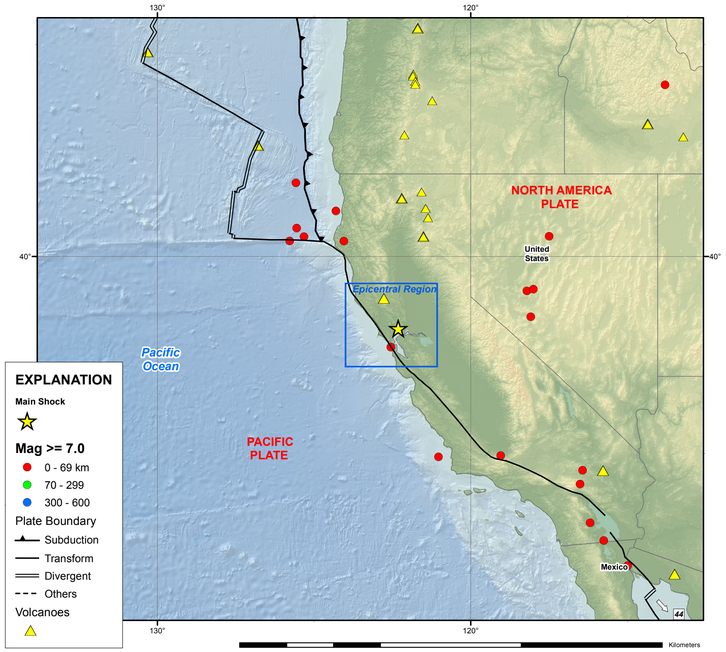
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

EARTHQUAKE SUMMARY MAP

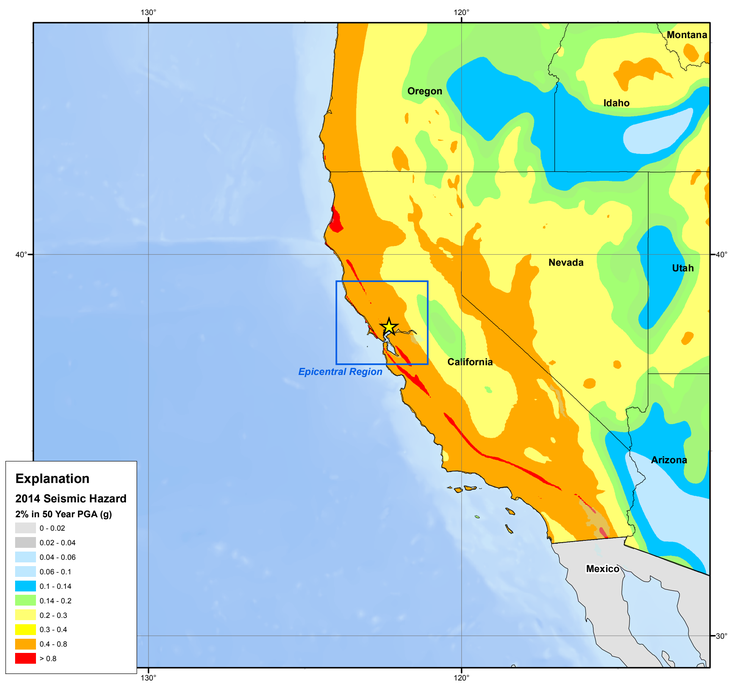
Prepared in cooperation with the Global Seismographic Network

M6.0 South Napa, California Earthquake of 24 August 2014

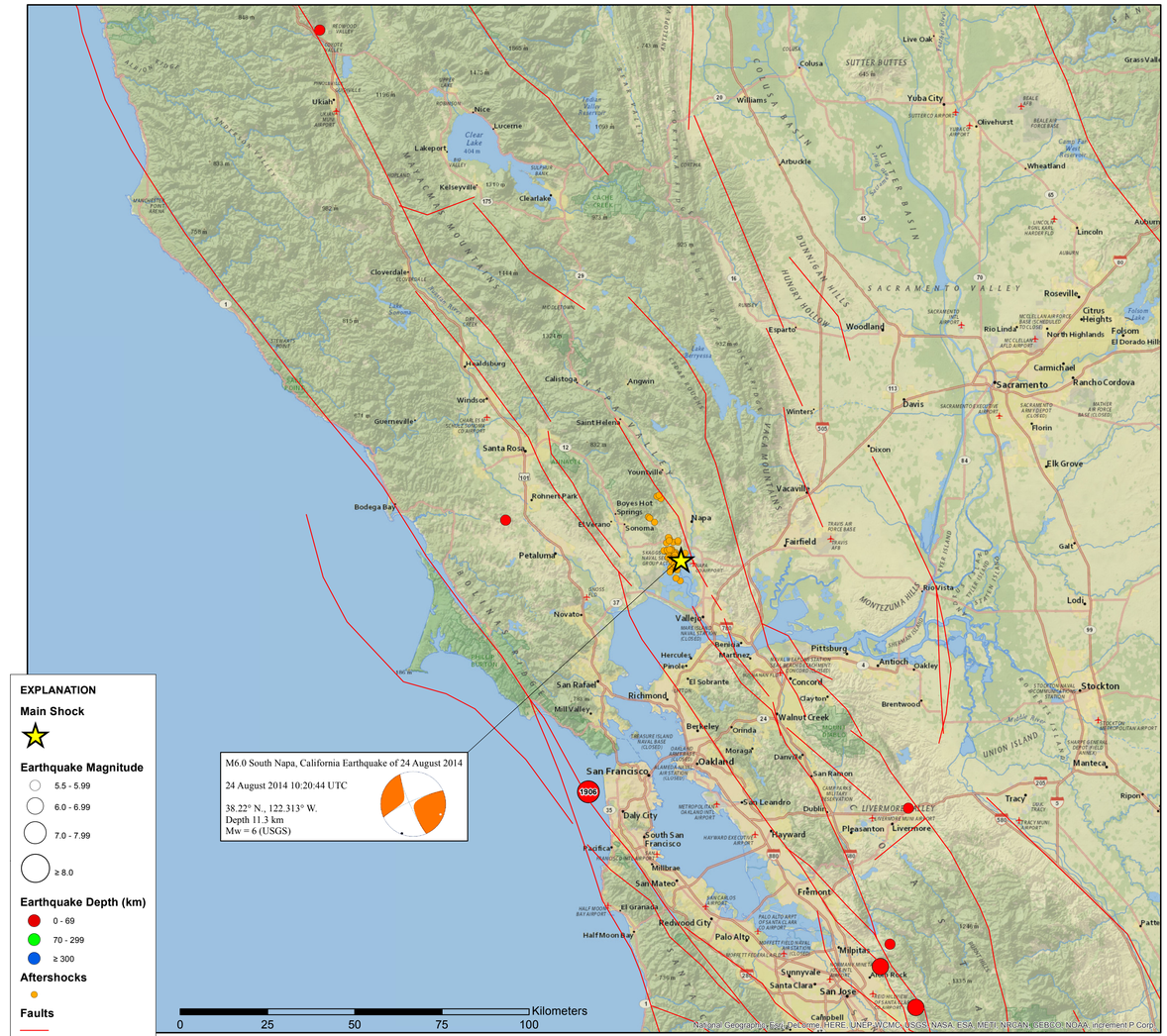
Tectonic Setting



Seismic Hazard



Epicentral Region



PAGER

M 6.0, 6.8 km (4.2 mi) NW of American Canyon, CA
Origin Time: Sun 2014-08-24 10:20:44 UTC (03:20:44 local)
Location: 38.22°N 122.31°W Depth: 11 km

Earthquake Shaking Red Alert

PAGER Version 25
Created: 2 days, 0 hours after earthquake

Estimated Fatalities

Red alert level for economic losses. Extensive damage is probable and the disaster is likely widespread. Estimated economic losses are less than 1% of GDP of the United States. Past events with this alert level have required a national or international level response.

Green alert level for shaking-related fatalities. There is a low likelihood of casualties.

Estimated Economic Losses

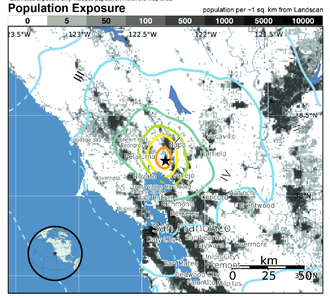
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	- -*	4,799k*	3,376k	379k	129k	47k	82k	1k	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE: Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
POTENTIAL DAMAGE: Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan



Structures:
Overall, the population in this region resides in structures that are highly resistant to earthquake shaking, though some vulnerable structures exist.

Historical Earthquakes (with MMI levels):

Date (UTC)	Dist. (km)	Mag.	Max MMI(#)	Shaking Deaths
1983-05-02	284	5.7	VIII(1k)	0
1980-01-24	76	5.8	VII(31k)	1
1989-10-18	132	6.9	IX(3k)	62

Recent earthquakes in this area have caused secondary hazards such as landslides and liquefaction that might have contributed to losses.

Selected City Exposure
from GeoNames.org

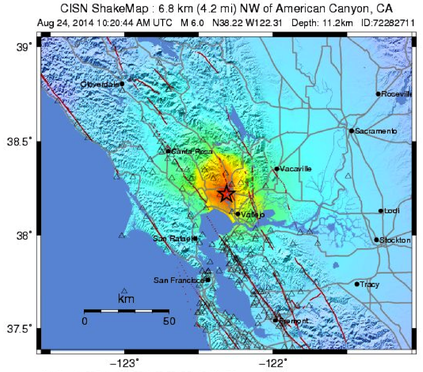
MMI	City	Population
VIII	Napa	77k
VII	American Canyon	19k
VII	Yountville	3k
VI	El Verano	4k
VI	Sonoma	11k
VI	Temelec	1k
IV	Oakland	391k
IV	San Francisco	805k
III	Sacramento	466k
III	Fremont	214k
III	Stockton	292k

bold cities appear on map (k = x1000)

PAGER content is automatically generated, and only considers losses due to structural damage. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: nc72282711

ShakeMap

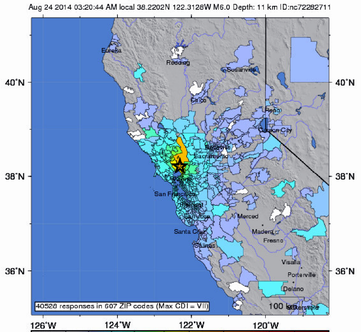


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

DYFI?

USGS Community Internet Intensity Map
NORTHERN CALIFORNIA
Aug 24 2014 03:20:44 AM local 38.2202N 122.3126W M6.0 Depth: 11 km ID:nc72282711



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Tue Aug 26 10:43:11 2014

TECTONIC SUMMARY

The earthquake lies within a 70-km-wide (44 miles) set of major faults of the San Andreas Fault system that forms the boundary between the Pacific and North American tectonic plates. The persistent northwestward movement of the Pacific plate relative to North America primarily causes right-lateral slip across the major faults, but also causes deformation between the major faults. The ongoing complex deformation field is revealed by modern geodetic surveys and earthquake patterns as well as the regional geologic structure. The earthquake is located north of San Pablo Bay between two major active fault systems: the Hayward-Rodgers Creek Fault system on the west and the Concord-Green Valley Fault system on the east. The earthquake occurred near the well-known West Napa Fault, and the less well known Carneros-Franklin Faults, which juxtapose different suites of rocks. Although there are several faults in the region of the earthquake, only the West Napa Fault is known to have displaced Holocene-age sediment — which is positive evidence of surface fault rupture in the last 11,000 years.

Historically, in this region shaking sufficient to seriously damage structures at Mare Island occurred during the M6.8 1868 Hayward Fault earthquake, the M7.8 1906 San Andreas Fault earthquake, and particularly during the M6.3 1898 Mare Island earthquake. The 1898 earthquake may have occurred about 20 km (12 miles) to the northwest on the southern Rodgers Creek Fault. Even larger nearby events than the 1898 earthquake can be expected in the future. In addition, the epicentral region of this earthquake is depicted on the USGS National Seismic Hazard Maps to have a high probability of strong shaking in the future.

The Hayward-Rodgers Creek Fault system, which is approximately 11 km (7 miles) west of the epicenter, generated damaging earthquakes in 1868 and probably in 1898. The Concord-Green Valley Fault system, which is 14 km (9 miles) east of the epicenter, produced a M5.5 earthquake in 1954; while it has not generated a large historical event, there is strong evidence for recent pre-historic activity. The 1999 Working Group on California Earthquake Probabilities (WG99, 1999) concluded that the Hayward-Rodgers Creek Fault system has a 32 percent probability of generating a large earthquake (M6.7 to 7.4) by the year 2030, and the Concord-Green Valley Fault system has a 6 percent chance of generating a large earthquake (M≥6.7) in the same time period.

The bayshore areas in the San Francisco Bay region are underlain by landfill and bay mud and have experienced disproportionately greater damage during historic earthquakes. Such damage is caused by soil failure in the fills and amplification of ground shaking by the soft bay mud.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Hayes, G. P., Wald, D. J., and Johnson R. L., 2012, A three-dimensional model of globalsubduction zone geometries: Journal of Geophysical Research, v. 117, B01302, doi:10.1029/2011JB008524.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models

REFERENCES

Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027-80.

Engdahl, E.R., and Villaseñor, A., 2002, Global Seismicity: 1900-1999, chap. 41 of Lee, W.H.K., and others, eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination;Bull. Seism. Soc. Amer., v. 88, p. 722-743.

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

Map updated by U.S. Geological Survey National Earthquake Information Center
26 August 2014
http://earthquake.usgs.gov/
Map not approved for release by Director USGS