external_facility_id (Text(32), required always)

This field identifies the facility. It must be unique for a facility type but the same `external_facility_id` may be used for different types of facilities.

facility_type (Text(10), required always)

This field identifies the type of facility. It must match one of the types in the `facility_type` table. Currently defined types are: BRIDGE, CAMPUS, CITY, COUNTY, DAM, DISTRICT, ENGINEERED, INDUSTRIAL, MULTIFAM, ROAD, SINGLEFAM, STRUCTURE, TANK, TUNNEL, UNKNOWN, and HAZUS building types. Refer the HAZUS Damage Level document (appendix A) for the 128 HAZUS building types and code era.

facility_name (Text(128), required for insert/replace)

The value of this field is what the user sees.

short_name (Text(10), optional)

The value of this field is used by ShakeCast when a shorter version of the name is needed due to space limitations in the output.

description (Text(255), optional)

You can use this field to include a short description of the facility.

lat (Float, required for insert/replace)

Specifies the latitude of the facility in degrees and fractional degrees.

lon (Float, required for insert/replace)

Specifies the longitude of the facility in degrees and fractional degrees.

6.5.5.2 Fragility Fields

Each field beginning with `METRIC:` is taken to be a facility fragility specifier. The format of a fragility specifier is:

METRIC:metric-name:damage-level

where *metric-name* is a valid Shakemap metric (MMI, PGV, PGA, PSA03, PSA10, or PSA30) and *damage-level* is a valid *damage level* (GREEN, YELLOW, ORANGE, or RED). Examples of Facility Fragility column labels are `METRIC:MMI:RED` and `metric:pga:yellow`.

The metric-name values are defined by the ShakeMap system, and are generally not changed. The above values are current as of spring 2008. The damage level values shown above are the default values shipped with ShakeCast. These values are defined in your local ShakeCast database, and you may use the administration Web interface (Section 4.3) to change those values and the color names that refer to them.

6.5.5.3 Attribute Fields

A facility can have attributes associated with it. These attributes can be used to group and filter facilities.

Each field beginning with `ATTR:` is taken to be a facility attribute specifier. The format of a facility attribute specifier is:

ATTR:attribute-name

where *attribute-name* is a string not more than 20 characters in length.

Examples of Facility Attribute column labels are `ATTR:COUNTY` and `ATTR:Construction`. Attribute values can be any string up to 30 characters long.

6.5.6 Example

6.5.6.1 Example 1 — Point Facilities

Assume we have a file named *ca_cities.csv* containing California cities that we want to load into the ShakeCast database. The file is in CSV format and includes the name of each city and the latitude/longitude of its city center or city hall. Records in the file are in the form

```
Rancho Cucamonga,34.1233,-117.5794
Pasadena,34.1561,-118.1318
```

The file is missing two required fields, `facility_type` and `external_facility_id`. Since the city name is unique we can add a new column that is a copy of the name column and use that as the `external_facility_id`. Another column containing the value CITY for each row is added for the `facility_type`. You can either make these changes using an editor, a spreadsheet program, or with a simple script written in a text processing language like Perl.

After making these modifications the records look like

```
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794
CITY,Pasadena,Pasadena,34.1561,-118.1318
```

The input file also needs a header record; after adding one the input file looks like

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,FACILITY_NAME,LAT,LON
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794
CITY,Pasadena,Pasadena,34.1561,-118.1318
...
```

The facilities in this file can now be loaded into ShakeCast using the command

```
manage_facility.pl ca_cities.csv
```

6.5.6.2 Example 2 — FragilityParameters

It is easy to load fragility parameters for your facilities using **manage_facility.pl**. Building on example 1, assume a simple model where Instrumental Intensity (MMI) above 7 corresponds to likely damage (RED), MMI between 5 and 7 corresponds to possible damage (YELLOW), and MMI below 5 corresponds to little chance of damage (GREEN). The lower threshold of each range (1, 5, 7) is appended to every record in the input file and the header record is changed to reflect the added fields:

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,FACILITY_NAME,LAT,LON, \
    METRIC:MMI:GREEN,METRIC:MMI:YELLOW,METRIC:MMI:RED
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794,1,5,7
CITY,Pasadena,Pasadena,34.1561,-118.1318,1,5,7
...
```

Import this file as before. New facility data will replace existing ones.

6.5.6.3 Example 3 — Multiple Attributes and Multiple Metrics

You can include multiple attributes, multiple metrics, or multiple attributes and multiple metrics for each row of an import file. For example,

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,ATTR:COUNTY, ATTR:SIZE, \
    METRIC:MMI:GREEN, METRIC:MMI:YELLOW, METRIC:MMI:RED
CITY,Rancho Cucamonga,San Bernardino,Small,1,2,6
CITY,Pasadena,Los Angeles,Medium,1,2,6
```


This file would be loaded using the command

```
manage_facility.pl --update city_county.csv
```

The above example updates the existing city locations to associate them with a county attribute and a size attribute, and defines the green, yellow, and red shaking thresholds.

6.6 manage_profile

6.6.1 Name

manage_profile.pl — ShakeCast Profile Management Tool

6.6.2 Synopsis

```
manage_profile.pl [ mode ] [ option ... ] [ profile.conf ] [ lat,lon ... ]
```

6.6.3 Description

The **manage_profile.pl** utility is used to insert, update, or delete geometry profiles in the ShakeCast database and to associate facilities within the profile boundaries with the profile. It reads data from a profile configuration file or lat/lon pairs of a polygon from the command line. Mode is one of `--insert`, `--delete`, `--update`, or `--poly`. The **manage_profile.pl** utility will operate in replace mode if you do not specify a mode.

--insert

New profiles are inserted. It is an error if the profile already exists; if it does the input record is skipped.

--delete

Delete existing profiles. All required profile fields must be supplied.

--poly

Read polygon data from the command line and output facility data within the polygon boundaries.

6.6.4 Options

--conf

Specify the optional profile configuration file.

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options.

6.6.5 File Format

The **manage_profile.pl** utility reads data from a file in Apache config format. Lines beginning with '#' and empty lines will be ignored. Spaces at the beginning and the end of a line will also be ignored as well as tabulators. If you need spaces at the end or the beginning of a value you can use double-quote ("). An option line starts with its name followed by a value. An equal sign (=) is optional. Some possible examples:

```
user      max
user = max
```

user max

If there is more than one statement with the same name, an array will be created instead of a scalar.

Each profile is defined as a **block** of options. A **block** looks much like a block in the well known Apache config format. It starts with **<blockname>** and ends with **</blockname>**. An example:

```
<CI>
  POLY      35.8000 -116.4000    \
            34.0815 -114.4717    \
            32.0000 -114.3333    \
            32.0000 -120.5000    \
            34.5000 -121.2500    \
            37.2167 -118.0167    \
            36.6847 -117.7930    \
            35.8000 -116.4000
  <NOTIFICATION>
    NOTIFICATION_TYPE      NEW_EVENT
    DELIVERY_METHOD        EMAIL_HTML
    EVENT_TYPE              ALL
  </NOTIFICATION>
  <NOTIFICATION>
    NOTIFICATION_TYPE      NEW_PROD
    DELIVERY_METHOD        EMAIL_HTML
    PRODUCT_TYPE           GRID_XML
    EVENT_TYPE              ALL
  </NOTIFICATION>
</CI>
```

6.6.5.1 Profile Tag Names

The following profile tag names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description for a more detailed description of the structure of the ShakeCast Database.

poly (float pairs, required always)

This field identifies the boundaries of the profile geometry. It must contain at least three anchor points in order to define a polygon. The total number of anchor points should be limited to less than 100, otherwise the administration interface may not be able to display the entire polygon during editing. The **manage_profile.pl** will, however, process the polygon definition.

notification (Text(32), optional)

One notification block represents one notification request associated with the profile and applies to all facilities within the profile polygon. Multiple notification blocks for a profile are permitted.

6.6.5.2 Notification Tag Names

Each notification block defines one notification request. Tag names correspond to the field names of the table “profile_notification_request.” Required tags for a notification block include NOTIFICATION_TYPE, DELIVERY_METHOD, and EVENT_TYPE. The EVENT_TYPE tag is required for notification type NEW_PROD, and the DAMAGE_LEVEL tag for notification type DAMAGE. Valid notification types are CAN_EVENT, NEW_EVENT, UPD_EVENT, SHAKING, NEW_PROD, and DAMAGE.

can_event

This notification request is triggered when an event is cancelled by the seismic network in which the event was located and the ShakeMap is removed from the USGS Web site.

Requires `EVENT_TYPE` and `DELIVERY_METHOD` tags.

new_event

This notification request is triggered when an event is located by a seismic network and a ShakeMap becomes available on the USGS Web site. Requires `EVENT_TYPE` and

`DELIVERY_METHOD` tags.

upd_event

This notification request is triggered when the source parameters of an event are updated with a new version by the seismic network. New versions of ShakeMaps for the event may or may not coincide with an updated event. Requires `EVENT_TYPE` and `DELIVERY_METHOD` tags.

new_prod

This notification request is triggered when a specified ShakeMap product of an event is available on the USGS Web site. Requires `EVENT_TYPE`, `DELIVERY_METHOD`, and

`PRODUCT_TYPE` tags.

shaking

This notification request is triggered when the ground shaking parameter at the location of the facility exceeds the preset value. Requires `EVENT_TYPE`, `DELIVERY_METHOD`, `METRIC`, and `LIMIT_VALUE` tags.

damage

This notification request is triggered when the ground shaking parameter at the location of the facility falls between the high and low values of facility fragility settings. Requires

`EVENT_TYPE`, `DELIVERY_METHOD`, and `DAMAGE_LEVEL` tags.

6.7 manage_user

6.7.1 Name

manage_user.pl — ShakeCast User Management Tool

6.7.2 Synopsis

```
manage_user.pl [ mode ] [ option ... ] file.csv [ file2.csv ... ]
```

6.7.3 Description

The **manage_user.pl** utility is used to insert, update, or delete user data in the ShakeCast database. It reads data from one or more CSV format files. One or more files must be given on the command line. Multiple files can have different formats. Mode is one of `--insert`, `--replace`, `--delete`, `--update`, or `--skip`. The **manage_user.pl** utility will operate in replace mode if you do not specify a mode.

--insert

New user records are inserted. It is an error for the user to already exist; if it does the input record is skipped.

--replace

New records are inserted. If there is an existing user it is first deleted, along with any associated delivery addresses, notification requests, and profiles. All required user fields must be supplied.

--delete

Delete existing users. All required user fields must be supplied.

--skip

New user records are inserted. Records for existing users are skipped without generating an error. The summary report will indicate how many records were skipped.

--update

Update existing users. If the user does not already exist an error is issued and the record is skipped.

In this mode the only required fields are `USERNAME` and `USER_TYPE`. Any delivery methods, profiles and users for cloning that appears in the input will be completely replaced.

6.7.4 Options

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

--limit=*n*

Terminate the import after *n* errors in input records. Set to 0 to allow an unlimited number of errors.

This limit only applies to errors encountered when processing a data record from the input file. More serious errors, such as omitting a required field, will always cause the entire input file to be skipped.

--quote=*x*

Use *x* as the quote character in the input file. The default quote character is a double-quote ("). This character is also used as the escape character within a quoted string.

--separator=*x*

Use *x* as the field separator character in the input file. The default separator character is a comma (,).

6.7.5 File Format

The **manage_user.pl** utility reads from one or more CSV-formatted files. By default, fields are separated by commas, and field values that include commas are protected by enclosing them in quotes, but these defaults can be modified; see the `--quote` and `--separator` options above.

The first record in the input file must contain column headers. These headers tell **manage_user.pl** how to interpret the rest of the records. Each header field must specify a user name field and a user type field. The header fields are not case sensitive; `username` and `USERNAME` are equivalent. Fields can appear in any order.

6.7.5.1 User Fields

The following facility names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description for a more detailed description of the structure of the ShakeCast database.

username (Text(32), required always)

This field identifies the user. It must be unique for a user type.

user_type (Text(10), required always)

This field identifies the type of use. It must match one of the types in the `user_type` table. Currently defined types are: `ADMIN`, `USER`, and `SYSTEM`.

full_name (Text(32), optional)

The value of this field is the user's full name.

email_address (Text(10), optional)

The value of this field is the user's email address for receiving communication from the ShakeCast system.

password (Text(10), optional)

The value of this field is used by ShakeCast to generate a password for accessing the ShakeCast interface and the Web site if password protected.

phone_number (Text(255), optional)

You can use this field to include a user's phone numbers.

6.7.5.2 Delivery Method Fields

Each field beginning with **DELIVERY:** is taken to be a delivery method specifier. The format of a delivery method specifier is:

DELIVERY:*delivery-method*

where *delivery-method* is a valid message format (PAGER, EMAIL_HTML, or EMAIL_TEXT). Examples of Delivery Method column labels are **DELIVERY:EMAIL_HTML** and **delivery:email_html**.

The message format values are defined by the ShakeCast system, and are generally not changed. The damage level values shown above are the default values shipped with ShakeCast. These values are defined in your local ShakeCast database, and you may use the administration Web interface to change those values and the color-names that refer to them.

6.7.5.3 Profile Fields

A user can have notification requests replicated from an existing profile. Each field beginning with **PROFILE:** is taken to be a profile specifier. The format of a profile specifier is:

PROFILE:*profile-name*

where *profile-name* is a valid profile name.

6.7.5.4 User Fields

A user can have notification requests replicated from an existing user. Each field beginning with **USER:** is taken to be a user specifier. The format of a user specifier is:

USER: *shakecast-user*

where *shakecast-user* is a valid user ID.

6.8 scfeed_local

6.8.1 Name

scfeed_local.pl — ShakeMap Grid/Product Injection Tool

6.8.2 Synopsis

```
scfeed_local.pl [ --event event_id ] [ option ... ]
```

6.8.3 Description

The **scfeed_local.pl** utility is used to process downloaded ShakeMap products located in the ShakeCast data directory. It reads one event ID from the command line and creates XML messages before feeding them to ShakeCast. The injection process triggers the ShakeCast process in the same manner as for a real earthquake with respect to facility damage assessment and user notifications.

The name of an unprocessed ShakeMap must match the name of an event ID. ShakeMaps can be downloaded via the USGS ShakeMap link from the ShakeCast Administration Panel or manually from other sources. It will be renamed with the version number appended to the end of the directory name after **scfeed_local.pl** has processed the ShakeMap. Outputs of ShakeCast XML files will also be stored in the same directory.

The script will quit gracefully if the ShakeMap has been processed earlier by the ShakeCast system, and as a result no notifications will be delivered. To reprocess a ShakeMap that already exists in the ShakeCast system, the administrator will need to either convert the ShakeMap into a test event or delete the event first. Instead of using the Administration Interface, an administrator can use the **tester.pl** utility to convert a ShakeMap to a test event and the **manage_event.pl** utility to delete a ShakeMap. The ShakeCast data directory for the deleted ShakeMap also needs to be removed from the file system before starting the reprocess procedure described earlier.

6.8.4 Options

--event

Specify ID of the event to process. All information for the processed ShakeMaps will be removed from the ShakeCast database; it does not affect downloaded products in the file system.

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

6.9 shake_fetch

6.9.1 Name

shake_fetch.pl — USGS ShakeMap Fetching Tool

6.9.2 Synopsis

```
shake_fetch.pl [ option ... ]
```

6.9.3 Description

The **shake_fetch.pl** utility is used to retrieve ShakeMaps from the USGS Web site then triggers the ShakeCast process for the downloaded event. An event can be either an actual or a scenario ShakeMap. The script is usually invoked as a scheduled task from the administration interface but also can be executed directly from the command line interface. Both `--network` and `--event` options are required. A previously processed event will not re-trigger the ShakeCast process.

6.9.4 Options

--network

Specify network code of the ShakeMap to process.

--event

Specify ID of the ShakeMap to process.

--help

Print a synopsis of program usage and invocation options.

6.10 template

6.10.1 Name

template.pl — ShakeCast General Templating Tool

6.10.2 Synopsis

```
template.pl [ option ... ] --event event_id --template template
```

6.10.3 Description

The **template.pl** utility is used to generate a ShakeCast facility summary for the specified event. The script reads at least one event ID and one template file from the command line. The output file is stored in the ShakeCast data directory for the specified event. By default, if no output filename is specified, the filename of the template file will be used (without “.tt” postfix) instead. The underscore symbol (`_`) will be interpreted as the file extension separator.

--event=s

Specify ID of the event to process.

--template=s

Specify a filename for the template used to generate ShakeCast summary. The template files are located under the ShakeCast “template/xml” directory. The system comes with two default templates. The file “shakecast.tt” is the template for generating “exposure.xml” and the file “kml.tt” for generating Google Earth KML format XML files.

6.10.4 Options

--version=n

Specify version number of the event to process.

--output=s

Specify filename of the output of ShakeCast summary. The output directory is the ShakeCast data directory for the specified event.

--help

Print a synopsis of program usage and invocation options.

6.10.5 File Format

The **template.pl** utility is based on the Perl Template Toolkit. Please see the Template Manual manual page on the Comprehensive Perl Archive Network (CPAN) for the complete reference, which goes into much greater detail about the features and use of the Template Toolkit.

This section covers a brief summary of the template directives. ShakeCast specific identifiers include `exposure`, `item`, and `type`. Facility specific identifiers include `name`, `latitude`, `longitude`, `damage_level`, `MMI`, `PGA`, `PGV`, `PSA03`, `PSA10`, and `PSA30`.

6.10.5.1 GET

Evaluate and print a variable or value.

```
[% GET variable %]
[% variable %]
[% hash.key %]
[% list.n %]
[% code(args) %]
[% obj.meth(args) %]
[% "value: $var" %]
```

6.10.5.2 CALL

As per GET but without printing result (for example, call code).

```
[% CALL variable %]
```

6.10.5.3 SET

Assign a values to variables.

```
[% SET variable = value %]      # 'SET' also optional
[% variable = other_variable
  variable = 'literal text @ $100'
  variable = "interpolated text: $var"
  list      = [ val, val, val, val, ... ]
  list      = [ val..val ]
  hash      = { var => val, var => val, ... }
%]
```

6.10.5.4 DEFAULT

Like SET above, but variables are only set if currently unset (that is, have no true value).

```
[% DEFAULT variable = value %]
```

6.10.5.5 INSERT

Insert a file without any processing performed on the contents.

```
[% INSERT legalese.txt %]
```

6.10.5.6 INCLUDE

Process another template file or block and include the output. Variables are localised.

```
[% INCLUDE template %]
[% INCLUDE template var = val, ... %]
```

6.10.5.7 PROCESS

As INCLUDE above, but without localising variables.

```
[% PROCESS template %]
[% PROCESS template var = val, ... %]
```

6.10.5.8 WRAPPER

Process the enclosed block WRAPPER ... END block then INCLUDE the named template, passing the block output in the 'content' variable.

```
[% WRAPPER template %]
  content...
[% END %]
```

6.10.5.9 BLOCK

Define a named template block for subsequent INCLUDE, PROCESS, etc.

```
[% BLOCK template %]
    content
[% END %]
```

6.10.5.10 FOREACH

Repeat the enclosed FOREACH ... END block for each value in the list.

```
[% FOREACH variable = [ val, val, val ] %] # either
[% FOREACH variable = list %]             # or
[% FOREACH list %]                         # or
    content...
    [% variable %]
[% END %]
```

6.10.5.11 WHILE

Enclosed WHILE ... END block is processed while condition is true.

```
[% WHILE condition %]
    content
[% END %]
```

6.10.5.12 IF / UNLESS / ELSIF / ELSE

Enclosed block is processed if the condition is true / false.

```
[% IF condition %]
    content
[% ELSIF condition %]
    content
[% ELSE %]
    content
[% END %]
[% UNLESS condition %]
    content
[% # ELSIF/ELSE as per IF, above %]
    content
[% END %]
```

6.10.5.13 SWITCH / CASE

Multi-way switch/case statement.

```
[% SWITCH variable %]
[% CASE val1 %]
    content
[% CASE [ val2, val3 ] %]
    content
[% CASE %]          # or [% CASE DEFAULT %]
    content
[% END %]
```

6.10.5.14 MACRO

Define a named macro.

```
[% MACRO name <directive> %]
[% MACRO name(arg1, arg2) <directive> %]
```



```
...
[% name %]
[% name(val1, val2) %]
```

6.10.5.15 FILTER

Process enclosed FILTER ... END block then pipe through a filter.

```
[% FILTER name %] # either
[% FILTER name( params ) %] # or
[% FILTER alias = name( params ) %] # or
content
[% END %]
```

6.10.5.16 USE

Load a "plugin" module, or any regular Perl module if LOAD_PERL option is set.

```
[% USE name %] # either
[% USE name( params ) %] # or
[% USE var = name( params ) %] # or
...
[% name.method %]
[% var.method %]
```

6.10.5.17 PERL / RAWPERL

Evaluate enclosed blocks as Perl code (requires EVAL_PERL option to be set).

```
[% PERL %]
# perl code goes here
$stash->set('foo', 10);
print "set 'foo' to ", $stash->get('foo'), "\n";
print $context->include('footer', { var => $val });
[% END %]
[% RAWPERL %]
# raw perl code goes here, no magic but fast.
$output .= 'some output';
[% END %]
```

6.10.5.18 TRY / THROW / CATCH / FINAL

Exception handling.

```
[% TRY %]
content
[% THROW type info %]
[% CATCH type %]
catch content
[% error.type %] [% error.info %]
[% CATCH %] # or [% CATCH DEFAULT %]
content
[% FINAL %]
this block is always processed
[% END %]
```

6.10.5.19 NEXT

Jump straight to the next item in a FOREACH/WHILE loop.

```
[% NEXT %]
```

6.10.5.20 LAST

Break out of FOREACH/WHILE loop.

```
[% LAST %]
```

6.10.5.21 RETURN

Stop processing current template and return to including templates.

```
[% RETURN %]
```

6.10.5.22 STOP

Stop processing all templates and return to caller.

```
[% STOP %]
```

6.10.5.23 TAGS

Define new tag style or characters (default: [% %]).

```
[% TAGS html %]
```

```
[% TAGS <!-- --> %]
```

6.10.5.24 COMMENTS

Ignored and deleted.

```
[% # this is a comment to the end of line  
    foo = 'bar'
```

```
%]
```

```
[%# placing the '#' immediately inside the directive  
    tag comments out the entire directive
```

```
%]
```

6.11 tester

6.11.1 Name

tester.pl – ShakeCast Test Event Tool

6.11.2 Synopsis

```
tester.pl [ option ... ]
```

6.11.3 Description

The **tester.pl** utility is used to handle ShakeCast test events and includes conversion, listing, and triggering of test events. The script is usually invoked from the administration interface but also can be executed directly. It reads one process type from the command line.

6.11.4 Options

--type

Specify the type of action to process. Process type is one of `event_menu`, `new_test`, `create_test`, `inject_next`, or `inject_first`.

event_menu

Output a list of test events available on the system.

new_test

Output a list of actual events on the system that have not been converted into test events.

create_test

Convert the specified event into a test event that can be triggered locally. Require an additional `--key` option. A new data directory for the event will be created under the “test_data” directory with the name of event ID and “_scte” postfix.

inject_first

Trigger a ShakeCast process for the specified test event as a new event. Require an additional `--key` option.

inject_next

Trigger a ShakeCast process for the specified test event as an updated event. Require an additional `--key` option.

--key

Specify ID of the event to process. All information for the processed ShakeMaps will be removed from the ShakeCast database; it does not affected downloaded products in the file system.

References

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- Wald, David J, and Lin, K., 2007, USGS ShakeCast—Automating, simplifying, and improving the use of ShakeMap for post-earthquake decisionmaking and response: U.S. Geological Survey Fact Sheet 2007-3086, 6 p., <http://pubs.usgs.gov/fs/2007/3086/>.
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- Wald, David J., Worden, B. C., Quitoriano, V., and Pankow, K. L., 2005, ShakeMap manual—Technical manual, user's guide, and software guide: U.S. Geological Survey Techniques and Methods 12–A1, 128 p., <http://pubs.usgs.gov/tm/2005/12A01/>.

Appendix A. Converting HAZUS Structure Type to Structural Damage Level

A.1 Selecting Model Building Type and Code Era

ShakeCast offers structural damage estimation capability adapted from the HAZUS-MH earthquake module (NIBS and FEMA, 2003). For any site of interest, the user begins by selecting from the available HAZUS model building types, of which there are 36 (table A.1). “Model building type” refers to the materials of construction (wood, steel, reinforced concrete, etc.), the system used to transmit earthquake forces from the ground through the building (referred to as the lateral force-resisting system), and sometimes height category (lowrise, midrise, and highrise, which generally correspond to 1-3, 4-7, and 8+ stories, respectively).

The user must also select for each facility its building code era, of which there are four (high code, moderate code, low code, and pre-code; table A.2 and fig. A.1). Code eras reflect important changes in design forces or detailing requirements that matter to the seismic performance of a building. Sixteen combinations of model building type and code era do not exist (for example, high-code unreinforced masonry bearing wall), so in total there are 128 choices for HAZUS model building type and code era. Note that code era is largely a function of location and year built, so in principal ShakeCast could simplify the user’s job of selecting a code era by asking for era of construction (pre-1941, 1941-1975, or post-1975) instead and then looking up the code era via internal GIS database.

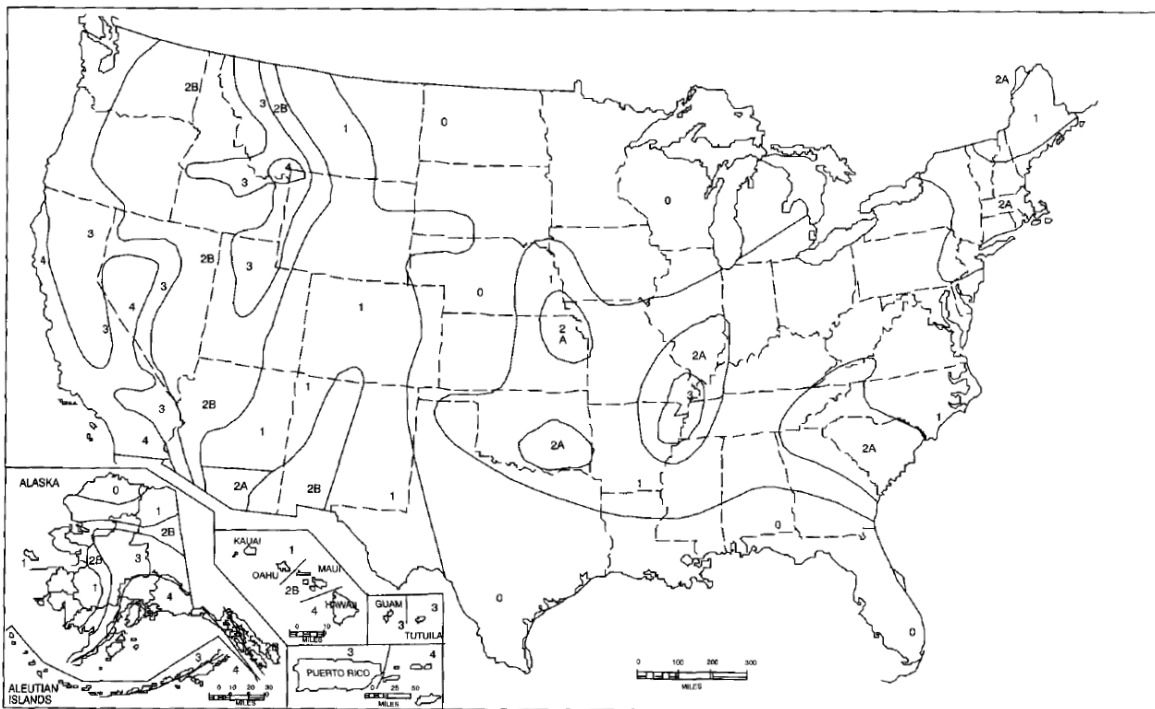


Figure A.1 Seismic zone map of the United States (fig. 16-2, ICBO, 1997).

A.2 Describing Damage

The user selects between 3 and 4 alert levels, meaning that any facility affected by an earthquake is noted either green, yellow, or red (3 levels), or green, yellow, orange, or red (4 levels). These colors index the likely structural damage state of the facility in HAZUS terms: green corresponds to HAZUS' undamaged or slight structural damage states, yellow corresponds to moderate structural damage, orange to extensive structural damage, and red to complete structural damage. These terms (slight, moderate, etc.) are described via likely effects of the earthquake on the structural system. For example, for a small woodframe building (W1, regardless of code era), "green" corresponds to "Undamaged or small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer." These descriptions can be found in the HAZUS-MH technical manual (NIBS and FEMA, 2003) Section 5.3.1.

A.3 Relating Seismic Excitation to Structural Damage

When an earthquake occurs, its shaking intensity at each facility location is estimated in terms of peak horizontal ground acceleration (PGA). Buildings and ground motions are highly variable, even given a model building type and PGA level, so it is uncertain the exact level of PGA that will cause a given facility to experience structural damage of any particular level. The relationship between PGA and damage state is therefore probabilistic, meaning that one can estimate the probability of a given building experiencing a given structural damage state when the building experiences a certain level of PGA. It is more convenient here to estimate the PGA at which there is a given probability of damage exceeding a given structural damage state. In ShakeCast, a facility is indicated as damage level x (that is, green, yellow, orange, or red) when the PGA is such that there is at least a 50% probability of the corresponding HAZUS structural damage state and less than a 50% probability of the next-higher HAZUS structural damage state. These PGA values are taken from the HAZUS-MH Technical Manual Table 5.14a-d.

A.4 Tabular Lookup Data

Two lookup files in CSV format are provided with this manual, one for a three-level damage scheme, the other for a four-level damage scheme. Each has seven columns or fields, listed in table A.3. The fields correspond to data appearing in the ShakeCast Facility Administration screen (see Section 4.3).

Table A.1. HAZUS-MH earthquake model building types (NIBS and FEMA 2003 Table 3.1)

No.	Label	Description	Height			
			Range		Typical	
			Name	Stories	Stories	Feet
1	W1	Wood, Light Frame ($\leq 5,000$ sq. ft.)		1 - 2	1	14
2	W2	Wood, Commercial and Industrial ($>5,000$ sq. ft.)		All	2	24
3	S1L	Steel Moment Frame	Low-Rise	1 - 3	2	24
4	S1M		Mid-Rise	4 - 7	5	60
5	S1H		High-Rise	8+	13	156
6	S2L	Steel Braced Frame	Low-Rise	1 - 3	2	24
7	S2M		Mid-Rise	4 - 7	5	60
8	S2H		High-Rise	8+	13	156
9	S3	Steel Light Frame		All	1	15
10	S4L	Steel Frame with Cast-in-Place Concrete Shear Walls	Low-Rise	1 - 3	2	24
11	S4M		Mid-Rise	4 - 7	5	60
12	S4H		High-Rise	8+	13	156
13	S5L	Steel Frame with Unreinforced Masonry Infill Walls	Low-Rise	1 - 3	2	24
14	S5M		Mid-Rise	4 - 7	5	60
15	S5H		High-Rise	8+	13	156
16	C1L	Concrete Moment Frame	Low-Rise	1 - 3	2	20
17	C1M		Mid-Rise	4 - 7	5	50
18	C1H		High-Rise	8+	12	120
19	C2L	Concrete Shear Walls	Low-Rise	1 - 3	2	20
20	C2M		Mid-Rise	4 - 7	5	50
21	C2H		High-Rise	8+	12	120
22	C3L	Concrete Frame with Unreinforced Masonry Infill Walls	Low-Rise	1 - 3	2	20
23	C3M		Mid-Rise	4 - 7	5	50
24	C3H		High-Rise	8+	12	120
25	PC1	Precast Concrete Tilt-Up Walls		All	1	15
26	PC2L	Precast Concrete Frames with Concrete Shear Walls	Low-Rise	1 - 3	2	20
27	PC2M		Mid-Rise	4 - 7	5	50
28	PC2H		High-Rise	8+	12	120
29	RM1L	Reinforced Masonry Bearing Walls with Wood or Metal Deck Diaphragms	Low-Rise	1-3	2	20
30	RM2M		Mid-Rise	4+	5	50
31	RM2L	Reinforced Masonry Bearing Walls with Precast Concrete Diaphragms	Low-Rise	1 - 3	2	20
32	RM2M RM2H		Mid-Rise	4 - 7	5	50
33			High-Rise	8+	12	120
34	URML	Unreinforced Masonry Bearing Walls	Low-Rise	1 - 2	1	15
35	URMM		Mid-Rise	3+	3	35
36	MH	Mobile Homes		All	1	10

Table A.2. HAZUS-MH guidelines for selection of damage functions for typical buildings based on UBC seismic zone and building age (NIBS and FEMA 2003 Table 5.20).

<i>UBC Seismic Zone (NEHRP Map Area)</i>	Post-1975	1941 - 1975	Pre-1941
Zone 4 (Map Area 7)	High-Code	Moderate-Code	Pre-Code (W1 = Moderate-Code)
Zone 3 (Map Area 6)	Moderate-Code	Moderate-Code	Pre-Code (W1 = Moderate-Code)
Zone 2B (Map Area 5)	Moderate-Code	Low-Code	Pre-Code (W1 = Low-Code)
Zone 2A (Map Area 4)	Low-Code	Low-Code	Pre-Code (W1 = Low-Code)
Zone 1 (Map Area 2/3)	Low-Code	Pre-Code (W1 = Low-Code)	Pre-Code (W1 = Low-Code)
Zone 0 (Map Area 1)	Pre-Code (W1 = Low-Code)	Pre-Code (W1 = Low-Code)	Pre-Code (W1 = Low-Code)

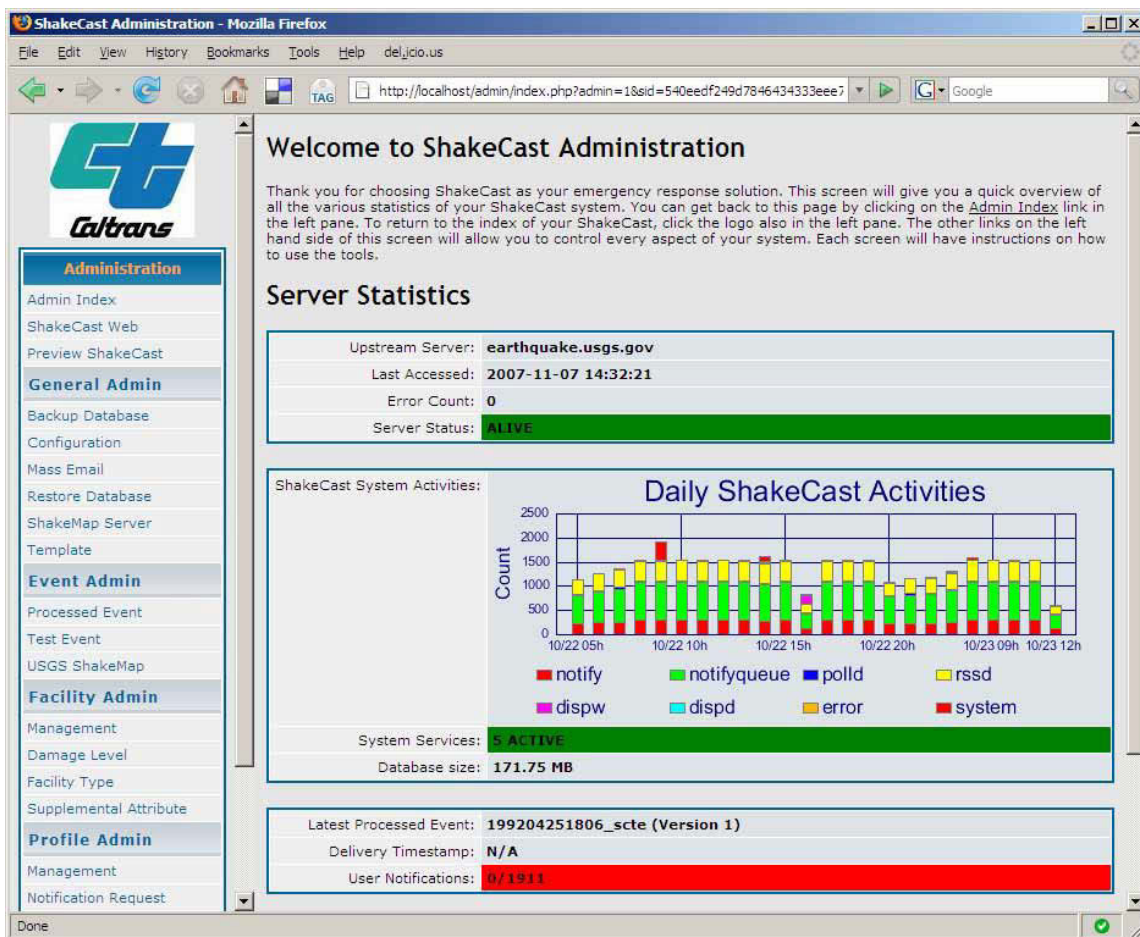
Table A.3. Layout of damage lookup tables.

Field name	Type	Description
ID	Integer	A unique index
Facility Type	String	HAZUS model building type and seismic design level
Color	String	Green, Yellow, Orange, or Red
Damage Level	String	Equivalent HAZUS structural damage level(s)
Low Limit	Integer	Intensity with 50% probability of this damage level occurring
High Limit	Integer	Intensity with 50% probability of next damage level occurring
Metric	String	Intensity metric

ShakeCast Administrator Web Interface

This document describes the Administrator Web Interface of ShakeCast. The ShakeCast interface is designed for an administrator to perform common tasks ranging from management of both facility and user inventory to system wide maintenance and configuration. The administrative page is restricted access to only ShakeCast users with administrative privileges. The range of tasks that can be performed from the interface includes: 1) Earthquake/ShakeMap management; 2) System configuration; 3) Facility management; 4) Notification/Profile management; and 5) User account and notification management.

The administrative page view displays a list of system management tasks in the left panel and the right panel the work area of the selected task. Figure 1 shows the default page view when first accesses the page. The right panel shows the current status of the ShakeCast system includes: 1) Network connection with the upstream USGS server for ShakeMap RSS data feed; 2) System services and summary of process logs; 3) Latest processed ShakeMap and notifications; and 4) Code version of the current system and available script updates. For each of the first three server system functions, there is a color indicator in either green or red that reflects the status of the function.



The ShakeCast administrator web interface does not cover management for system level services and supporting software. There are currently five ShakeCast daemon services (dispatch, polling, RSS, notify queue, notify processes) and their configuration files that require direct access to the operating system. In addition to the ShakeCast system services, the same restriction also applies to supporting software including the Apache web server and MySQL database applications. An administrator will need to log on to the server system where the ShakeCast system resides to make changes to the configuration files of applications and to start and stop ShakeCast system processes and supporting software.

General Administration

The general administration section allows a ShakeCast administrator to manage system wide tasks in six different categories: 1) Backup Database; 2) Configuration; 3) Mass Email; 4) Restore Database; 5) ShakeMap Server; and 6) Template.

- Backup database: perform backup of the ShakeCast database consisting 70 tables. The backup options can be a combination of table structure and data. The output format is a single file in either plain text or compressed format. The backup copy can be used to restore the system database using the 'Restore Database' function described later.

Database Utilities : Backup

Here you can back up all ShakeCast-related data. If you have any additional custom tables in the same database with ShakeCast that you would like to back up as well, please enter their names, separated by commas, in the Additional Tables textbox below. If your server supports it you may also gzip-compress the file to reduce its size before download.

Backup options	
Full backup	<input checked="" type="radio"/>
Structure-Only backup	<input type="radio"/>
Data only backup	<input type="radio"/>
Additional tables	<input type="text"/>
Gzip compress file	No <input checked="" type="radio"/> Yes <input type="radio"/>

Start Backup

- General Configuration: display a list of configurable options of the system. These options include configurations of system identity and user page, session management, and external SMTP server.
 - System Identity. The hostname and port fields describe the URL which a ShakeCast user will use to access the system. Each hostname requires a unique API key from the Google Maps server. User-related settings include account activation, access control, and web page style.

General Configuration

The form below will allow you to customize all the general options of the ShakeCast system. Use the related links on the left hand panel for configurations of specific inventory groups.

General System Settings	
Domain Name	<input type="text" value="localhost"/>
Server Port The port your server is running on, usually 80. Only change if different	<input type="text" value="80"/>
Script path The path where ShakeCast web script is located relative to the domain name	<input type="text" value="/"/>
Site name	<input type="text" value="ShakeCast 2.0"/>
Google Maps API Key Unique Google Maps API key is required for each ShakeCast server. API key sign-up	<input type="text" value="ABQIAAAAFr1SZqAxLssG5U"/>
Enable account activation	<input type="radio"/> None <input type="radio"/> User <input checked="" type="radio"/> Admin
Enable Visual Confirmation Requires users enter a code defined by an image when registering.	<input checked="" type="radio"/> Yes <input type="radio"/> No
Allow automatic logins Determines whether users are allowed to select to be automatically logged in when visiting the server	<input checked="" type="radio"/> Yes <input type="radio"/> No
Automatic login key expiry How long a autologin key is valid for in days if the user does not visit the server. Set to zero to disable expiry.	<input type="text" value="0"/>
Allowed login attempts The number of allowed login attempts.	<input type="text" value="5"/>
Login lock time Time in minutes the user have to wait until he is allowed to login again after exceeding the number of allowed login attempts.	<input type="text" value="30"/>
Number of Displayed Items Per Page	<input type="text" value="50"/>
Default Style	<input type="text" value="Caltrans"/>
Date Format The syntax used is identical to the PHP date() function.	<input type="text" value="D M d, Y g:i a"/>
System Timezone	<input type="text" value="GMT"/>
Enable GZip Compression	<input type="radio"/> Yes <input checked="" type="radio"/> No

- Cookie settings. ShakeCast system implements session control via a cookie stored on the user's web browser during log-in. The administrator can use this setting to configure the time period for each successful log-in.

Cookie settings	
These details define how cookies are sent to your users' browsers. In most cases the default values for the cookie settings should be sufficient, but if you need to change them do so with care -- incorrect settings can prevent users from logging in	
Cookie domain	<input type="text"/>
Cookie name	<input type="text" value="sc2mysql"/>
Cookie path	<input type="text" value="/"/>
Cookie secure If your server is running via SSL, set this to enabled, else leave as disabled	<input checked="" type="radio"/> Disabled <input type="radio"/> Enabled
Session length [seconds]	<input type="text" value="3600"/>

- Email Settings. This form contains information of the Email server which the ShakeCast system or administrator use to send email to the end users. This configuration does not alter the settings of SMTP server information in 'sc.conf' which the ShakeCast system uses to send email notifications. A utility script 'sync_conf.pl' is included for synchronization of configuration settings.

Email Settings

Admin Email Address: admin@localhost

Email Signature: Thanks, The Management
This text will be attached to all outgoing emails

Use SMTP Server for email: ☒ Yes ☐ No
Say yes if you want or have to send email via a named server instead of the local mail function

SMTP Server Address:

SMTP Username:
Only enter a username if your SMTP server requires it

SMTP Password:
Only enter a password if your SMTP server requires it

- Mass Email: display a form for the administrator to compose an email message for delivery to the registered users.

Email

Here you can email a message to either all of your users or all users of a specific group. To do this, an email will be sent out to the administrative email address supplied, with a blind carbon copy sent to all recipients. If you are emailing a large group of people please be patient after submitting and do not stop the page halfway through. It is normal for a mass emailing to take a long time and you will be notified when the script has completed

Compose

Recipients: All Users

Subject:

Message:

Email

- Restore Database: display a dialog for the administrator to upload a backup file of database. The database backup file can be generated from the ShakeCast backup function or from common database dumping utilities. This process will overwrite any existing data in the current system.

Database Utilities : Restore

This will perform a full restore of all tables from a saved file. If your server supports it, you may upload a gzip-compressed text file and it will automatically be decompressed. **WARNING:** This will overwrite any existing data. The restore may take a long time to process, so please do not move from this page until it is complete.

Select a file

Browse... Start Restore

- ShakeMap Server: display a list of trusted servers in which ShakeMap products reside. This list also includes the ShakeCast system itself. The ShakeCast system comes pre-configured with three default servers that should not be removed: 1)

Server ID 1 contains the hostname that is allowed for injecting ShakeMap products into the current ShakeCast system. The default setting is 'localhost.' Any changes to this server should also be applied to the 'sc.conf' file. 2) Server ID 1000 is the ID of the current ShakeCast system. The default setting is 'localhost' and should be changed to the hostname of the system the ShakeCast is installed. 3) Server ID 1302 is the upstream USGS web server that hosts ShakeMap products for real time notifications. The new ShakeCast system also supports the server-client configuration of the original ShakeCast system. The administrator can consult documentation of version 1 for details. Available functions for each server are: Edit, Delete, and Password.

ShakeCast Server Administration

From this control panel you can add, edit, and remove servers.

ID	DNS Address	Organization	Last Heard From	Status	Error Count	Upstream	Downstream	Poll	Query	Self	Action
1	localhost		2007-11-07 02:17:02	ALIVE	0	1					Edit Delete Password
1000	localhost		2006-12-08 16:21:58	ALIVE	0					1	Edit Delete Password
1302	earthquake.usgs.gov		2007-11-07 16:53:26	ALIVE	0	1	0	0	1	0	Edit Delete Password

[Add new server](#)

- Edit. The server form contains sever related information including identification and permitted functions.

Server Settings

ID*

DNS Address*

Organization

Upstream ☒ Yes

Downstream ☐ Yes

Poll ☐ Yes

Query ☐ Yes

[Submit](#)

- Delete. Remove information of the sever entry from the database.
- Password. Configure password for accessing the designated server. Both Server ID 1000 (local system) and 1302 (USGS web server) do not require password for access. The system is pre-configured password for incoming password for Server ID 1 (injection system). Any changes to the incoming password for a server will update the password file 'sc-servers' for authentication by the Apache web server.

- Template: display a list of configurable notification templates that are available for the system. The templates are categorized in six different notification types and each notification type consists of five different delivery methods, a total of 30 template variations. The six notification types are “Cancel Event”, “New Event”, “Updated Event”, “New Product”, “Facility Shaken”, and “Facility Damage.” The five different delivery methods are “Pager”, “HTML Email”, “Text Email”, “Voice”, and “Script.” In addition to the default template, the administrator can create custom templates for any the template variant. Each defined template is divided into three sections, the header, body, and footer and files reside in the “templates” directory. This configuration does not apply to the ShakeCast web pages. The available functions for each defined template are: View, Edit, and Delete.

ShakeCast Template Administration

From this control panel you can add, edit, and remove templates.

Notification Type	Message Type	File Name	Description	Action
Cancel Event	Text Email	default		View Edit Delete
New Event	Pager	default		View Edit Delete
New Event	Text Email	default		View Edit Delete
New Event	HTML Email	default		View Edit Delete
New Event	Script	default		View Edit Delete
Updated event	Pager	default		View Edit Delete
Updated event	Text Email	default		View Edit Delete
Updated event	HTML Email	default		View Edit Delete
Facility Shaken	Text Email	default		View Edit Delete
Facility Shaken	HTML Email	default		View Edit Delete
Facility Shaken	Script	default		View Edit Delete
New Product	Text Email	default		View Edit Delete
New Product	HTML Email	default		View Edit Delete
Facility Damage	Pager	default		View Edit Delete
Facility Damage	Text Email	default		View Edit Delete
Facility Damage	HTML Email	default		View Edit Delete
Facility Damage	Script	default		View Edit Delete

[Add new template](#)

- View. The function shows the content of the selected template when combining all three sections of the template.

'SHAKING-EMAIL_HTML-default' Template

```

; Default HTML Email Notification -- header
;
From: ShakeCast <%HEADER_FROM%>
To: %HEADER_TO%
Subject: Testing Windows ShakeCast : %EVENT_ID% (%_ITEMNO%)
Content-Type: text/html
      
```

ShakeCast Event: Magnitude %MAGNITUDE%

ShakeMap %EVENT_NAME|[NULL]|(Unnamed Event) %Version %SHAKEMAP_VERSION%

Event Location: %EVENT_LOCATION_DESCRIPTION%

Event Time: %EVENT_TIMESTAMP%

Generated at: %GENERATION_TIMESTAMP%

Reported by: Server ID = %SERVER_ID%, DNS = %DNS_ADDRESS%

Shaking Summary

Number of Facilities Reported: %_ITEMNO%

Max Value: MMI: %_MAX_METRIC_MMI%;

Acceleration: %_MAX_METRIC_PGA|[NULL]|(not measured)%

Number of Reports of Shaking over Threshold: %_ITEMNO%

Facility Shaking Estimates from ShakeMap

;;;;

Facility	Metric	Value
%FACILITY_NAME%	%METRIC%	%GRID_VALUE%

[END]

- Edit. The editable form allows the ShakeCast administrator to create/edit both existing and new templates. A template variant only allows for one 'default' template. Custom templates can be created by giving the template a new template name and filename other than "default."
- Delete. Remove information of the template entry from the database and the local file system.

'SHAKING-EMAIL_HTML-default' Template

Name*

File Name*

Description

Header Section

```

; Default HTML Email Notification -- header
;
From: ShakeCast <%HEADER_FROM%>
To: %HEADER_TO%
Subject: Testing Windows ShakeCast : %EVENT_ID% (%_ITEMNQ%)
Content-Type: text/html

<font size=+2><b>ShakeCast Event: Magnitude
%MAGNITUDE%</b></font><br>
ShakeMap %EVENT_NAME:[NULL];(Unnamed Event) %Version
%SHAKEMAP_VERSION%<br>
Event Location: %EVENT_LOCATION_DESCRIPTION%<br>
Event Time: %EVENT_TIMESTAMP%<br>
Generated at %GENERATION_TIMESTAMP%<br>
Reported by: Server ID = %SERVER_ID%, DNS = %DNS_ADDRESS%

```

Body Section

```

<tr>
<td>%FACILITY_NAME%
<td>%METRIC%
<td>%GRID_VALUE%
</tr>

```

Footer Section

```

</table>
[END]

```

Event Administration

The event administration section allows a ShakeCast administrator to manage ShakeMap events in three different categories: 1) Processed ShakeMap events; 2) ShakeCast test events; and 3) Additional ShakeMap inventory on the USGS web site.

ShakeCast Processed Event List								
From this control panel you can add, edit, and remove test events.								
Event ID	Timestamp	Magnitude	Latitude	Longitude	Location Description	Action		
2007285_222046 -1	2007-10-12 02:38:43	3.14	38.6006	-118.4494	10.9 miles ENE of HAWTHORNE-NV	Re-Alert	Comment	Delete
2007282_221806 -1	2007-10-09 13:12:01	3.48	38.4716	-118.5044	7.5 miles ESE of HAWTHORNE-NV	Re-Alert	Comment	Delete
2007282_221782 -1	2007-10-09 13:12:01	3.18	38.4601	-118.5	8.2 miles ESE of HAWTHORNE-NV	Re-Alert	Comment	Delete
2007282_221841 -1	2007-10-09 12:32:12	2.9	38.4736	-118.5044	7.5 miles ESE of HAWTHORNE-NV	Re-Alert	Comment	Delete
2007282_221779 -5	2007-10-09 12:13:15	3.79	38.4801	-118.5002	7.5 miles ESE of HAWTHORNE-NV	Re-Alert	Comment	Delete
2007hzah - 1	2007-10-02 03:43:39	5.7	-4.5294	101.1811	SOUTHERN SUMATRA, INDONESIA	Re-Alert	Comment	Delete
2007271_220917 -1	2007-09-28 00:23:21	2.94	35.7503	-115.8148	47.4 miles SW of LAS_VEGAS-NV	Re-Alert	Comment	Delete
2007htai - 1	2007-09-26 04:43:16	5.9	-3.8822	-79.1707	NEAR THE COAST OF ECUADOR	Re-Alert	Comment	Delete
14325560 - 7	2007-09-25 22:38:23	3.9	33.7372	-117.4705	9.4 mi WNW of Lake Elsinore, CA	Re-Alert	Comment	Delete
2007268_220640 -1	2007-09-25 06:06:17	3.02	39.0415	-118.555	32.2 miles SSE of FALLON-NV	Re-Alert	Comment	Delete
14325120 - 4	2007-09-23 08:13:41	3.5	32.693	-116.0592	4.8 mi SW of Ocotillo, CA	Re-Alert	Comment	Delete
2007263_220225 -1	2007-09-20 08:49:29	3.67	40.5031	-115.7391	22.7 miles S of ELKO-NV	Re-Alert	Comment	Delete
2007256_219568 -1	2007-09-13 10:43:30	3.36	40.7815	-116.9227	9.6 miles N of BATTLE_MOUNTAIN-NV	Re-Alert	Comment	Delete
2007256_219567 -1	2007-09-13 10:30:49	3.37	40.6598	-116.7925	7.4 miles E of BATTLE_MOUNTAIN-NV	Re-Alert	Comment	Delete

- **Processed Event:** display a list of both actual and scenario ShakeMaps that have been processed by the ShakeCast and are present in the database. Available functions for each processed event are: Re-Alert, Comment, and Delete.
 - **Re-Alert.** The Re-Alert function triggers the ShakeCast notification process to re-send notifications to ShakeCast users whom were on the recipient list. The list of recipients and facilities is based on the time the event was processed.
 - **Comment.** The Comment function allows a ShakeCast administrator to attach additional information to a processed event, either via email notification and/or web posting. The target of email comment only applies to the list of recipients who received ShakeCast notifications for the specified event.

Comment Event via Email/Web Page

Here you can comment and email a message to either all of your users whom received ShakeCast notifications for the event. To do this, an email will be sent out to the administrative email address supplied, with a blind carbon copy sent to all recipients. If you are emailing a large group of people please be patient after submitting and do not stop the page halfway through. It is normal for a mass emailing to take a long time and you will be notified when the script has completed.

Comment Target : ☐ Email ☐ Web Page

Compose

Recipients Notified ShakeCast Users for this event

Subject Re: ShakeCast Notification for Event 2007285_22

Message

Submit

- **Delete.** The Delete function removes all processed information for the specified event including event information, metrics, and notifications from the database. This function is typically used to remove unwanted events from the database and to reprocess selected ShakeCast events. This function does not remove ShakeMap products from the ShakeCast download directory.
- **Test Event:** display a list of processed ShakeMaps that are available for the purpose of local testing. To trigger a test event, click on the links in the Action column to simulate either a new or an updated event. Notifications generated from test events are sent to ShakeCast users whose notification profiles are configured to also receive test events. To add a processed ShakeCast event to the list for test event, click on the “Add new test event” button on the bottom of the page and select an event from a list of processed ShakeCast events. To remove a test event, delete the event directory from the ShakeCast test event directory from the operating system.

ShakeCast Test Event List

From this control panel you can add, edit, and remove test events.

Event ID	Magnitude	Latitude	Longitude	Location Description	Action	
SanGregorio_3_se_scte	7.44	36.805	-122.162	SGF_SGS+SGN	Version 1	Version N+1
200708152340_scte	8	-13.32	-76.51	Off Coast of Central Peru	Version 1	Version N+1
200610151714_scte	6	20.129	-155.983	Big Island Region, Hawaii	Version 1	Version N+1
200610151707_scte	6.7	19.8777	-155.935	Big Island Region, Hawaii	Version 1	Version N+1
200605262253_scte	6.3	-7.955	110.43	Yogyakarta, Indonesia	Version 1	Version N+1
200602222219_scte	7	-21.259	33.48	Mozambique	Version 1	Version N+1
200510080350_scte	7.6	34.465	73.584	Kashmir, Pakistan	Version 1	Version N+1
200503281609_scte	8.6	2.069	97.097	Nias, Sumatra	Version 1	Version N+1
200503200153_scte	6.6	33.802	130.209	Fukuoka, Japan	Version 1	Version N+1
200502220225_scte	6.4	30.691	56.794	Dahuiyeh, Iran	Version 1	Version N+1
200412260058_scte	9	3.287	95.972	Banda Aceh, Sumatra, Indonesia	Version 1	Version N+1
200411150906_scte	7.2	-4.691	-77.509	Buenaventura, Colombia	Version 1	Version N+1
200410220056_scte	6.6	33.23	138.881	Miyako, Japan	Version 1	Version N+1

- USGS ShakeMap:** retrieves a list of both actual and scenario ShakeMaps on the USGS web site that are available for download and process. The two available options for a ShakeMap event are “Download Only” and “Inject.” The “Download Only” function retrieves all available products for a ShakeMap and stores them in the ShakeCast data directory on the server system. The “Inject” function performs the same “Download Only” function and an additional ShakeCast process to for the ShakeMap event as for the real-time RSS system process. The major differences for the “Inject” function are that it is not restricted to the ShakeMap region directive of the RSS process and is also able to process scenario ShakeMaps. The ShakeCast administrator should use the “Inject” function with caution since the process treats actual USGS ShakeMaps as real events.

ShakeMap Event List on the USGS web site

From this control panel you can view, download, inject ShakeMaps on the USGS web site.

Actual Events : [S. California](#) | [N. California](#) | [Pacific NW](#) | [Nevada](#) | [Utah](#) | [Hawaii](#) | [Global](#)
Scenario Events : [S. California](#) | [N. California](#) | [Pacific NW](#) | [Nevada](#) | [Utah](#) | [Alaska](#) | [Hawaii](#) | [Global](#)

Event ID	Network	Action
2007imal	global	Download Only Inject
2007288_222252	nn	Download Only Inject
2007ikbb	global	Download Only Inject
93394	ak	Download Only Inject
2007285_222046	nn	Download Only Inject
2007iiaa	global	Download Only Inject
2007iibu	global	Download Only Inject
2007iia5	global	Download Only Inject
2007ihac	global	Download Only Inject
2007iqa7	global	Download Only Inject
2007282_221806	nn	Download Only Inject
2007282_221782	nn	Download Only Inject
2007282_221841	nn	Download Only Inject
2007282_221779	nn	Download Only Inject
2007ifbt	global	Download Only Inject
2007ifbi	global	Download Only Inject
2007ida2	global	Download Only Inject
2007icah	global	Download Only Inject

Facility Administration

The facility administration section handles facility specific interaction with the ShakeCast system. This management section is divided into four categories: 1) Damage Level; 2) Facility Type; 3) Facility Management; and 4) Supplemental Attributes. Changes made in each category have different scope of influence. The “Damage Level” settings apply to all facilities in the ShakeCast database. Settings for both “Facility Type” and “Supplemental Attributes” are defined for specific structure types. Finally, the “Facility Management” allows management of facility specific information. It is worth noting that any changes made to “Damage Level” and “Facility Type” will not affect corresponding settings for existing facilities inside the database and only apply to new facilities. In addition to manual editing of facility settings, the administrator can use the “manage_facility.pl” tool to refresh settings of all facility via batch processing.

- **Damage Level:** display a list of available damage state descriptions for facilities. The ShakeCast system is pre-configured with a four damage level classification. The number of damage levels is flexible and the ShakeCast administrator can create additional damage states for custom needs. Although defined damage levels are available to all facilities for damage assessment, it is not necessary to define the range of ground intensity measures for all damage levels for a given facility. Undefined damage levels of a facility will simply not be used to measure damage state for the facility.

ShakeCast Damage Level Administration

From this control panel you can add, edit, and remove damage levels.

Damage Level	Name	Description	Severity Rank	Max Severity	Action
GREEN	Damage Unlikely or Slightly	Damage is not likely to the facility.	100		Edit Delete
YELLOW	Moderate Damage Possible	This facility has possibly suffered damage.	200		Edit Delete
ORANGE	Extensive Damage Possible	This facility has possibly suffered extensive damage.	300		Edit Delete
RED	Complete Damage Possible	This facility has probably suffered damage.	400	Yes	Edit Delete
Add new damage level					

- Facility Type:** display a list of available definitions of structure type for facilities. Each facility type includes a set of optional fields of default fragility settings. The ShakeCast system comes with default fragility settings for 128 choices of HAZUS model building type and code era (see document “HAZUS Damage Level” for detailed definition). The database also contains definitions of common geotechnical structures but includes no fragility settings. ShakeCast users can define custom structure types for their facilities. To define damage states for a given facility type, the ShakeCast administrator will need to provide the range of high and low values of the described damage level and the metric of ground intensity measure.

ShakeCast Facility Type Administration

From this control panel you can add, edit, and remove facility type specific parameters and fragilities.

Facility Type	Name	Description	Action
C1HH	C1H High Code	C1H High Code	Edit Delete
C1HM	C1H Moderate Code	C1H Moderate Code	Edit Delete
C1HL	C1H Low Code	C1H Low Code	Edit Delete
C1HP	C1H Pre Code	C1H Pre Code	Edit Delete
C1MH	C1M High Code	C1M High Code	Edit Delete
C1MM	C1M Moderate Code	C1M Moderate Code	Edit Delete
C1ML	C1M Low Code	C1M Low Code	Edit Delete
C1MP	C1M Pre Code	C1M Pre Code	Edit Delete
C1LH	C1L High Code	C1L High Code	Edit Delete
C1LM	C1L Moderate Code	C1L Moderate Code	Edit Delete
C1LL	C1L Low Code	C1L Low Code	Edit Delete
C1LP	C1L Pre Code	C1L Pre Code	Edit Delete
C2HH	C2H High Code	C2H High Code	Edit Delete
C2HM	C2H Moderate Code	C2H Moderate Code	Edit Delete
C2HL	C2H Low Code	C2H Low Code	Edit Delete
C2HP	C2H Pre Code	C2H Pre Code	Edit Delete
C2MH	C2M High Code	C2M High Code	Edit Delete
C2MM	C2M Moderate Code	C2M Moderate Code	Edit Delete
C2ML	C2M Low Code	C2M Low Code	Edit Delete
C2MP	C2M Pre Code	C2M Pre Code	Edit Delete
C2LH	C2L High Code	C2L High Code	Edit Delete
C2LM	C2L Moderate Code	C2L Moderate Code	Edit Delete
C2LL	C2L Low Code	C2L Low Code	Edit Delete

ShakeCast Facility Type Administration

From this control panel you can add, edit, and remove facility type specific parameters and fragilities.

Facility Type Information	
Facility Type	C1HH
Name	C1H High Code
Description	C1H High Code
<input type="button" value="Submit"/>	

Damage Level	Low Limit	High Limit	Metric
Damage Unlikely or Slightly	0	25	Peak Ground Acceleration (%g)
Moderate Damage Possible	25	71	Peak Ground Acceleration (%g)
Extensive Damage Possible	71	155	Peak Ground Acceleration (%g)
Complete Damage Possible	155	99999	Peak Ground Acceleration (%g)

- Facility Management: display a list of user-defined facilities populated in the ShakeCast database. From this view the administrator can create new facilities and manage information of existing ones. Required fields for a user-defined facility include facility name, facility type, and location in latitude and longitude. Facility location can be either a point location or a rectangular area. Fragility settings for a facility are needed for damage estimate. Custom fragility settings for a facility, either in values and/or choices of metric, will override the default settings for the given facility type. For ShakeCast systems with large inventory of facilities, the administrator can use the system utility “manage_facility.pl” to populate new facilities and to update/remove existing ones.

ID	Type	Facility Name	Description	Latitude	Longitude	Action
9124	BRIDGE	W Cabrillo Storage Uc	11-SD-008-2.32-SD	32.7633 <-> 32.7633	-117.1633 <-> -117.1633	Edit Delete
6488	BRIDGE	101/134, 170 Separation	07-LA-101-11.75-LA	34.1533 <-> 34.1533	-118.3783 <-> -118.3783	Edit Delete
3187	BRIDGE	101/280 Ic - S101 (Upper), N101 To N280 (Lower)	04-SF-101-1.63-SF	37.735 <-> 37.735	-122.4067 <-> -122.4067	Edit Delete
6171	BRIDGE	104Th Street Uc	07-LA-110-14.72-LA	33.94 <-> 33.94	-118.2783 <-> -118.2783	Edit Delete
7498	BRIDGE	105-110 Hov Connector Oc	07-LA-105-R7.11-LA	33.9283 <-> 33.9283	-118.285 <-> -118.285	Edit Delete
3000	BRIDGE	106Th Avenue Uc	04-ALA-580-R35.71-OAK	37.7483 <-> 37.7483	-122.145 <-> -122.145	Edit Delete
6172	BRIDGE	108Th Street Uc	07-LA-110-14.47-LA	33.9367 <-> 33.9367	-118.2783 <-> -118.2783	Edit Delete
4721	BRIDGE	10Th Avenue Oc	06-KIN-198-R18.96-HAN	36.325 <-> 36.325	-119.6367 <-> -119.6367	Edit Delete
3555	BRIDGE	10Th Street Oc	04-SCL-101-38.09-SJS	37.3633 <-> 37.3633	-121.8967 <-> -121.8967	Edit Delete
3757	BRIDGE	10Th Street Separation (152/101)	04-SCL-152-R9.91-GIL	37.0028 <-> 37.0028	-121.5569 <-> -121.5569	Edit Delete
1991	BRIDGE	10Th Street Uc	03-SAC-050-L.96-SAC	38.565 <-> 38.565	-121.4983 <-> -121.4983	Edit Delete
1992	BRIDGE	10Th Street Uc	03-SAC-050-L.96-SAC	38.565 <-> 38.565	-121.4983 <-> -121.4983	Edit Delete

ShakeCast Facility Administration

From this control panel you can add, edit, and remove facilities. Predefined facility fragility setting values include 15% amplitude adjustment from mean to peak values.

Edit Facility Information

Facility Name

Abbeville, LA (pop. 11)

*

Short Name

*

Facility Type

City

*

Facility Description

*

Latitude

29.967

*

<->

29.967

*

Longitude

-92.133

*

<->

-92.133

*

Damage Level	Low Limit	High Limit	Metric
Damage Unlikely or Slightly	1	5	Instrumental Intensity
Moderate Damage Possible	5	7	Instrumental Intensity
Extensive Damage Possible			Instrumental Intensity
Complete Damage Possible	7	999999	Instrumental Intensity

Facility Attribute

ADMIN_REGION

- Supplemental Attributes: display a list of defined attributes associated with structure types. Supplemental attribute is a free-form field and multiple fields are permitted. It is designed to store specific information for facility types that are not commonly shared among facilities.

Profile Administration

A ShakeCast profile can be viewed as a pseudo user who represents a group of users with shared notification requests but different delivery methods. ShakeCast notification profiles are optional for setting up notification for systems with relatively small facility inventory or with a number of users. For larger system, notification profiles provide an efficient method to limit size growth of the database and to maintain performance of notification processing.

The profile administration section handles management of profiles with respect to both facilities and notification requests. This management section is divided into two categories: 1) Management of profile geometry polygons for facility association; and 2) Notification request for profile. Same as for facility management, there is command line counterpart of the web interface, “manage_profile.pl.” For system with large inventory, the administrator can use the “manage_profile.pl” tool to refresh settings of all profiles via batch processing.

From this control panel you can add, edit, and remove profile specific parameters and attributes.

- **Management:** display a list of defined profiles that a user can subscribe for notification requests. Each profile consists of a geometric polygon outlining the region of interest and a set of notification requests for the enclosed facilities. The administrator defines the polygon via the interactive map and with the additional options for selecting rectangular and circular regions. Upon submitting the form, a list of facilities enclosed by the geometric boundaries will be assigned to the profile. The list of facilities for a profile is not restricted to the facilities enclosed inside the polygon and can be edited later.

From this control panel you can add, edit, and remove polygon attributes

Final Report - Appendix 5

- Notification Request: display a list of available notification requests configured for each profile. From this view the administrator selects a profile to edit or remove its notifications.

Profile Notification Request Administration				
From this control panel you can add, edit, and remove profile notification settings				
ID	Profile Name	Description	Notification Settings	Action
17	CUS	Contiguous US	6	Edit Delete
18	CI	Southern California	6	Edit Delete
19	NC	Northern California	6	Edit Delete
20	PN	Pacific Northwest	0	Edit Delete
21	AK	Alaska Region	0	Edit Delete
22	UT	Utah Region	0	Edit Delete
23	HV	Hawaii Region	0	Edit Delete
24	NN	Nevada Region	6	Edit Delete

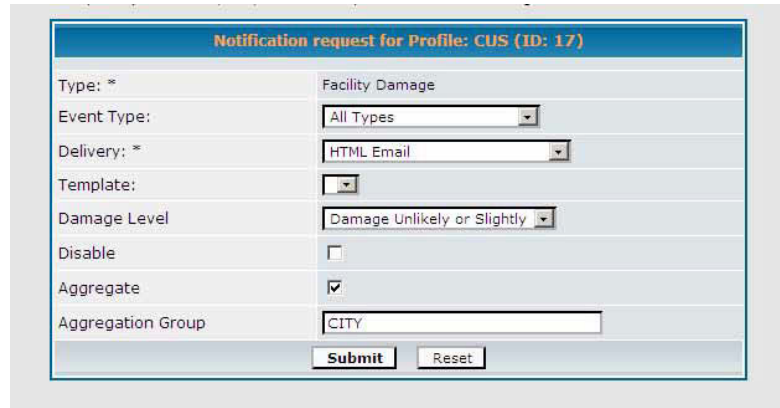
When creating a notification request, there are six different notification types to choose from. The notification types include “New Event”, “Cancel Event”, “Update Event”, “New Product”, “Facility Shaken”, and “Facility Damage.” It is permitted to define more than one notification requests of the same type for a profile. Multiple notification requests can be aggregated into groups as a combined message during the dissemination of notifications based on users’ requests.

Profile Notification Request Administration												
From this control panel you can add, edit, and remove profile notification settings												
Notification request for Profile: CUS (ID: 17)												
ID	Type	Event Type	Delivery	Template	Limit Value	Damage Level	Product	Metric	Disable	Aggregate	Aggregation Group	Facility
40	Facility Damage	All Types	HTML Email			Damage Unlikely or Slightly				Yes	CITY	10018 Edit Delete
42	Facility Damage	All Types	HTML Email			Complete Damage Possible				Yes	CITY	10018 Edit Delete
41	Facility Damage	All Types	HTML Email			Moderate Damage Possible				Yes	CITY	10018 Edit Delete
37	New Event	All Types	HTML Email									10018 Edit Delete
38	New Product	All Types	HTML Email				GRID_XML					10018 Edit Delete
39	Facility Shaken	All Types	HTML Email		1			Instrumental Intensity		Yes		10018 Edit Delete
Add a Notification Request: <input type="text" value="Select a Notification Request"/> <input type="button" value="Add"/>												
All times are GMT												

Inside the notification request view, the available functions are Add, Edit, Delete, and Facility selection. To add a new request, use the selectable menu on the lower left corner of the form to create and configure the request. The Delete function removes the selected notification request from the database.

All notification request types require information of notification type, event type, and delivery method. For “New Product” type, an additional field of product type is needed. For “Facility Damage” type, the additional required field is damage level. For “Facility Shaken” type, the administrator needs to specify both the

metric and the limit value of shaking threshold.



Notification request for Profile: CUS (ID: 17)

Type: * Facility Damage

Event Type: All Types

Delivery: * HTML Email

Template:

Damage Level: Damage Unlikely or Slightly

Disable: ☐

Aggregate: ☒

Aggregation Group: CITY

Submit Reset

To fine tune the list of facilities for a profile, the administrator click on the facility link inside the notification request view page. The facility selection view is a set of paged tables with included facilities marked with check marks. The administrator can switch between the subscribed list and the full list of facilities to add and remove facilities from the list. The facility inventory is updated for the profile after the administrator submits the changes.

n add, edit, and remove profile notification settings

Facilities of Notification Request for Profile: CUS (17)						
Subscribed List Full List						
ID	Type	Facility Name	Latitude	Longitude	Select	
1	BRIDGE	Minot Creek	41.5536	-124.0547	<input checked="" type="checkbox"/>	
2	BRIDGE	Hunter Creek	41.5581	-124.0589	<input checked="" type="checkbox"/>	
3	BRIDGE	High Prairie Creek	41.5683	-124.0689	<input checked="" type="checkbox"/>	
4	BRIDGE	Wilson Creek	41.6044	-124.1006	<input checked="" type="checkbox"/>	
5	BRIDGE	Smith River (Hiouchi)	41.8064	-124.0822	<input checked="" type="checkbox"/>	
6	BRIDGE	Myrtle Creek	41.8017	-124.0556	<input checked="" type="checkbox"/>	
7	BRIDGE	Hardscrabble Creek	41.8392	-124.0261	<input checked="" type="checkbox"/>	
8	BRIDGE	Smith River	41.8425	-124.0117	<input checked="" type="checkbox"/>	
9	BRIDGE	Middle Fork Smith River	41.8578	-123.8853	<input checked="" type="checkbox"/>	
10	BRIDGE	Patrick Creek	41.8744	-123.8436	<input checked="" type="checkbox"/>	
11	BRIDGE	Middle Fork Smith River	41.88	-123.8272	<input checked="" type="checkbox"/>	
12	BRIDGE	Middle Fork Smith River	41.8831	-123.8186	<input checked="" type="checkbox"/>	
13	BRIDGE	Middle Fork Smith River	41.8608	-123.8719	<input checked="" type="checkbox"/>	
14	BRIDGE	Smith River	41.8797	-124.1369	<input checked="" type="checkbox"/>	
15	BRIDGE	Rowdy Creek	41.9283	-124.1417	<input checked="" type="checkbox"/>	
16	BRIDGE	Gilbert Creek	41.9819	-124.2031	<input checked="" type="checkbox"/>	
17	BRIDGE	Panther Creek	41.5561	-124.0567	<input checked="" type="checkbox"/>	
18	BRIDGE	Route 101/169 Separation	41.5228	-124.0342	<input checked="" type="checkbox"/>	
19	BRIDGE	Hoppow Creek (W169-N101)	41.5231	-124.0333	<input checked="" type="checkbox"/>	
20	BRIDGE	Hoppow Creek (Off-Ramp)	41.5228	-124.035	<input checked="" type="checkbox"/>	
21	BRIDGE	Klamath River	41.5181	-124.0314	<input checked="" type="checkbox"/>	

User Administration

The user administration section handles tasks of user specific interactions with the ShakeCast system. Depending on the system configuration, creation of a new user

account and notification requests can be initiated by either the end-user or the administrator. Upon user's request for a new account, the administrator can usually approve or deny the request by responding to the email message sent by the ShakeCast system. This management view allows the administrator to review settings of all user accounts and can overwrite any existing settings. The section is divided into three categories: 1) Management; 2) Notification Request; and 3) Replication. Batch processing for a large number of user accounts and settings of notification requests is available via the ShakeCast utility "manage_user.pl."

- **Management:** display a list of users stored inside the ShakeCast database. In addition to the basic user information the table also shows the user privilege and user status. A "Suspended" user status indicates that the user account exists in the database but neither user log-on nor receiving notifications are permitted. To remove a user permanently from the database, the administrator should use the "Delete" function from within this view. There are three available functions for the "Management" view: Add, Edit, and Delete. The "Delete" function removes all information including user data, notification requests, and previous notifications for the selected user from the ShakeCast. Both the "Add" and "Edit" functions share the same interface. The exception is that for "Add" the administrator needs to provide a unique user name for the new user account.

User Administration

Here you can change your users' information and certain options.

Select a User

Username	Full Name	Email Address	Job Title	Organization	User Level	User Status	Action
scadmin					Administrator	Active	Edit Delete
SteveSahs	Steve Sahs	steve_sahs@dot.ca.gov			User	Active	Edit Delete
MarkYashinski	Mark Yashinski	mark_yashinski@dot.ca.gov			User	Active	Edit Delete
MikeKeever	Mike Keever	mike_keeveer@dot.ca.gov			User	Active	Edit Delete
LorenTurner	Loren Turner	loren_turner@dot.ca.gov			Administrator	Active	Edit Delete
BobTanaka	Bob Tanaka	bob_tanaka@dot.ca.gov			User	Active	Edit Delete
John							

The user account form consists of four sections regarding information for user log-in, user profile, delivery addresses, and special fields. The user can update information for the first three sections from the user accessible account management page. The administrator-only fields allow both suspension and removal of any user account, including the administrator. The administrator can also use this form to modify user privilege. It is advisory to limit the number of users with administrator's privilege.

User Administration

Here you can change your users' information and certain options.

Registration Information	
Items marked with a * are required unless stated otherwise.	
Username: *	<input type="text" value="LorenTurner"/>
E-mail address: *	<input type="text" value="loren_turner@dot.ca.gov"/>
New password: * You only need to supply a password if you want to change it	<input type="text"/>
Confirm password: * You only need to confirm your password if you changed it above	<input type="text"/>

Contact Information	
Full Name	<input type="text" value="Loren Turner"/>
Occupation	<input type="text"/>
Organization	<input type="text"/>
Location	<input type="text"/>

Delivery Method Information	
HTML Email	<input type="text" value="loren_turner@dot.ca.gov"/>
Text Email	<input type="text"/>
Pager	<input type="text" value="loren_turner@dot.ca.gov"/>

Special admin-only fields	
These fields are not able to be modified by the users. Here you can set their status and other options that are not given to users.	
User is active	<input checked="" type="radio"/> Yes <input type="radio"/> No
User Level	<input type="text" value="Administrator"/>
Delete this user?	<input type="checkbox"/> Click here to delete this user; this cannot be undone.
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

- Notification Request: works the same as the notification request view for profile management. Changes of notification request settings only apply to the selected user.
- Replication: display a form with two drop-down selectable lists for both the source and destination for the replication process. The ShakeCast replication function allows the administrator to duplicate notification requests of a selected profile or user to a group of users. For better performance for system notifications immediately after earthquakes, the administrator can create a profile for users who share common notification requests. By assigning the user group to a single profile it effectively reduces the processing time and the table size of the notification queue. User replication is suitable to produce a template of notification requests for particular users for further customization.

User/Profile Replication Administration

Here you can replicate users' information of notification requests and profiles. An user can not be both the source and destination of replication.

Source User/Profile	Destination Users
<div> <div>User List</div> <div>Profile List</div> </div> <div>Select a User</div>	<div>Select a List of Users</div> <div> 1: 6: Loren Turner 7: Steve Sahs 8: Mark Yashinski 9: Mike Keever 10: Bob Tanaka 11: John OSullivan 12: Pat Hipley 13: Pete Whitfield 14: Martha Merriam 15: Michael B Johnson 16: Nick Burmas 17: Abhijit Naik 18: Allaoua Kartoum 19: Amir Rahbari 20: Brian Jesse 21: Charles Sikorsky 22: Chris Campbell 23: Chuong Ho </div>
<div>Replicate</div> <div>Reset</div>	

Miscellaneous Administration

- Web access to ShakeCast system version 1: In addition to the standard portal access, the ShakeCast version 2 system also retains the web directories from the previous version for the purpose of both user and server communications. Access to these pages is restricted and is authenticated through the Apache web server. The administrator has to edit the files “httpd-sc.conf” and “sc-servers” files to configure user access and password changes. To disable the version web access, edit the ShakeCast web configuration file “httpd-sc.conf” under the “conf” directory by commenting out the “scripts/s” and the “scripts/c” sections.
- PMA access: The ShakeCast system has pre-configured an optional installation of PHPMYAdmin into the “/pma” directory. The application allows the administrator to interact with the database via the web interface. To access the interface, the administrator is required to provide the same username and password as for the version 1 web access and also the username and password to the ShakeCast database. To disable the PMA access, edit the ShakeCast web configuration file “httpd-sc.conf” under the “conf” directory by commenting out the “pma” section.
- Database configuration: Information regarding access to the ShakeCast database and authentication is stored inside the “sc.conf” configuration file under the “conf” directory. The administrator will also need to update the “sc.conf” file every time when access information to the database is changed.
- Default center location: The default center point for the ShakeCast mapping interface is stored in the file “default-sc.js” under the “docs” directory and is currently set in California. The administrator can edit the content of the file to change the default center location.

ShakeCast User Web Interface

This document describes the User Web Interface of ShakeCast. The User Web Interface is called the “ShakeCast Portal” and is used for all interaction with the ShakeCast system, such as reviewing ShakeCast damage assessment summary for facilities affected by earthquakes, applying for a ShakeCast user account, or signing-up for automatic ShakeCast notifications on facilities likely affected after earthquakes. The key features of the ShakeCast Portal are:

- Runs on any of the popular Web browsers connected to the Internet.
- Accesses to all processed ShakeMaps for both actual and scenario earthquakes.
- Displays all pertinent information associated with facilities including facility parameters, intensity measures and damage estimates
- Management automatic ShakeCast notifications for both message formats and facilities of interest.
- Accesses to ShakeCast web GIS interface.
- For users with administrative privileges, an additional “Administration Panel” link will also become available.

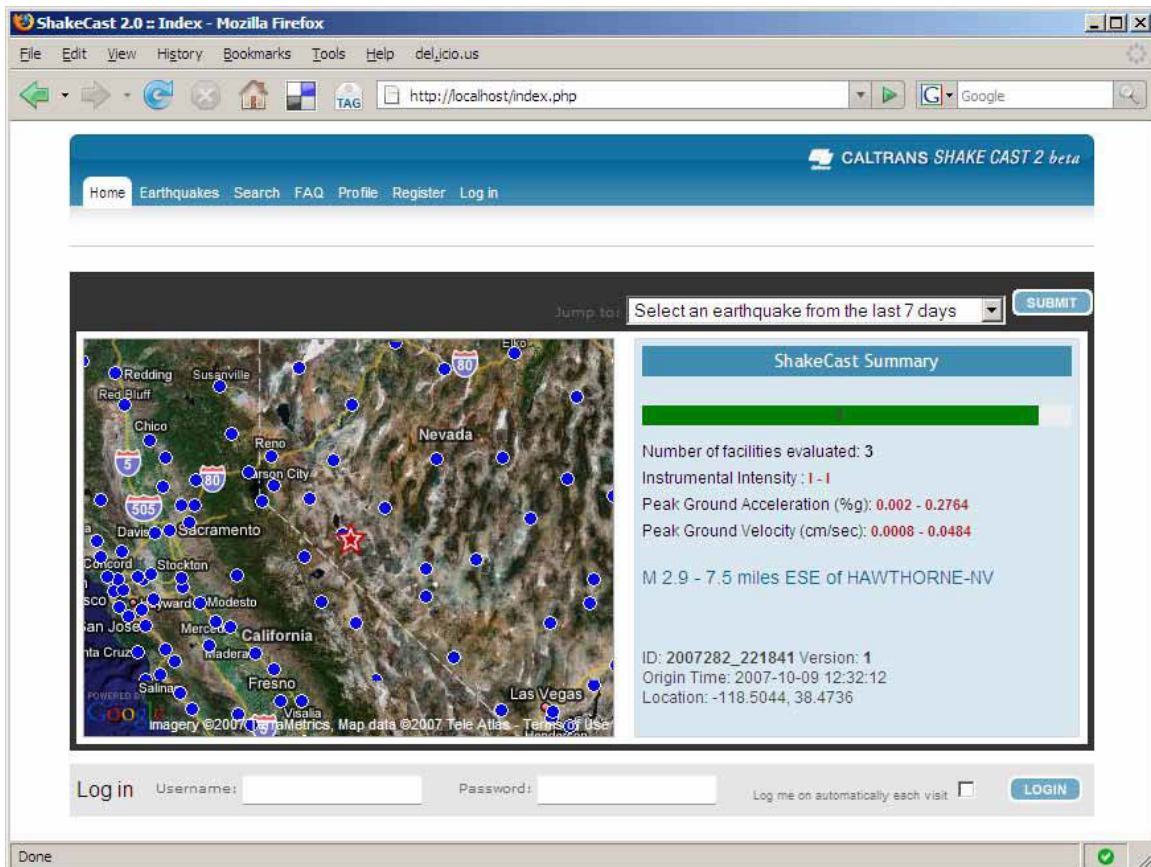


Figure 1. Default web page of the ShakeCast Portal.

System Requirements

The ShakeCast Portal is implemented with common web technologies, such as PHP, Javascript, and AJAX, etc., and is compliant with the HTML 4 specifications. The Portal runs on any browser with HTML Strict DTD support, which includes Microsoft's Internet Explorer 7 and up as well as Firefox. If you do not have one of these browsers, then you may freely download them from Microsoft and Mozilla. The ShakeCast Portal is supported for Windows 98, Windows 2000, Windows XP, Mac OS X, Linux, Sun Solaris and other UNIX-based operating systems.

If operated from behind a firewall, the ShakeCast Portal will operate properly only if the firewall allows HTTP requests to Port 80. If the Portal is repeatedly unable to connect to the ShakeCast and Google Map GIS servers, then you should contact your system administrator.

Log In Procedure

In order to log in, you must be a registered ShakeCast user. Registering can be accomplished by clicking on the "Register" link on the ShakeCast Portal front page. Note that only registered users can modify their personal preferences for receiving ShakeCast notifications.

Logging in requires you to provide a user-id and password. Both user-id and password are case sensitive. If you forget your password, click on the "I forgot my password" link and fill in the information requested; your new password will be then be emailed to you.

If the user-id and password are entered correctly, both the "Register" and "Log In" links at the Portal will be replaced with the "Log out" link with the user-id indicated.

Log Out Procedure

To log out of ShakeCast Portal, you must either click on the "Log out" link from the Portal, which will close your active session with the server but leave the Portal browser open, or close the browser window/quit the application, which also will close the active session.

Front Page of ShakeCast Portal

The ShakeCast Portal front page is shown in Figure 1. The Portal window is partitioned into a number of components that each serves a different purpose:

1. Primary navigation links: a horizontal panel located beneath the organization's logo and ShakeCast banner contains a set of primary navigation links that allows a user to perform operations or access additional information.
2. System message: an area between the primary navigation links and the ShakeCast summary panel that displays event specific information. Typical system messages are a banner indicating a scenario earthquake and crucial comments manually entered by an administrator.
3. Recently processed earthquake selector: a pull-down menu that allow a user to view ShakeCast summary for recently processed earthquakes.

4. ShakeCast facility/ShakeMap overview: an area in the middle left of the ShakeCast summary panel that displays an overview map with both the ShakeMap and facility layers.
5. ShakeCast facility summary: an area in the upper right of the ShakeCast summary panel that displays the number of facilities evaluated, facility potential damage estimates, and the units and the range of ground shaking intensity measures extracted from ShakeMap.
6. ShakeCast event summary: an area in the lower right of the ShakeCast summary panel that displays the key source parameters of the earthquake evaluated. The list of parameters includes the event ID, ShakeMap version number, magnitude, location, and origin time.

Primary Navigation Link Tabs

To Primary navigation link tabs currently have the following links in a panel on top of the ShakeCast Portal. Clicking one will invoke the described operation:

- Home: direct the browser window back to the default page of the ShakeCast portal.
- Earthquakes: direct the browser window to the ShakeCast listing of processed ShakeMaps.
- Search: direct the browser window to the ShakeCast search function for information regarding facility inventories and processed ShakeMaps.
- FAQ: direct the browser window to a list of answers to common problems ShakeCast users encountered.
- Profile: direct the browser window to allow ShakeCast user for managing personal information and notification preferences.
- Register: direct the browser window to the user registration page that allows a non-user to sign-up for an account.
- Administration Panel: direct the browser window to the restricted section for system maintenance and management. This feature is only visible and available to ShakeCast users with administrative privileges.
- Log In/Log Out: the Log In link appears when a user first accesses the page without signing-in. It directs the browser window that allows a user to enter information of username and password or to retrieve a lost password. The Log Out link terminates the current Log In session and redirect the browser window to the default portal page.

Listing of ShakeCast Summary for Earthquakes

ShakeCast summary of affected facilities for earthquakes is accessed via the Earthquake link. This feature allows a ShakeCast user to view facility damage assessment for past earthquakes. The list of processed earthquakes is divided into three categories: 1) Latest Earthquake, 2) Earthquake Archive, and 3) Scenario earthquakes.

No. Facility Evaluated	Magnitude	Earthquake	Location	Event ID	Last Update
3	2.9	7.5 miles ESE of HAWTHORNE-NV (Version 1)	38.4736, -118.5044	2007282_221841	Wed Oct 10, 2007 5:51 am
4	3.48	7.5 miles ESE of HAWTHORNE-NV (Version 1)	38.4716, -118.5044	2007282_221806	Wed Oct 10, 2007 1:12 am
4	3.79	7.5 miles ESE of HAWTHORNE-NV (Version 5)	38.4801, -118.5002	2007282_221779	Tue Oct 09, 2007 10:04 pm
4	3.18	8.2 miles ESE of HAWTHORNE-NV (Version 1)	38.4601, -118.5	2007282_221782	Tue Oct 09, 2007 7:34 pm
12	3.5	2.9 mi N of Chatsworth, CA (Version 4)	34.2982, -118.6117	CI 14313828	Thu Oct 04, 2007 2:05 am
4	2.94	47.4 miles SW of LAS_VEGAS-NV (Version 1)	35.7503, -115.8148	2007271_220917	Tue Oct 02, 2007 11:36 pm
0	5.9	NEAR THE COAST OF ECUADOR (Version 1)	-3.8822, -79.1707	US 2007htaj	Tue Oct 02, 2007 11:33 pm
0	5.7	SOUTHERN SUMATRA, INDONESIA (Version 1)	-4.5294, 101.1811	US 2007hzah	Tue Oct 02, 2007 11:27 pm
0	8	Off Coast of Central Peru (Version 4)	-13.32, -76.51	US 200708152340	Fri Sep 28, 2007 8:22 pm
0	6	Big Island Region, Hawaii (Version 4)	20.129, -155.983	US 200610151714	Fri Sep 28, 2007 8:21 pm
0	6.7	Big Island Region, Hawaii (Version 4)	19.8777, -155.935	US 200610151707	Fri Sep 28, 2007 8:21 pm

Figure 2. The Earthquake page lists the events processed by the ShakeCast system and the number of evaluated facilities in reverse chronological order.

- Latest Earthquake: display a table listing all versions of published ShakeMaps for the most recently processed earthquake. As a common earthquake refining process, the source parameters for a significant earthquake and associated ground motion estimates are constantly updated as more information become available. The ShakeCast system tracks version changes of ShakeMap for an earthquake and re-evaluate facility damage assessment accordingly.
- Earthquake Archive: display a table listing previously processed ShakeMaps for actual earthquakes and their facility damage assessment.
- Scenarios: display a table listing previously processed scenario ShakeMaps and their facility damage assessment. ShakeCast scenarios also include converted actual ShakeMaps for the purpose of local testing.

All tabs can be sorted by selecting the top of any column.

ShakeCast Facility Damage Assessment

The ShakeCast facility damage assessment view is the center piece of the web portal. ShakeCast users interact with the view in either table or map mode.

- **Table mode:** display facility damage assessment in a number of paged tables connected with navigation links. Each row of the table represents ShakeCast damage assessment for one facility. It consists of facility information, damage state estimate, and ground motion estimates at the location of facility. To view the facility on a map, click the facility row to enable the mapping inset.

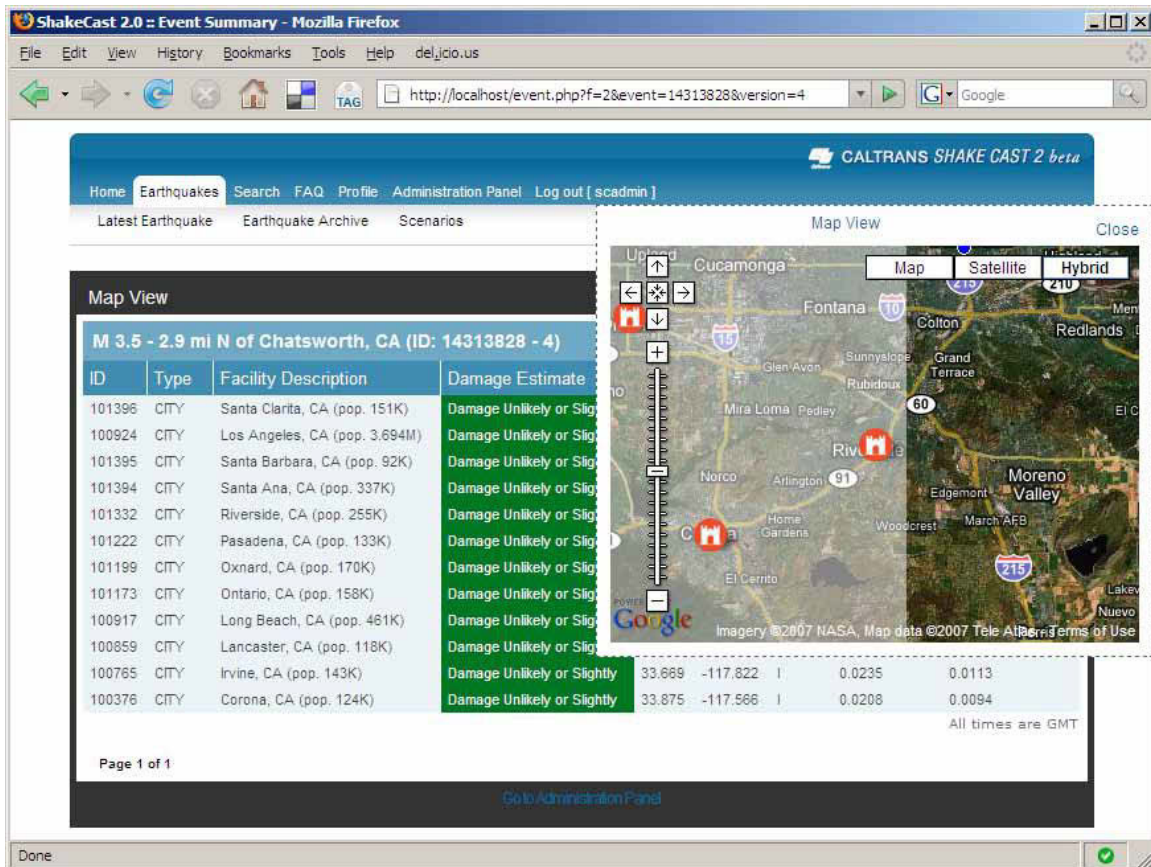


Figure 3. The Event page displays in table mode. Facilities with damage estimates are listed in paged tables with navigation links. Each row of the table represents one facility and contains information regarding facility description, damage estimate, and ground shaking estimates for the site for all available metrics.

- **Map mode:** display facility damage assessment via a web based mapping interface, currently the Google Maps interface. Facilities are presented in both images and list items with facility-type filtering. The facility markers within the mapping area become visible at proper zoom level and are color-coded corresponding to damage estimates. To view the ground motion measures of a facility, click the facility marker in the mapping area to display the parametric values.

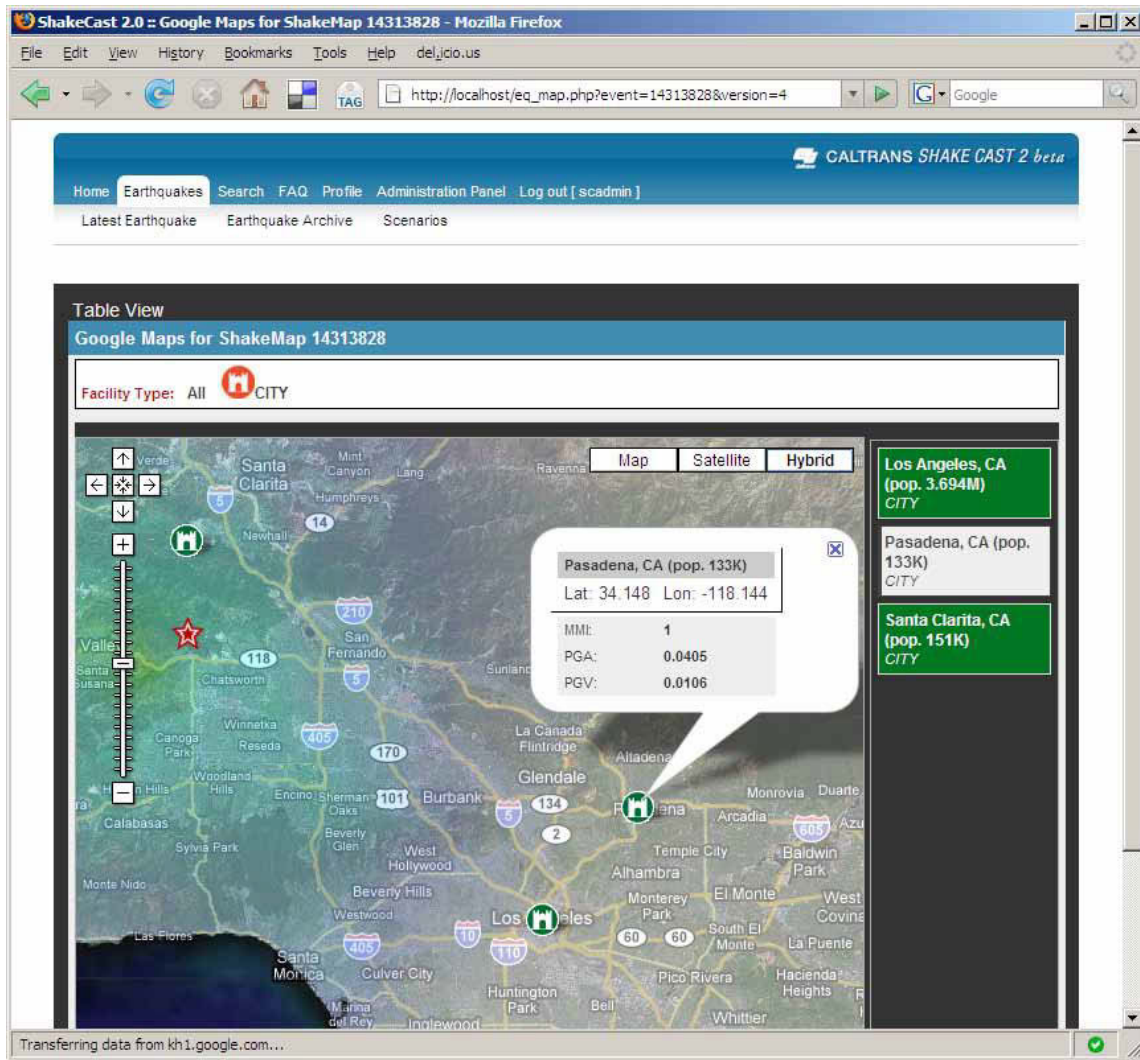


Figure 4. The Event page displays in map mode. The map display is divided into three regions: 1) Facility type selector is located on top of the display and is used to turn on/off facilities of certain type; 2) Facility list panel to the right of the display shows a list of facilities located within the mapping area with color-coded damage estimates; and 3) The interactive mapping area displays the facility locations with the ShakeMap image overlay. The facility markers are in color-coded damage levels and users can pan, zoom, and click on the facilities to reveal shaking parameters.

Search Facilities

The search function is designed to retrieve facility information inside the ShakeCast database. The search result contains facility information, fragility settings including metrics and ranges of threshold, and damage estimates from all previously processed ShakeMaps.

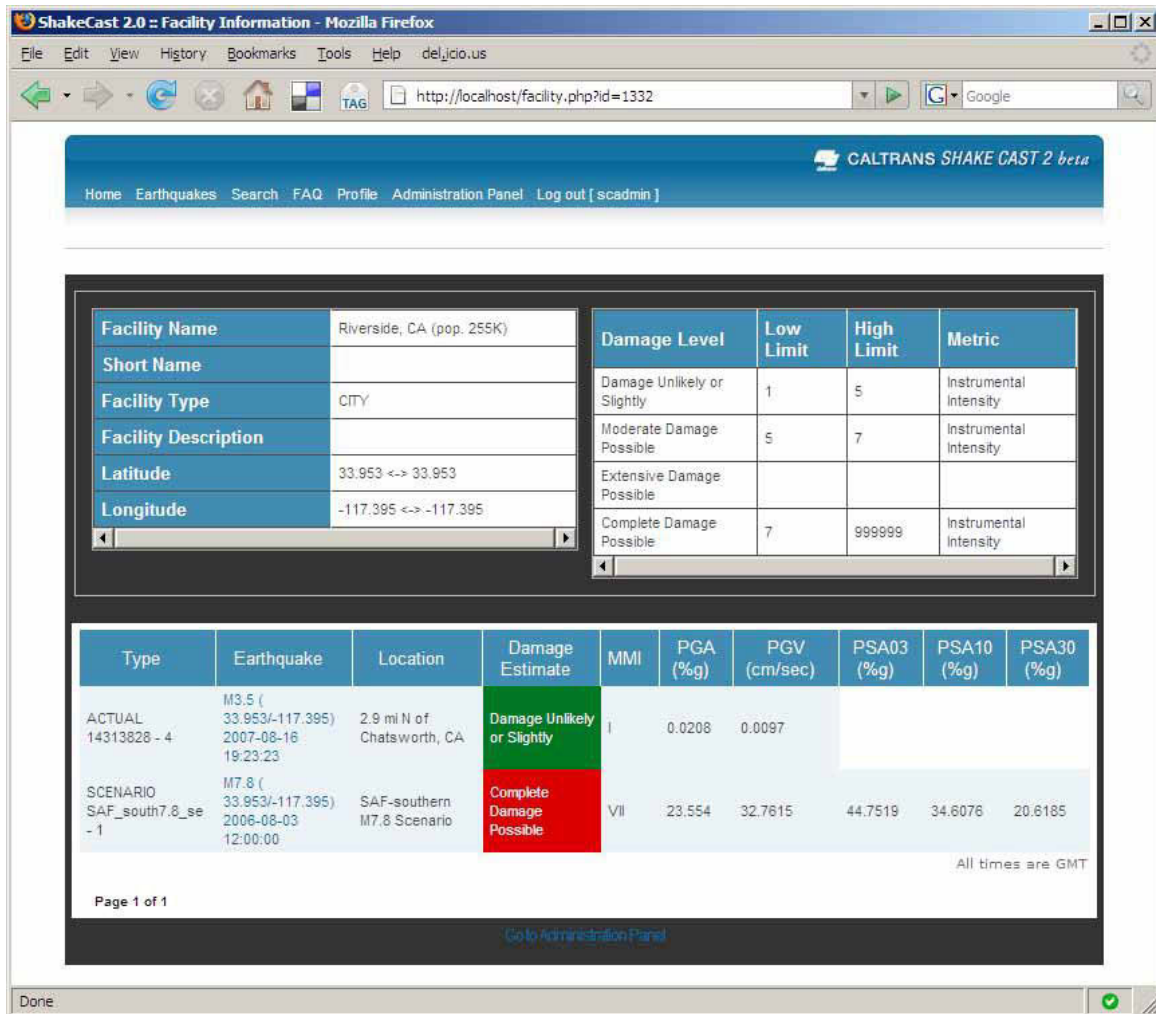


Figure 5. The search result of a facility displays parameters for the facility and the history of damage estimates from previous earthquakes.

Frequently Asked Questions (FAQ)

The FAQ page is intended to answer some of the more commonly asked questions. Users should contact the ShakeCast administrator for further questions and bug reports.

User Profile Management

ShakeCast users manage their registered information, delivery methods for notifications, and notification profiles from the profile page. This page view is consisted of three editing panels: 1) General Settings; 2) Email List; and 3) Notification Profiles.

- General Settings: display user editable password and contact information. New password will take effect after the current active session is closed, either by closing the browser window or by logging out of the ShakeCast system.

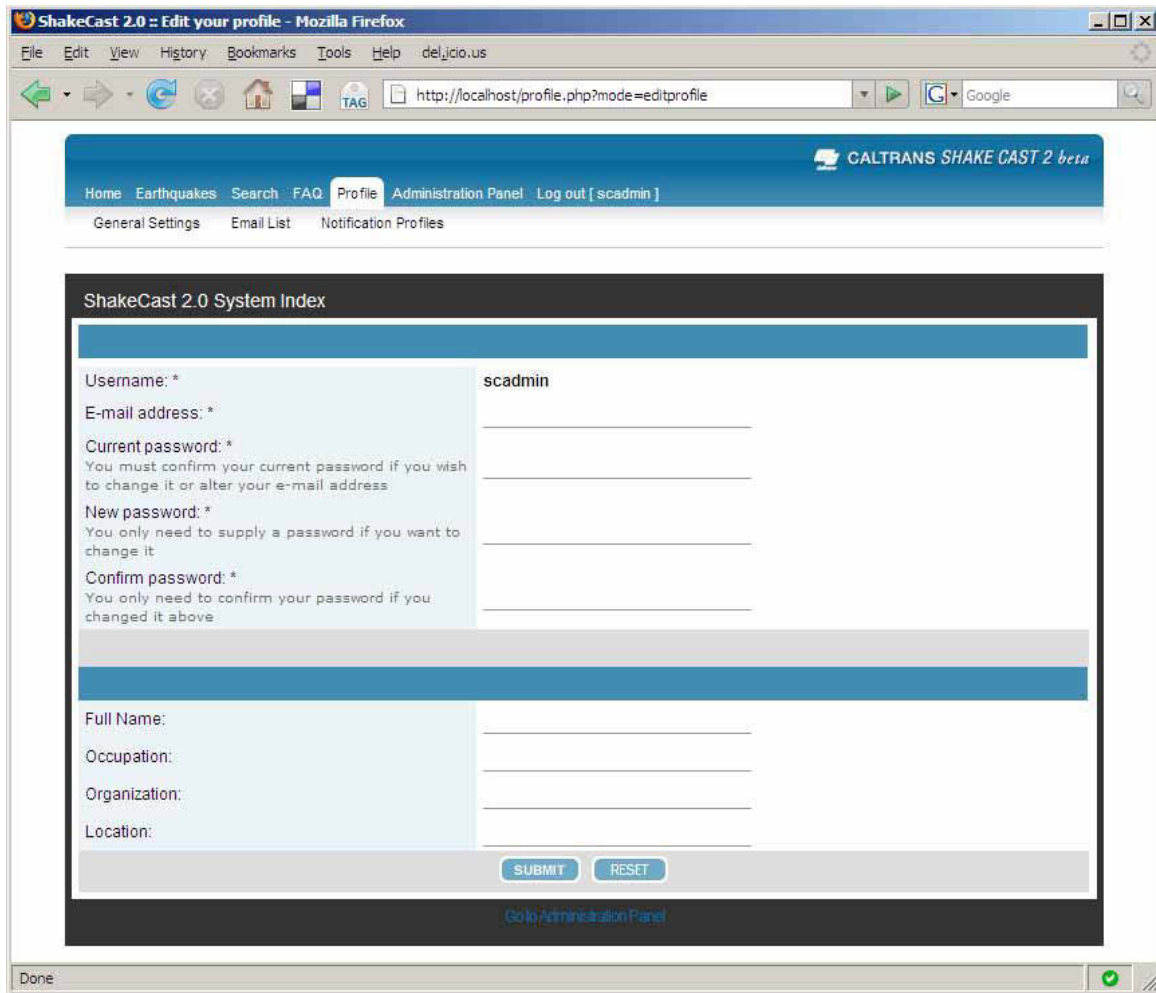


Figure 6. The General Settings page displays editable information for a registered ShakeCast user. The user can use this form to update his/her password and contact information.

- Email List: display an editable list of addresses the ShakeCast user registered with the system. A user can registered up to three different addresses for receiving content rich HTML notification messages, plain text email notifications, or short text paging messages. The default email address will be used for receiving ShakeCast notifications if no custom addresses are specified in this panel. All newly registered delivery addresses activations by either the user or system administrator. User activation is completed by clicking on an activation link in the confirmation message sent to the new delivery address. Before a delivery address is activated, a lock symbol will appear in the panel and no ShakeCast notifications will be delivered to that address.

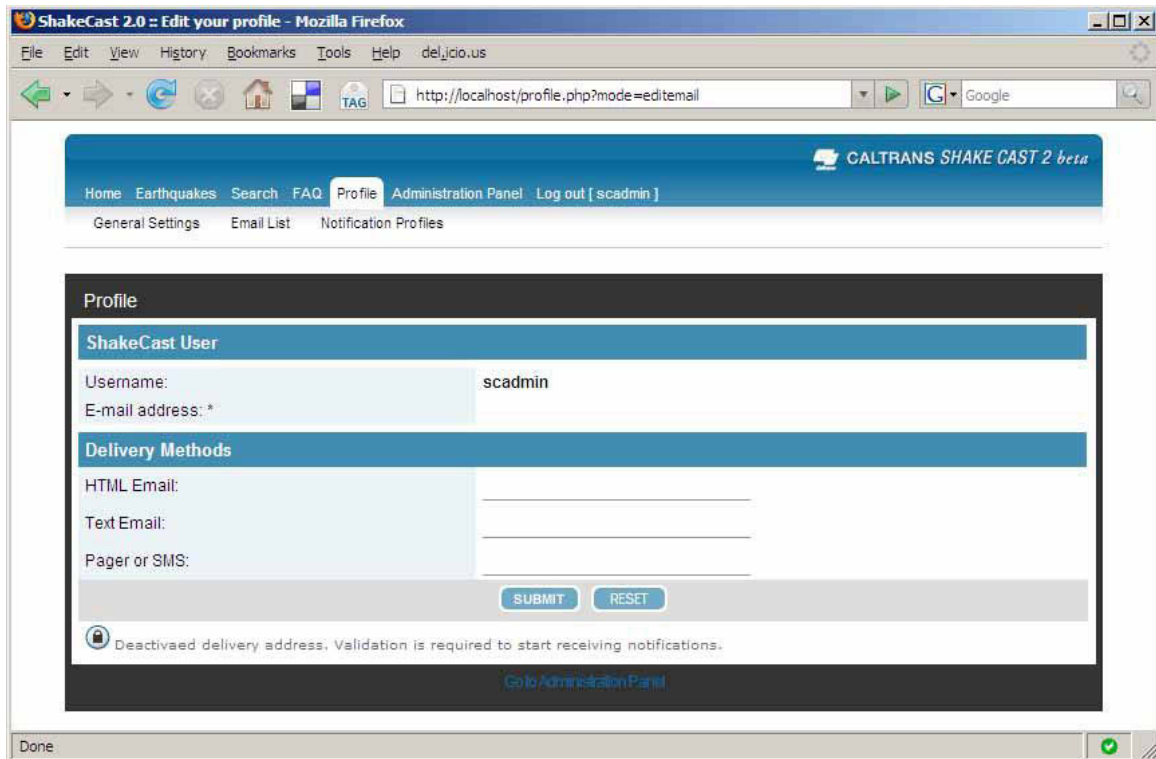


Figure 7. The Delivery Methods page displays user defined email addresses to receiving ShakeCast notification. All new delivery addresses requires activation before they can be used to receive notifications.

- Notification Profiles: display a list of selectable notification profiles that are available to the user. To add a profile to user's notification preference, click on the profile to highlight the selection. The coverage area will be shown in the map area. Uncheck a profile from the list to remove it from user's preference. At the end of profile selections, the user will need to click on the button "Update Notification Profiles" to submit the changes to the ShakeCast database.

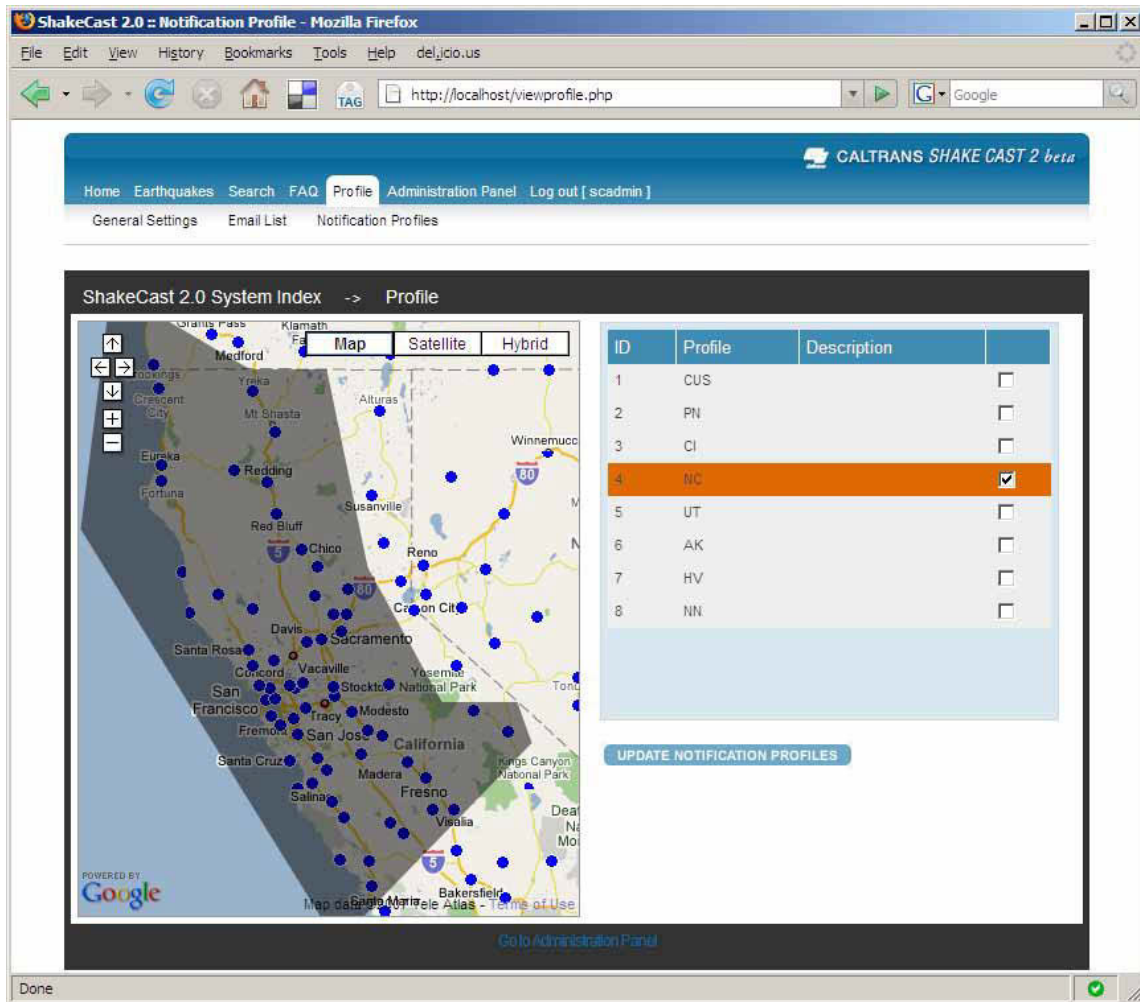


Figure 8. The Notification Profiles page displays a list of pre-defined notification profiles to the user. A user subscribe or unsubscribe a profile by checking and un-checking the profile in the table. Changes will be take effect after the user submits the form.

User Registration

By default, a ShakeCast system is pre-configured with restricted access to registered users. The registration process is typically a two step process. In the first step a new user submits contact information to sing up for a new account and will receive a confirmation email message for the submitted request. After the ShakeCast administrator receives and approves the request, the user will receive a second approval email message. To activate the account and to log in for the first time, click on the link provided inside the approval message. If a user account is created by an administrator, the new user will simply receive one confirmation email message for account activation.

ShakeCast 2.0 :: Register - Mozilla Firefox

File Edit View History Bookmarks Tools Help del.icio.us

http://localhost/profile.php?mode=register&agreed=true

CALTRANS SHAKE CAST 2 beta

Home Earthquakes Search FAQ Profile Register Log in

General Settings Email List Notification Profiles

ShakeCast 2.0 System Index

Username: *

E-mail address: *

Password: *

Confirm password: *

If you are visually impaired or cannot otherwise read this code please contact the Administrator for help.

1H5FF9

Confirmation code: *

Enter the code exactly as you see it. The code is case sensitive and zero has a diagonal line through it.

Full Name:

Occupation:

Organization:

Location:

SUBMIT RESET

Done

Figure 9. The Registration page displays a form in which the prospect user submits contact information for review. Depending on system configuration the user will receive one confirmation message for submittal and another for account activation.

NAME

heartbeat.pl - ShakeCast Heartbeat Generator

SYNOPSIS

heartbeat.pl

DESCRIPTION

The **heartbeat.pl** utility is used to generate a ShakeCast event XML with event type as “HEARTBEAT.” The output is injected into the ShakeCast system via **sm_inject.pl** and a copy stored in the ShakeMap data directory. This will trigger an event notification to users whom are subscribed to receiving heartbeat events.

The script reads no options from the command line. To create a customized heartbeat event, edit the script located inside the ShakeCast bin directory.

NAME

logrotate.pl - ShakeCast Log File Rotation Tool

SYNOPSIS

```
logrotate.pl [ -conf config file ]
```

DESCRIPTION

The **logrotate.pl** utility is used to generate rotating backup files of ShakeCast log files (`sc.log`, `sc_access.log`, and `sc_error.log`). Configurable parameters include `rotate-time`, `max_size`, `keep-files`, `compress`, and `status-file`. The administrator can schedule a routine run of this script for maintenance of ShakeCast log files.

The script reads one optional configuration file from the command line. The default configuration file is “`sc.conf`”.

rotate-time

Specify the time windows for keeping log entries.

max_size

Specify the size limit of log files.

keep-files

Specify the number of backup log files to retain.

compress

Specify the compression option of backup log files.

status-file

Specify the filename of process status.

OPTIONS

--conf

Specify the filename of a custom configuration file to read process parameters for `logstats.pl`.

NAME

logstats.pl - ShakeCast Chart Generator for System Statistics

SYNOPSIS

```
logstats.pl [ -conf config file ]
```

DESCRIPTION

The **logstats.pl** utility is used to process ShakeCast log files (`sc.log`, `sc_access.log`, and `sc_error.log`) specified in the system configuration file and generate a set of image files in both histogram and pie charts. The daily activity chart is the default chart displayed in the default page of the Administration Web Interface. The administrator can schedule a routine run of this script to generate new statistics charts.

The script reads one optional configuration file from the command line. The default configuration file is “`sc.conf`”.

OPTIONS

--conf

Specify the filename of a custom configuration file to read process parameters for `logstats.pl`.

NAME

manage_event.pl - ShakeCast Event Management Tool

SYNOPSIS

```
manage_event.pl [ mode ] [ option ... ] event_id [event_id2 ... ]
```

DESCRIPTION

The **manage_event.pl** utility is used to re-alert, or delete processed ShakeMap events in the ShakeCast database. It reads one or more event ids from the command line. Mode is one of `--resend` or `--delete`. `manage_event.pl` will return an error message if you do not specify a mode.

--resend

Reprocess notifications for the ShakeMaps and resend notifications to users who are on the recipient list.

--delete

Delete existing events. All information for the processed ShakeMaps will be removed from the ShakeCast database but not downloaded products in the file system.

OPTIONS

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

NAME

manage_facility.pl - ShakeCast Facility Management Tool

SYNOPSIS

```
manage_facility.pl [ mode ] [ option ... ] file.csv [ file2.csv ... ]
```

DESCRIPTION

The **manage_facility.pl** utility is used to insert, update, or delete facility data in the ShakeCast database. It reads data from one or more CSV format files. One or more files must be given on the command line. Multiple files can have different formats. Mode is one of `--insert`, `--replace`, `--delete`, `--update`, or `--skip`. `manage_facility.pl` will operate in `replace` mode if you do not specify a mode.

--insert

New facility records are inserted. It is an error for the facility to already exist; if it does the input record is skipped.

--replace

New records are inserted. If there is an existing facility it is first deleted, along with any associated attributes and fragility levels. All required facility fields must be supplied.

--delete

Delete existing facilities. All required facility fields must be supplied.

--skip

New facility records are inserted. Records for existing facilities are skipped without generating an error. The summary report will indicate how many records were skipped.

--update

Update existing facilities. If the facility does not already exist an error is issued and the record is skipped.

In this mode the only required fields are `EXTERNAL_FACILITY_ID` and `FACILITY_TYPE`. Any group values are simply added to the existing set of attributes for the facility, unless the new value matches an existing value, in which case the group value is skipped. For metrics, any metric that appears in the input will be completely replaced.

OPTIONS

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

--limit=*n*

Terminate the import after *n* errors in input records. Set to 0 to allow an unlimited number of errors.

This limit only applies to errors encountered when processing a data record from the input file. More serious errors, such as omitting a required field, will always cause the entire input file to be skipped.

--quote=*x*

Use *x* as the quote character in the input file. The default quote character is a quote ("). This character is also used as the escape character within a quoted string.

--separator=*x*

Use *x* as the field separator character in the input file. The default separator character is a comma (,).

FILE FORMAT

manage_facility.pl reads from one or more CSV-formatted files. By default fields are separated by commas and field values that include commas are protected by enclosing them in quotes, but these defaults can be modified; see the **--quote** and **--separator** options below.

The first record in the input file must contain column headers. These headers tell **manage_facility.pl** how to interpret the rest of the records. Each header field must specify a facility field, a facility metric field, or a group field. The header fields are case-insensitive; `facility_name` and `FACILITY_NAME` are equivalent. Fields can appear in any order.

Facility Fields

The following facility names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description for a more detailed description of the structure of the ShakeCast Database.

external_facility_id (Text(32), required always)

This field identifies the facility. It must be unique for a facility type but the same `external_facility_id` may be used for different types of facilities.

facility_type (Text(10), required always)

This field identifies the type of facility. It must match one of the types in the `facility_type` table. Currently defined types are: BRIDGE, CAMPUS, CITY, COUNTY, DAM, DISTRICT, ENGINEERED, INDUSTRIAL, MULTIFAM, ROAD, SINGLEFAM, STRUCTURE, TANK, TUNNEL, UNKNOWN, and HAZUS building types. Refer the HAZUS Damage Level document for the 128 HAZUS building types and code era.

facility_name (Text(128), required for insert/replace)

The value of this field is what the user sees.

short_name (Text(10), optional)

The value of this field is used by ShakeCast when a shorter version of the name is needed due to space limitations in the output.

description (Text(255), optional)

You can use this field to include a short description of the facility.

lat (Float, required for insert/replace)

Specifies the latitude of the facility in degrees and fractional degrees.

lon (Float, required for insert/replace)

Specifies the longitude of the facility in degrees and fractional degrees.

Fragility Fields

Each field beginning with `METRIC:` is taken to be a facility fragility specifier. The format of a fragility specifier is:

METRIC:*metric-name:damage-level*

where *metric-name* is a valid Shakemap metric (MMI, PGV, PGA, PSA03, PSA10, or PSA30) and *damage-level* is a valid damage level (GREEN, YELLOW, ORANGE, or RED). Examples of Facility Fragility column labels are `METRIC:MMI:RED` and `metric:pga:yellow`.

The metric-name values are defined by the ShakeMap system, and are generally not changed. The above values are current as of summer 2007. The damage-level values shown above are the default values shipped with ShakeCast. These values are defined in your local ShakeCast database, and you may use the administration web interface to change those values and the color-names that refer to them.

Attribute Fields

A facility can have attributes associated with it. These attributes can be used to group and filter facilities.

Each field beginning with `ATTR:` is taken to be a facility attribute specifier. The format of a facility attribute specifier is:

ATTR:*attribute-name:attribute-value*

where *attribute-name* is a string not more than 20 characters in length.

Examples of Facility Attribute column labels are `ATTR:COUNTY` and `ATTR:Construction`. Attribute values can be any string up to 30 characters long.

EXAMPLES

Example 1 -- Point Facilities

Assume we have a file named `ca_cities.csv` containing California cities that we want to load into the ShakeCast database. The file is in CSV format and includes the name of

each city and the latitude/longitude of its city center or city hall. Records in the file are of the form

```
Rancho Cucamonga,34.1233,-117.5794
Pasadena,34.1561,-118.1318
```

The file is missing two required fields, `external_facility_id` and `facility_type`. Since the city name is unique we can add a new column that is a copy of the name column and use that as the `external_facility_id`. Another column containing the value `CITY` for each row is added for the `facility_type`. You can either make these changes using a spreadsheet program or with a simple script written in a text processing language like Perl.

After making these modifications the records look like

```
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794
CITY,Pasadena,Pasadena,34.1561,-118.1318
```

The input file also needs a header record; after adding one the input file looks like

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,FACILITY_NAME,LAT,LON
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794
CITY,Pasadena,Pasadena,34.1561,-118.1318
...
```

The facilities in this file can now be loaded into ShakeCast using the command

```
manage_facility.pl ca_cities.csv
```

Example 2 -- Fragility Parameters

It is easy to load fragility parameters for your facilities using **manage_facility.pl**. Building on the previous example, assume a simple model where Instrumental Intensity (MMI) above 7 corresponds to likely damage (RED), MMI between 5 and 7 corresponds to possible damage (YELLOW), and MMI below 5 corresponds to little chance of damage (GREEN). The lower threshold of each range (1, 5, 7) is appended to every record in the input file and the header record is changed to reflect the added fields:

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,FACILITY_NAME,LAT,LON, \
    METRIC:MMI:GREEN,METRIC:MMI:YELLOW,METRIC:MMI:RED
CITY,Rancho Cucamonga,Rancho Cucamonga,34.1233,-117.5794,1,5,7
CITY,Pasadena,Pasadena,34.1561,-118.1318,1,5,7
...
```

Import this file as before. New facility data will replace existing ones.

Example 3 -- Multiple Attributes and Multiple Metrics

You can include multiple attributes, multiple metrics, or multiple attributes and multiple metrics for each row of an import file. For example,

```
FACILITY_TYPE,EXTERNAL_FACILITY_ID,ATTR:COUNTY, ATTR:SIZE,\
    METRIC:MMI:GREEN, METRIC:MMI:YELLOW, METRIC:MMI:RED
CITY,Rancho Cucamonga,San Bernardino,Small,1,2,6
CITY,Pasadena,os Angeles,Medium,1,2,6
```

This file would be loaded using the command

```
manage_facility.pl --update city_county.csv
```

The above example updates the existing city locations to associate them with a county attribute and a size attribute, and defines the green, yellow, and red shaking thresholds.

NAME

manage_profile.pl - ShakeCast Profile Management Tool

SYNOPSIS

```
manage_profile.pl [ mode ] [ option ... ] [ profile.conf ] [ lat,lon ... ]
```

DESCRIPTION

The **manage_profile.pl** utility is used to insert, update, or delete geometry profiles in the ShakeCast database and to associate facilities within the profile boundaries with the profile. It reads data from a profile configuration file or lat/lon pairs of a polygon from the command line. Mode is one of `--insert`, `--delete`, `--update`, or `--poly`.

`manage_profile.pl` will operate in `replace` mode if you do not specify a mode.

--insert

New profiles are inserted. It is an error if the profile already exists; if it does the input record is skipped.

--delete

Delete existing profiles. All required profile fields must be supplied.

--poly

Read polygon data from the command line and output facility data within the polygon boundaries.

OPTIONS

--conf

Specify the optional profile configuration file.

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

FILE FORMAT

manage_profile.pl reads data from a file in Apache config format. Lines begin with '#' and empty lines will be ignored. Spaces at the beginning and the end of a line will also be ignored as well as tabulators. If you need spaces at the end or the beginning of a value you can use apostrophe ". An option line starts with its name followed by a value. An '=' sign is optional. Some possible examples:

```
user      max
user = max
```

user max

If there is more than one statement with the same name, it will create an array instead of a scalar.

Each profile is defined as a **block** of options. A **block** looks much like a block in the well known apache config format. It starts with **<blockname>** and ends with **</blockname>**. An example:

```
<CI>
  POLY      35.8000 -116.4000    \
            34.0815 -114.4717    \
            32.0000 -114.3333    \
            32.0000 -120.5000    \
            34.5000 -121.2500    \
            37.2167 -118.0167    \
            36.6847 -117.7930    \
            35.8000 -116.4000
  <NOTIFICATION>
    NOTIFICATION_TYPE      NEW_EVENT
    DELIVERY_METHOD        EMAIL_HTML
    EVENT_TYPE              ALL
  </NOTIFICATION>
  <NOTIFICATION>
    NOTIFICATION_TYPE      NEW_PROD
    DELIVERY_METHOD        EMAIL_HTML
    PRODUCT_TYPE           GRID_XML
    EVENT_TYPE              ALL
  </NOTIFICATION>
</CI>
```

Profile Tag Names

The following profile tag names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description for a more detailed description of the structure of the ShakeCast Database.

poly (float pairs, required always)

This field identifies the boundaries of the profile geometry. It must contain at least three anchor points in order to define a polygon. The total number of anchor points should limit to less than 100, otherwise the administration interface may not be able to display the entire polygon during editing. The manage_profile.pl will however process the polygon definition.

notification (Text(32), optional)

One notification block represents one notification request associated with the profile and applies to all facilities within the profile polygon. Multiple notification blocks for a profile are permitted.

Notification Tag Names

Each notification block defines one notification request. Tag names are corresponding to the field names of the table “profile_notification_request.” Required tags for a notification block include NOTIFICATION_TYPE, DELIVERY_METHOD, and EVENT_TYPE. Valid notification types are CAN_EVENT, NEW_EVENT, UPD_EVENT, SHAKING, NEW_PROD, and DAMAGE.

can_event

This notification request is triggered when an event is cancelled by the seismic network in which the event was located and the ShakeMap removed from the USGS web site. Require EVENT_TYPE and DELIVERY_METHOD tags.

new_event

This notification request is triggered when an event is located by a seismic network and a ShakeMap becomes available on the USGS web site. Require EVENT_TYPE and DELIVERY_METHOD tags.

upd_event

This notification request is triggered when the source parameters of an event is updated with a new version by the seismic network. New versions of ShakeMaps for the event may or may not coincide with an updated event. Require EVENT_TYPE and DELIVERY_METHOD tags.

new_prod

This notification request is triggered when a specified ShakeMap product of an event is available on the USGS web site. Require EVENT_TYPE, DELIVERY_METHOD, and PRODUCT tags.

shaking

This notification request is triggered when the ground shaking parameter at the location of the facility exceeds the preset value. Require EVENT_TYPE, DELIVERY_METHOD, METRIC, and LIMIT_VALUE tags.

damage

This notification request is triggered when the ground shaking parameter at the location of the facility falls between the high and low values of facility fragility settings. Require EVENT_TYPE, DELIVERY_METHOD, and DAMAGE_LEVEL tags.

NAME

manage_user.pl - ShakeCast User Management Tool

SYNOPSIS

```
manage_user.pl [ mode ] [ option ... ] file.csv [ file2.csv ... ]
```

DESCRIPTION

The **manage_user.pl** utility is used to insert, update, or delete user data in the ShakeCast database. It reads data from one or more CSV format files. One or more files must be given on the command line. Multiple files can have different formats. Mode is one of `--insert`, `--replace`, `--delete`, `--update`, or `--skip`. `manage_user.pl` will operate in `replace` mode if you do not specify a mode.

--insert

New user records are inserted. It is an error for the user to already exist; if it does the input record is skipped.

--replace

New records are inserted. If there is an existing user it is first deleted, along with any associated delivery addresses, notification requests and profiles. All required user fields must be supplied.

--delete

Delete existing users. All required user fields must be supplied.

--skip

New user records are inserted. Records for existing users are skipped without generating an error. The summary report will indicate how many records were skipped.

--update

Update existing users. If the user does not already exist an error is issued and the record is skipped.

In this mode the only required fields are `USERNAME` and `USER_TYPE`. Any delivery methods, profiles and users for cloning that appears in the input will be completely replaced.

OPTIONS

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

--limit=*n*

Terminate the import after *n* errors in input records. Set to 0 to allow an unlimited number of errors.

This limit only applies to errors encountered when processing a data record from the input file. More serious errors, such as omitting a required field, will always cause the entire input file to be skipped.

--quote=*x*

Use *x* as the quote character in the input file. The default quote character is a quote ("). This character is also used as the escape character within a quoted string.

--separator=*x*

Use *x* as the field separator character in the input file. The default separator character is a comma (,).

FILE FORMAT

manage_user.pl reads from one or more CSV-formatted files. By default fields are separated by commas and field values that include commas are protected by enclosing them in quotes, but these defaults can be modified; see the **--quote** and **--separator** options below.

The first record in the input file must contain column headers. These headers tell **manage_user.pl** how to interpret the rest of the records. Each header field must specify a user name field and a user type field. The header fields are case-insensitive; `username` and `USERNAME` are equivalent. Fields can appear in any order.

User Fields

The following facility names are recognized. These fields correspond to tables and columns in the ShakeCast database. Please refer to the ShakeCast Database Description for a more detailed description of the structure of the ShakeCast Database.

username (Text(32), required always)

This field identifies the user. It must be unique for a user type.

user_type (Text(10), required always)

This field identifies the type of use. It must match one of the types in the `user_type` table. Currently defined types are: ADMIN, USER, and SYSTEM.

full_name (Text(32), optional)

The value of this field is the user's full name.

email_address (Text(10), optional)

The value of this field is the user's email address for receiving communication from the ShakeCast system.

password (Text(10), optional)

The value of this field is used by ShakeCast to generate password for accessing the ShakeCast interface and the web site if password protected.

phone_number (Text(255), optional)

You can use this field to include a user's phone number.

Delivery Method Fields

Each field beginning with `DELIVERY:` is taken to be a delivery method specifier. The format of a delivery method specifier is:

DELIVERY:*delivery-method*

where *delivery-method* is a valid message format (PAGER, EMAIL_HTML, or EMAIL_TEXT). Examples of Delivery Method column labels are `DELIVERY:EMAIL_HTML` and `delivery:email_html`.

The message format values are defined by the ShakeCast system, and are generally not changed. The damage-level values shown above are the default values shipped with ShakeCast. These values are defined in your local ShakeCast database, and you may use the administration web interface to change those values and the color-names that refer to them.

Profile Fields

A user can have notification requests replicated from an existing profile. Each field beginning with `PROFILE:` is taken to be a profile specifier. The format of a profile specifier is:

PROFILE:*profile-name*

where *profile-name* is a valid profile name.

User Fields

A user can have notification requests replicated from an existing user. Each field beginning with `USER:` is taken to be a user specifier. The format of a user specifier is:

USER:*shakecast-user*

where *shakecast-user* is a valid user id.

NAME

scfeed_local.pl – ShakeMap Grid/Product Injection Tool

SYNOPSIS

```
scfeed_local.pl [ -event event_id ] [ option ... ]
```

DESCRIPTION

The **scfeed_local.pl** utility is used to process downloaded ShakeMap products located in the ShakeCast data directory. It reads one event id from the command line and creates XML messages before feeding them to ShakeCast. The injection process triggers the ShakeCast process in the same manner as for a real earthquake with respect to facility damage assessment and user notifications.

The name of an unprocessed ShakeMap must match the name of the event ID. ShakeMaps can be downloaded via the USGS ShakeMap link from the ShakeCast Administration Panel or manually from other sources. It will be renamed with the version number appended to the end of the directory name after **scfeed_local.pl** processed the ShakeMap. Outputs of ShakeCast XML files will also be stored in the same directory.

The script will quit gracefully if the ShakeMap has been processed earlier by the ShakeCast system and as a result no notifications will be delivered. To reprocess a ShakeMap that already exists in the ShakeCast system, the administrator will need to either convert the ShakeMap into a test event or delete the event first. In addition to the Administration Interface, an administrator can use the **tester.pl** utility to convert a ShakeMap to a test event and the **manage_event.pl** utility to delete a ShakeMap. The ShakeCast data directory for the deleted ShakeMap also needs to be removed from the file system before starting the reprocess procedure described earlier.

OPTIONS

--event

Specify ID of the event to process. All information for the processed ShakeMaps will be removed from the ShakeCast database but not downloaded products in the file system.

--verbose

Display more detailed information about the progress of the import. This option may be repeated to increase detail further.

--help

Print a synopsis of program usage and invocation options

NAME

template.pl – ShakeCast General Templating Tool

SYNOPSIS

```
template.pl [ option ... ] -event event_id -template template
```

DESCRIPTION

The **template.pl** utility is used to generate ShakeCast facility summary for the specified event. The script reads at least one event ID and one template file from the command line. The output file is stored in the ShakeCast data directory for the specified event.

--event=s

Specify ID of the event to process.

--template=s

Specify filename of the template used to generate ShakeCast summary. The template files are located under the ShakeCast “template/xml” directory. The system comes with two default templates. “shakecast.tt” is the template for generating “exposure.xml” and the “kml.tt” for generating Google Earth kml format XML files.

OPTIONS

--version=n

Specify version number of the event to process.

--output=s

Specify filename of the output of ShakeCast summary. The output directory is the ShakeCast data directory for the specified event.

--help

Print a synopsis of program usage and invocation options

FILE FORMAT

template.pl is based on the Perl Template Toolkit. Please see the Template Manual manpage for the complete reference which goes into much greater details about the features and use of the Template Toolkit.

This section covers a brief summary of the template directives. ShakeCast specific identifiers include `exposure`, `item`, and `type`. Facility specific identifiers include `name`, `latitude`, `longitude`, `damage_level`, `MMI`, `PGA`, `PGV`, `PSA03`, `PSA10`, and `PSA30`.

GET

Evaluate and print a variable or value.

```
[% GET variable %]
[%     variable %]
[%     hash.key %]
[%     list.n %]
[% code(args) %]
[% obj.meth(args) %]
[% "value: $var" %]
```

CALL

As per GET but without printing result (e.g. call code)

```
[% CALL variable %]
```

SET

Assign a values to variables.

```
[% SET variable = value %]      # 'SET' also optional
[%     variable = other_variable
    variable = 'literal text @ $100'
    variable = "interpolated text: $var"
    list      = [ val, val, val, val, ... ]
    list      = [ val..val ]
    hash      = { var => val, var => val, ... }
%]
```

DEFAULT

Like SET above, but variables are only set if currently unset (i.e. have no true value).

```
[% DEFAULT variable = value %]
```

INSERT

Insert a file without any processing performed on the contents.

```
[% INSERT legalese.txt %]
```

INCLUDE

Process another template file or block and include the output. Variables are localised.

```
[% INCLUDE template %]
[% INCLUDE template var = val, ... %]
```

PROCESS

As INCLUDE above, but without localising variables.

```
[% PROCESS template %]
[% PROCESS template var = val, ... %]
```

WRAPPER

Process the enclosed block WRAPPER ... END block then INCLUDE the named template, passing the block output in the 'content' variable.

```
[% WRAPPER template %]
    content...
[% END %]
```

BLOCK

Define a named template block for subsequent INCLUDE, PROCESS, etc.,

```
[% BLOCK template %]
    content
[% END %]
```

FOREACH

Repeat the enclosed FOREACH ... END block for each value in the list.

```
[% FOREACH variable = [ val, val, val ] %] # either
[% FOREACH variable = list %]              # or
[% FOREACH list %]                         # or
```

```

        content...
        [% variable %]
[% END %]

```

WHILE

Enclosed WHILE ... END block is processed while condition is true.

```

[% WHILE condition %]
    content
[% END %]

```

IF / UNLESS / ELSIF / ELSE

Enclosed block is processed if the condition is true / false.

```

[% IF condition %]
    content
[% ELSIF condition %]
    content
[% ELSE %]
    content
[% END %]
[% UNLESS condition %]
    content
[% # ELSIF/ELSE as per IF, above %]
    content
[% END %]

```

SWITCH / CASE

Multi-way switch/case statement.

```

[% SWITCH variable %]
[% CASE val1 %]
    content
[% CASE [ val2, val3 ] %]
    content
[% CASE %]          # or [% CASE DEFAULT %]
    content
[% END %]

```

MACRO

Define a named macro.

```

[% MACRO name <directive> %]
[% MACRO name(arg1, arg2) <directive> %]
...
[% name %]
[% name(val1, val2) %]

```

FILTER

Process enclosed FILTER ... END block then pipe through a filter.

```

[% FILTER name %]          # either
[% FILTER name( params ) %] # or
[% FILTER alias = name( params ) %] # or
    content
[% END %]

```

USE

Load a "plugin" module, or any regular Perl module if LOAD_PERL option is set.

```

[% USE name %]          # either
[% USE name( params ) %] # or
[% USE var = name( params ) %] # or
...
[% name.method %]
[% var.method %]

```

PERL / RAWPERL

Evaluate enclosed blocks as Perl code (requires EVAL_PERL option to be set).

```
[% PERL %]
    # perl code goes here
    $stash->set('foo', 10);
    print "set 'foo' to ", $stash->get('foo'), "\n";
    print $context->include('footer', { var => $val });
[% END %]
[% RAWPERL %]
    # raw perl code goes here, no magic but fast.
    $output .= 'some output';
[% END %]
```

TRY / THROW / CATCH / FINAL

Exception handling.

```
[% TRY %]
    content
    [% THROW type info %]
[% CATCH type %]
    catch content
    [% error.type %] [% error.info %]
[% CATCH %] # or [% CATCH DEFAULT %]
    content
[% FINAL %]
    this block is always processed
[% END %]
```

NEXT

Jump straight to the next item in a FOREACH/WHILE loop.

```
[% NEXT %]
```

LAST

Break out of FOREACH/WHILE loop.

```
[% LAST %]
```

RETURN

Stop processing current template and return to including templates.

```
[% RETURN %]
```

STOP

Stop processing all templates and return to caller.

```
[% STOP %]
```

TAGS

Define new tag style or characters (default: [% %]).

```
[% TAGS html %]
[% TAGS <!-- --> %]
```

COMMENTS

Ignored and deleted.

```
[% # this is a comment to the end of line
    foo = 'bar'
%]
[%# placing the '#' immediately inside the directive
    tag comments out the entire directive
%]
```

NAME

tester.pl – ShakeCast Test Event Tool

SYNOPSIS

```
tester.pl [ option ... ]
```

DESCRIPTION

The **tester.pl** utility is used to handle ShakeCast test events and includes conversion, listing, and triggering of test events. The script is usually invoked from the administration interface but also can be executed directly. It reads one process type from the command line.

OPTIONS

--type

Specify the type of action to process. Process type is one of 'event_menu', 'new_test', 'create_test', 'inject_next', or 'inject_first'.

event_menu

Output a list of test events available on the system.

new_test

Output a list of actual events on the system that have not been converted into test events.

create_test

Convert the specified event into a test event that can be triggered locally. Require an additional **-key** option. A new data directory for the event will be created under the "test_data" directory with the name of event ID and "_scte" postfix.

inject_first

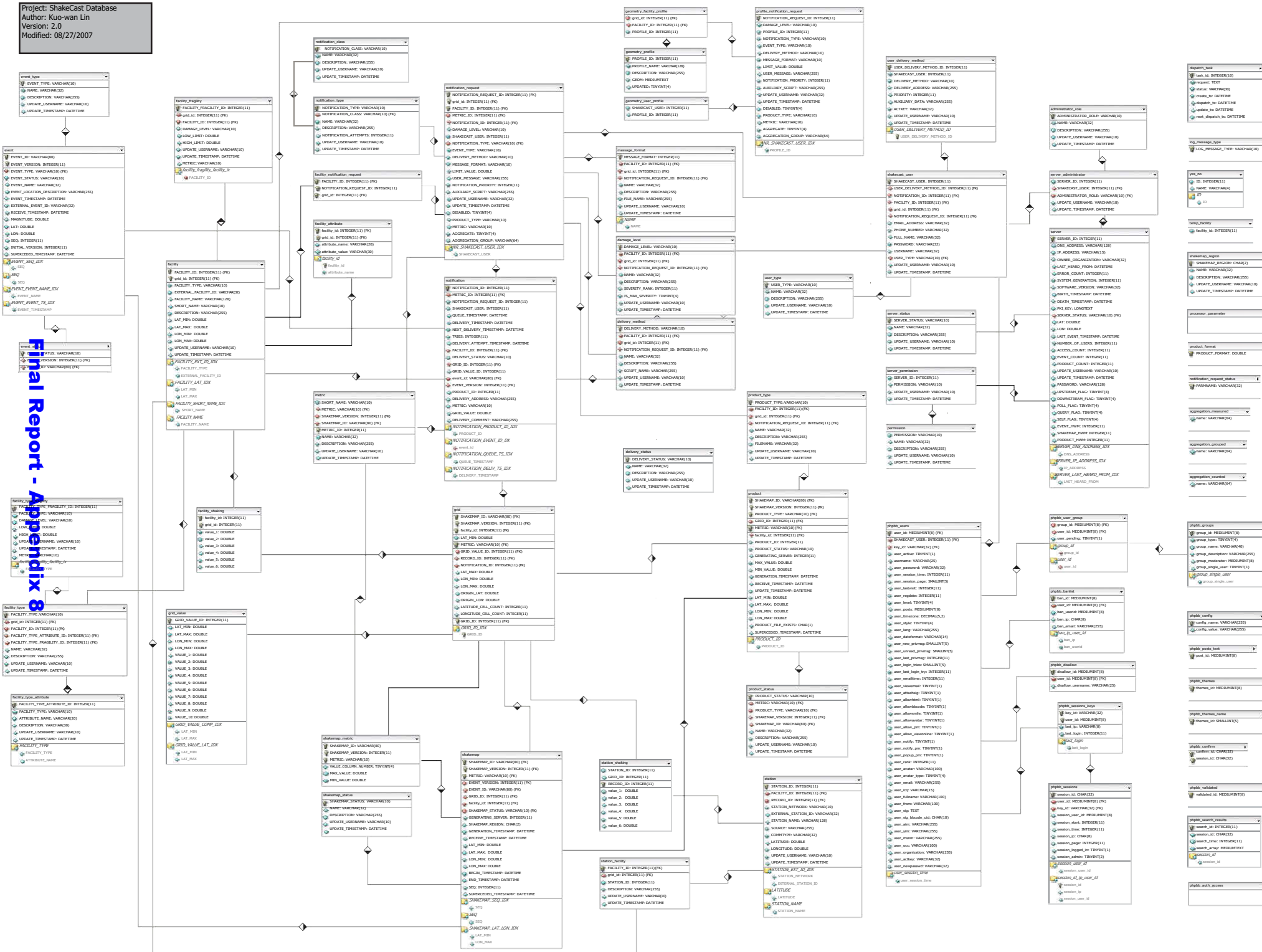
Trigger a ShakeCast process for the specified test event as a new event. Require an additional **-key** option.

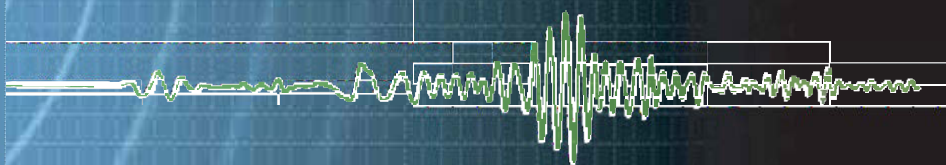
inject_next

Trigger a ShakeCast process for the specified test event as an updated event. Require an additional **-key** option.

--key

Specify ID of the event to process. All information for the processed ShakeMaps will be removed from the ShakeCast database but not downloaded products in the file system.





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 developed and is used primarily for emergency response, loss estimation, and public information. However, for an informed response to a serious earthquake, critical users must go beyond just looking at ShakeMap, and understand the likely extent and severity of impact on the facilities for which they are responsible. To this end the U.S. Geological Survey (USGS) has developed ShakeCast.

ShakeCast allows utilities, transportation agencies, businesses, and other large organizations to control and optimize the earthquake information they receive. With ShakeCast, they can automatically determine the shaking value at *their* facilities, set thresholds for notification of damage states for each facility, and then automatically notify (by pager, cell phone, or email) specified operators and inspectors within their organizations who are responsible for those particular facilities so they can set priorities for response.



Collapse of the Interstate-5/State Highway-14 interchange showing damage north of Los Angeles caused by the 1994 magnitude 6.7 Northridge, California, earthquake. Thousands of State and County bridges were shaken at varying intensity levels during this earthquake; many required inspections.

Example Uses and Users: The California Department of Transportation (Caltrans)

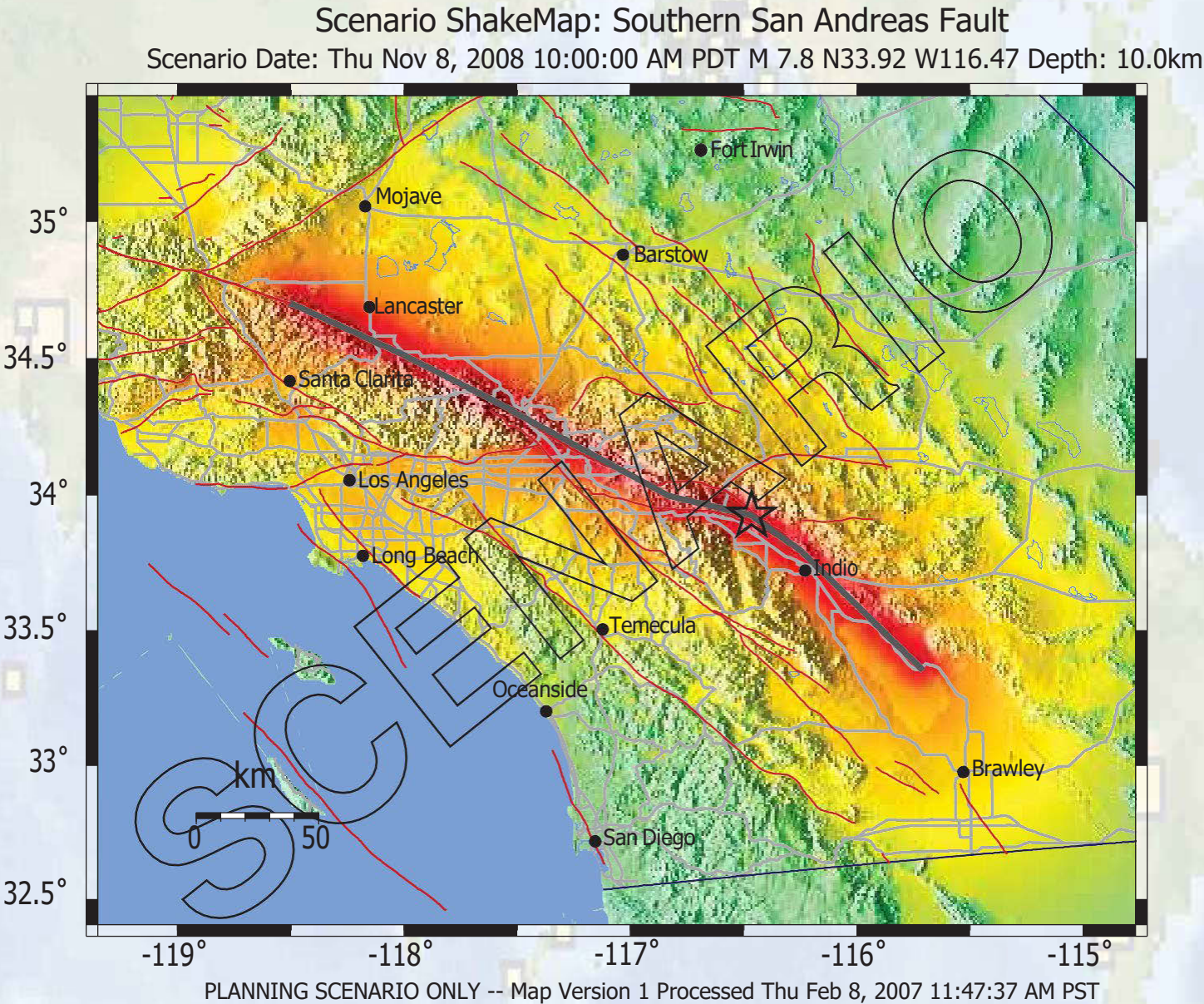
Caltrans has deployed the prototype ShakeCast system (Version 1.0). Following a major earthquake, Caltrans faces an array of decisionmaking challenges. Perhaps no other agency has a comparable earthquake exposure in the State of California. Caltrans has more than 11,000 bridges and overpasses under its responsibility in California; having an instantaneous snapshot of the likely damage to each will allow Caltrans to set priorities for traffic rerouting, closures, and inspections following a damaging earthquake. One of several critical tasks facing Caltrans after an earthquake is to rapidly assess the condition of all bridges and roadway corridors in the State highway system. Timely response is important to ensure public safety, aid routing of emergency vehicle traffic, and (re-) establish critical lifeline routes.

In addition to real-time notification, ShakeCast also can generate and deliver scenario earthquakes for facility response plans (figs. 1 and 2). This application includes routine testing of the system, earthquake scenario exercises, and evaluating performance and response under potential earthquake conditions. ShakeMap is now used routinely to generate earthquake scenarios for many regions; ShakeCast will further allow planning exercises

to be performed using the same notification tools that will be available and in place for responding to a real earthquake.

ShakeCast Technology

Individuals, companies, utilities, and agencies could develop their own strategies and tools for using ShakeMap given their



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+

Figure 1. ShakeMap intensity map for a magnitude 7.8 Scenario Earthquake on the southern San Andreas fault. Red lines delineate faults and light grey lines show highways.

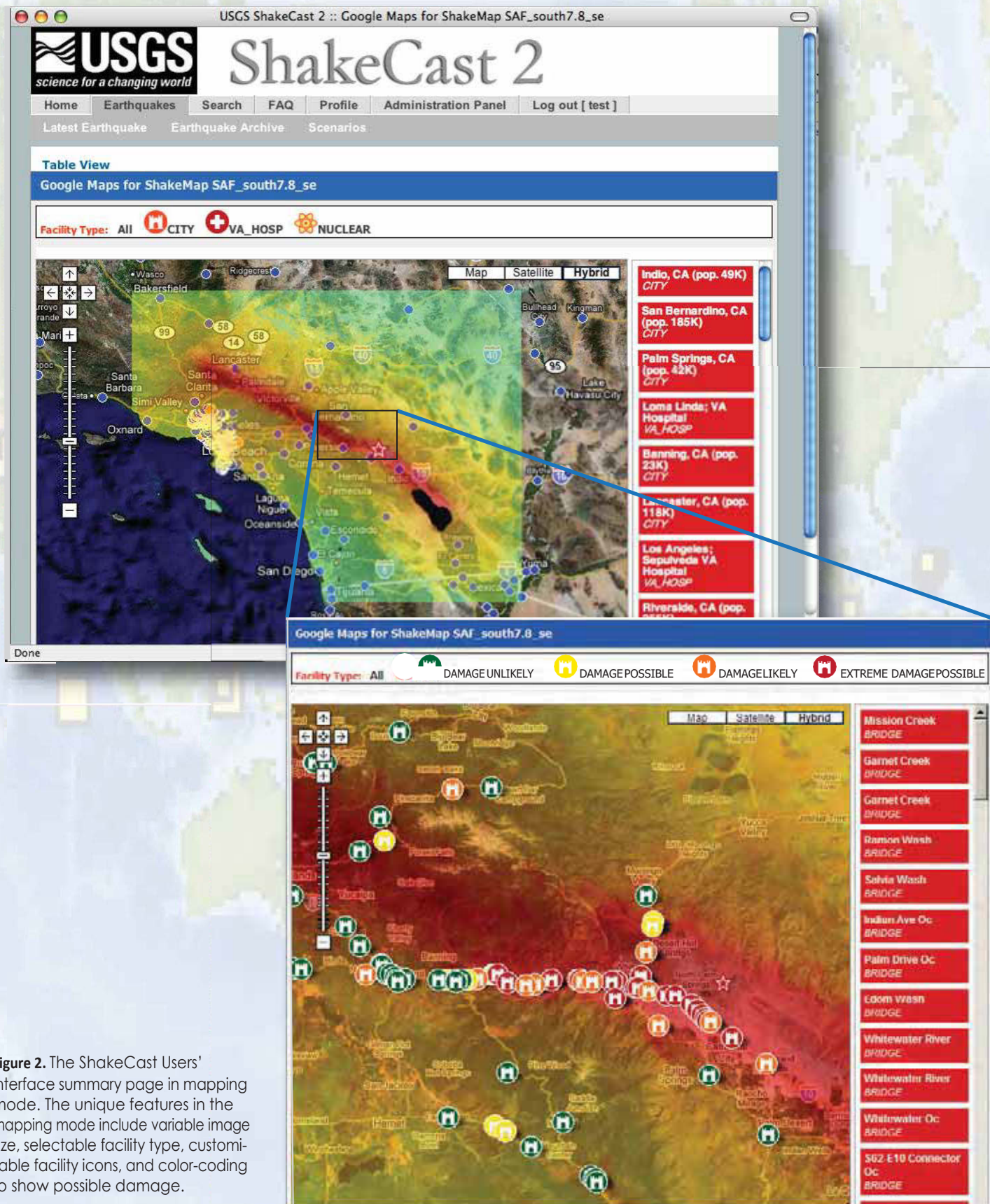


Figure 2. The ShakeCast Users' interface summary page in mapping mode. The unique features in the mapping mode include variable image size, selectable facility type, customizable facility icons, and color-coding to show possible damage.

Example Uses and Users: Los Angeles Unified School District (LAUSD)

LAUSD is using Shakecast to help improve earthquake monitoring and emergency response in southern California, where it is responsible for over 700,000 K-12 students, 100,000 employees, 13,500 buildings, and 1,100 schools and offices. Students and schools are spread across 704 square miles. Under an agreement with the City of Los Angeles, LAUSD buildings are integral to the emergency operations of the city, because school facilities will serve as emergency shelters to be managed by the Red Cross. Hence, knowing which structures are most likely damaged is critical for response and recovery, for example, in designating emergency shelters.

unique facilities and communication paths. However, such efforts are costly and complex. Rather, the USGS is facilitating this process with ShakeCast, building a more general-use tool for the most critical user needs. The ShakeCast software is customizable for facilities, fragilities, and notifications, and we anticipate additional adaptations will be made since the open-source code is provided. Such innovations then can be provided in the tool kit included with updates of the ShakeCast system.

Information Technology (IT) security is a primary concern for users requiring automatic electronic delivery of information. By taking advantage of standard Internet protocols, ShakeCast users avoid most typical corporate and Government concerns and firewall limitations. By using Really Simply Syndication (RSS) and interval polling, users initiate all communications with the USGS Web servers that host ShakeMap, and retrieve selected products as a request rather than a “push.” This RSS approach allows users to update software automatically under conditions of their own choosing.

ShakeCast software is built upon open-source tools, providing standard, freely available software for all users, encouraging user improvements, and simplifying interfacing with existing users’ response tools. ShakeCast uses the Apache Web server and PHP (Hypertext Preprocessor) for dynamic Web content, MySQL for facility and notification databases, and is wrapped in Practical Extraction and Report Language (PERL) scripting. Exchange files are in Extensible Markup Language (XML) for standardized interfacing with Web, geographic information system (GIS), spreadsheets, databases, and other applications.

Where Can ShakeCast be Used?

ShakeMap is now produced for all earthquakes around the globe of magnitude 5.5 or larger. Globally, these ShakeMaps are primarily predictive and thus lack the resolution and certainty of shaking estimates for maps made in regions of dense seismic instrumentation for which it was principally developed. Regions in the United States that have ShakeMap operating with reasonable (but variable) seismic station coverage include major parts of California, Washington, Oregon, Nevada, Utah, Hawaii, and Alaska. Other regions are improving station coverage. Hence, since ShakeMaps are produced for any region of the world, ShakeCast can be deployed for any exposure of facilities worldwide, again with more uncertainty in the results in regions not specifically listed above.

We use the term “facilities” loosely; at the USGS National Earthquake Information Center (NEIC) in Golden, Colorado, we assign cities as “facilities” and run ShakeCast to determine

shaking levels at cities within the United States and around the globe any time a ShakeMap is produced. The list of cities, their populations, and the intensity estimated at each city becomes a Hypertext Markup Language (HTML) email notification that proves useful for NEIC analysts and for other response purposes. Ultimately, these city-based notifications will be integrated as an option in the USGS Earthquake Notification Service (ENS), but this option does not reduce the need for critical users to put their own inventories into an in-house ShakeCast system.

ShakeCast Availability and Installation

ShakeCast is available in two levels, full and “Lite.” We describe in detail the full ShakeCast system that allows users to estimate impact to numerous facilities, each potentially with different vulnerabilities and notification recipients. We expect this system to be deployed by critical users in an earthquake-hardened, operational environment. We have also made available ShakeCast Lite, a subset of the system that allows users to automatically receive ShakeMap products on their laptop or desktop computers, and launch predefined applications using those maps or data. For example, many users employ ShakeCast Lite to automatically open a Web browser showing the latest ShakeMap in their region, launch Google Earth® with the ShakeMap KML file, download ShakeMap grid files, and initiate loss-estimation applications, or deliver ShakeMap GIS files to their corporate GIS department for further analyses. ShakeCast Lite is simple to install and use.

An overview of ShakeCast from the users’ perspective is provided in figure 3. Organizations using ShakeMap/ShakeCast first download and install the ShakeCast (Version 2) software package on a hardened in-house computer system. The software is installed with an interactive installation script. Facility, vulnerability, and notification data are input using import tools and simple, comma separated (CSV) users’ files. ShakeCast comes preconfigured, but custom configuration is simplified by ShakeCast tools and the Web interface. The Web interface allows an administrator to access all functions of the local ShakeCast system, and end users are able to manage their own personal information and notification preferences.

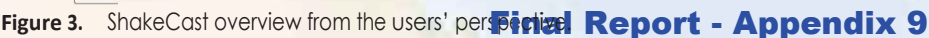
Initial setup involves the following steps: (1) populating a database of facility locations and types; (2) assigning fragilities using specific ShakeMap parameters (for example, intensity, peak or spectral acceleration) and the corresponding likely “green,” “yellow,” and “red” damage states (“damage unlikely,” “damage possible,” and “damage likely” thresholds, for example); (3) specifying who receives notifications by listing

Example user and earthquake data, tutorials, and documentation are provided with the installation package.

Ongoing software development of ShakeCast continues, and much of it is motivated by users' experiences and recommendations.

s Additional predefined facility structure types and vulnerability functions. Currently (2007) 36 structure types are available from the Federal Emergency Management Agency's Hazards US loss modeling software (HAZUS-MH).

s Ability to select a specific structure and seismic instrument data over interpolated shaking values from ShakeMap.





Collapsed section of the Cypress viaduct of Interstate 880 in Oakland following the magnitude 6.9 earthquake in 1989 in Loma Prieta, California.

- s Expanded GIS support for common data exchange formats and application programming interfaces (APIs) (currently supports data export via user-defined templates).

- s Support for UNIX, Mac, and LINUX operating systems (currently runs on Microsoft Windows).

- s Compute and visualize uncertainties in ground shaking and damage likelihood.

- s Improved re-notification logic, allowing flexibility in conditions for re-alerting (for example, if damage state changes for one or more facilities).

Optional, automatic updates of the software will be provided by the RSS feed from USGS Web servers.

Sources of Additional Information

On the Web:

ShakeMap:

<http://earthquake.usgs.gov/shakemap/>

ShakeCast Software:

<http://earthquake.usgs.gov/shakecast/>

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