

The Coming Bay Area Earthquake - 2010 Update

Scenario for a Magnitude 7.0 Earthquake on the
Hayward Fault

Northern California Chapter of the
Earthquake Engineering Research Institute

Janiele Maffei SE



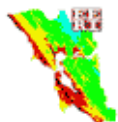
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National Hazards Reduction Program¹

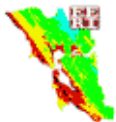
Original Authors

- ❑ 1-Socioeconomic Setting - Angelo Siracusa
- ❑ 2-Geology and Seismology - David Schwartz
- ❑ 3-Ground Failure Phenomena – William Lettis
- ❑ 4-Water and Sewer Delivery Systems – David Pratt
- ❑ 5-Buildings and Transportation Systems affected by Ground Failures –John Egan
- ❑ 6-Ground Motions – Paul Somerville
- ❑ 7-Transportation Systems affected by ground motions – Brian Maroney
- ❑ 8-Power, Telecommunications, and Fuel Delivery Systems – Edward Matsuda
- ❑ 9-Critical Facilities – Bill Holmes
- ❑ 10-Commercial and Residential Buildings – Ron Hamburger
- ❑ 11-Emergency Response and Relief – Henry Renteria
- ❑ 12-Regional Response – Richard Eisner
- ❑ 13-Housing and Social Recover – Mary Comerio
- ❑ 14-Regional Transportation Response – Joel Markowitz
- ❑ 15-Economic Recovery- Tapan Munroe
- ❑ 16- A Call to Action – L. Thomas Tobin

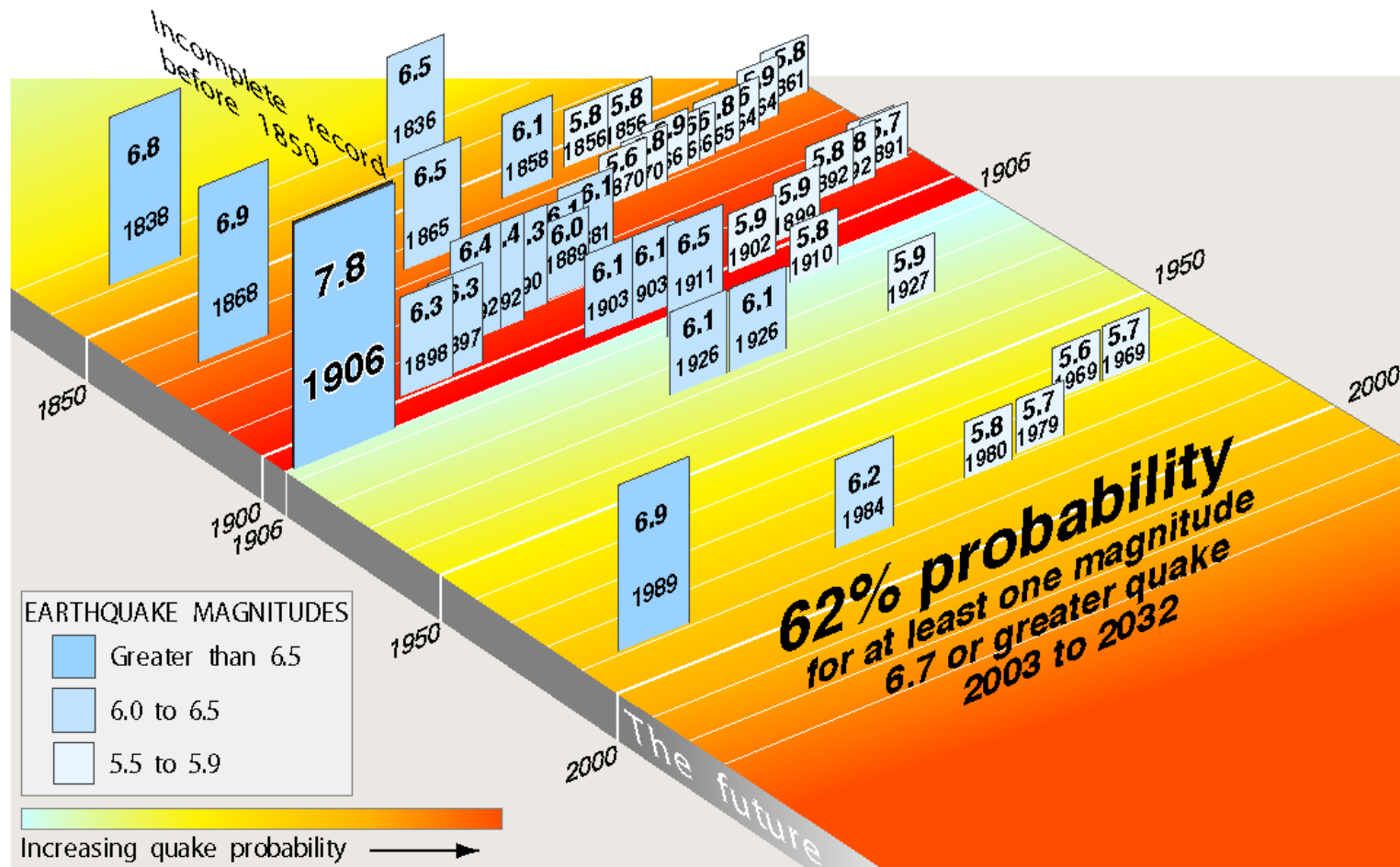


Socioeconomic Setting – 7.4 Million living within 9 County San Francisco Bay Area

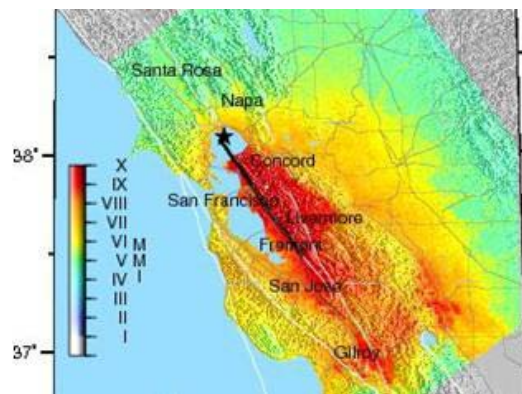
HAYWARD
FAULT



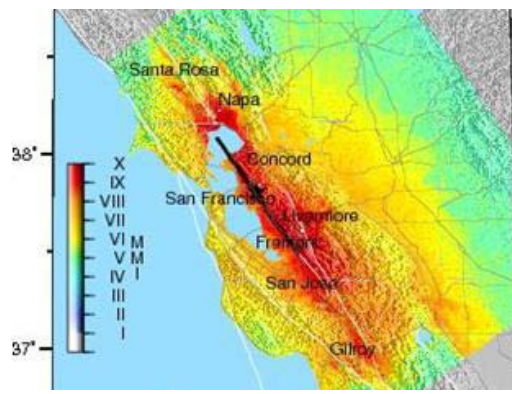
Geology and Seismology – Probability Increases



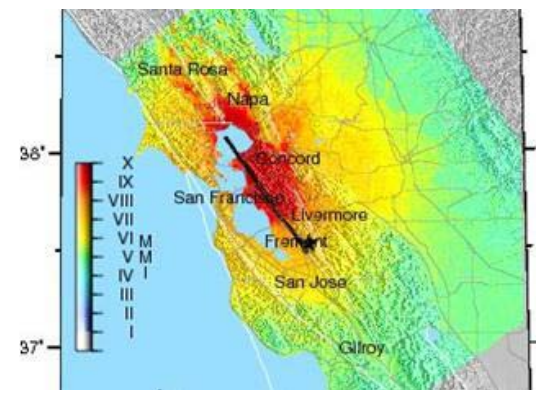
Scenario - M7.0 earthquake, San Pablo epicenter, with rupture the full length of Hayward Fault



(b) San Pablo epicenter



(d) Oakland epicenter

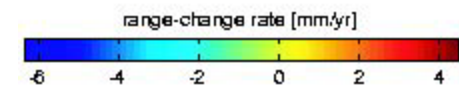
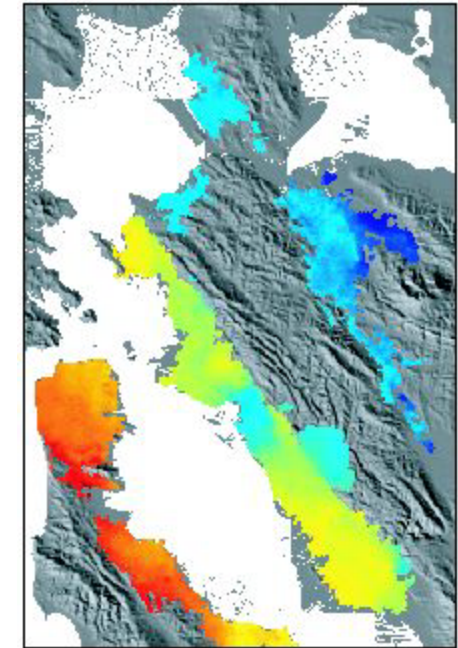
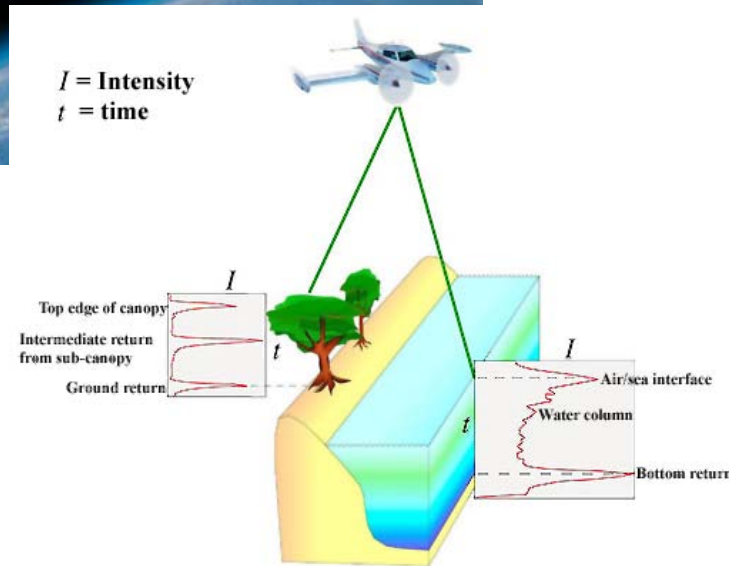


(f) Fremont epicenter

*RMS 1868 Hayward
Earthquake: 140-
year Retrospective*



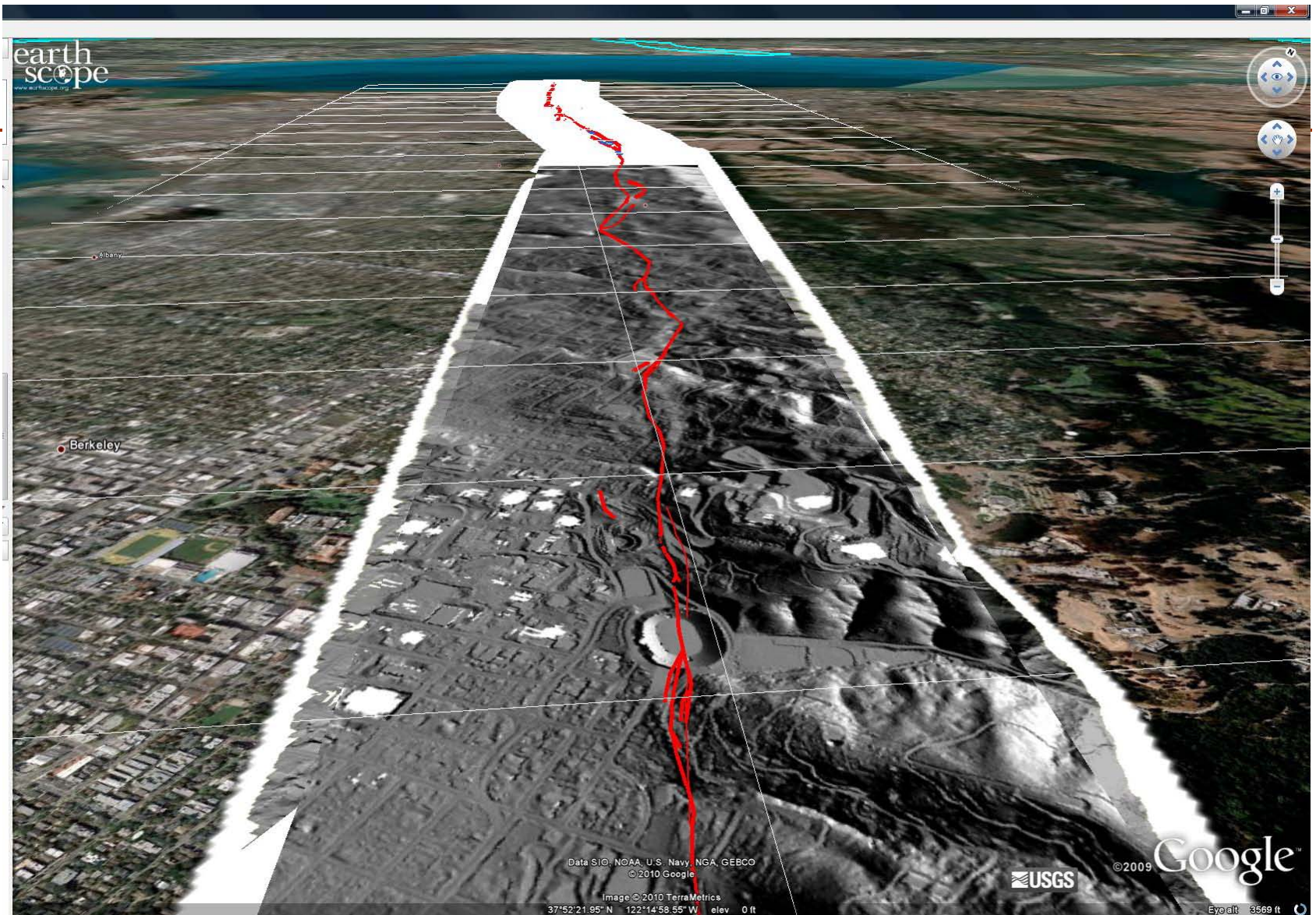
New Technology for tracking ground motions - GPS, InSAR and Lidar



UC Seismological
Laboratory

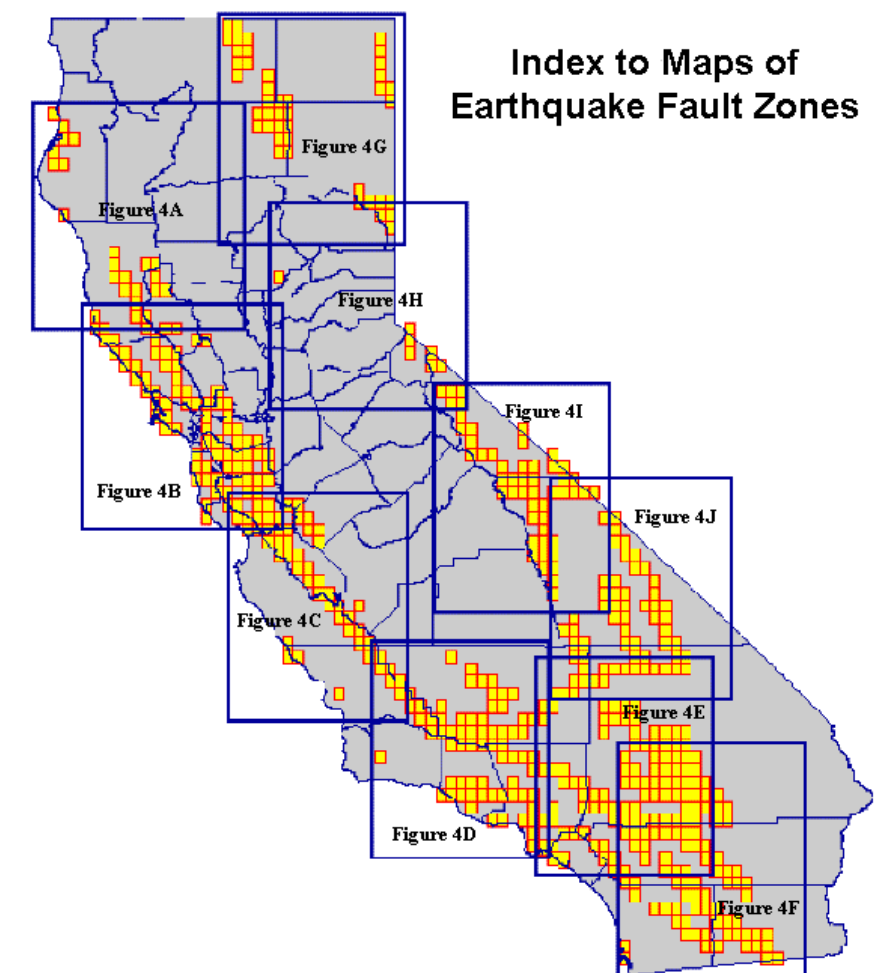


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Improved Maps - Alquist Priolo Earthquake Fault Zones

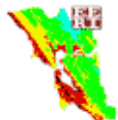
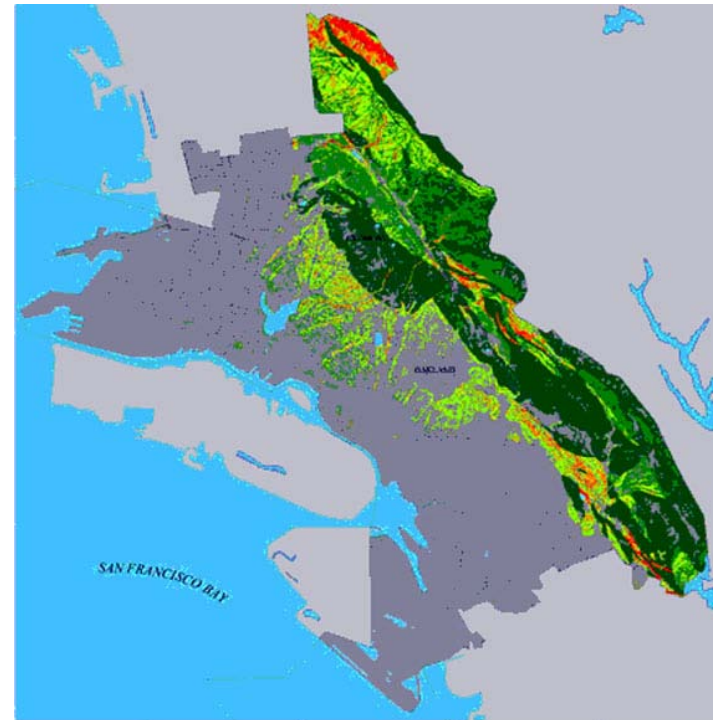


CDC

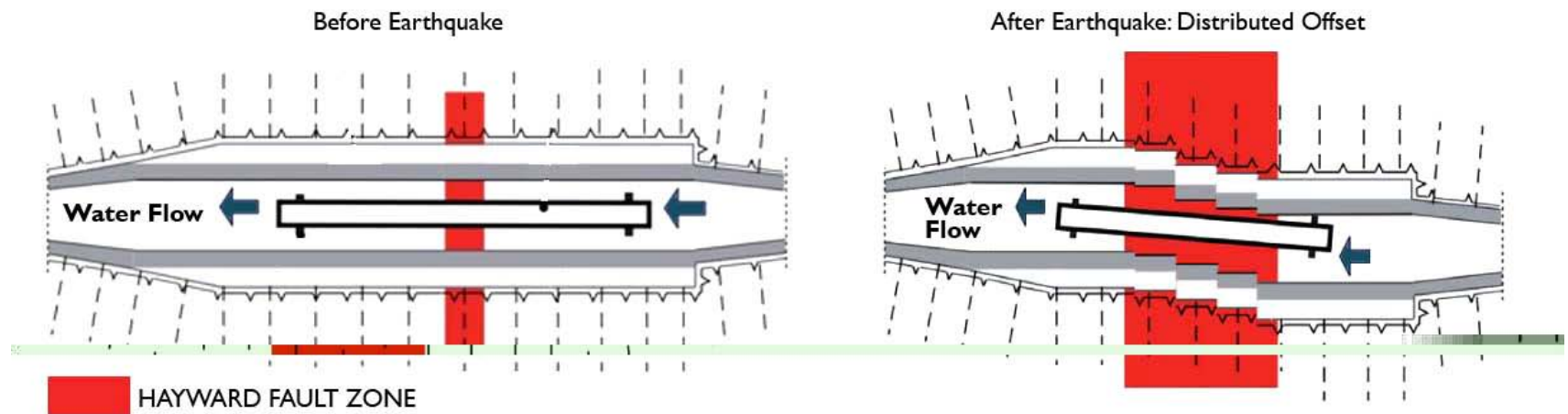


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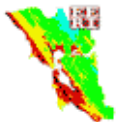
Liquefaction and Landslide Maps



EBMUD Seismic Improvement Project Complete



EBMUD Claremont Tunnel



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SF Water and East Bay Water and Sewer Delivery Systems cross Hayward Fault



BART Seismic Improvement Program underway



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Caltrans Seismic Retrofit Program Underway



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Bay Bridge Replacement Project Underway



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Port of Oakland – Oakland Airport Upgrades



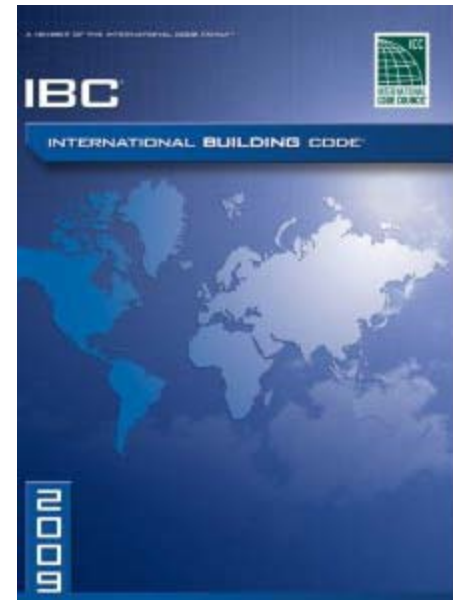
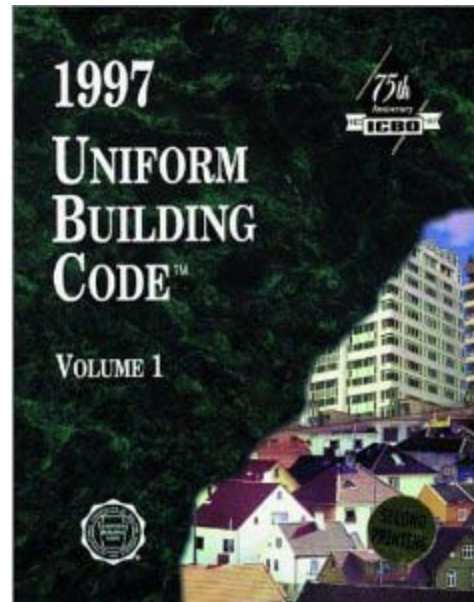
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Port of Oakland – Maritime Embankment Strengthening Program Complete



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New Information on Ground Motions Included in Modern Building Codes



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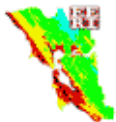
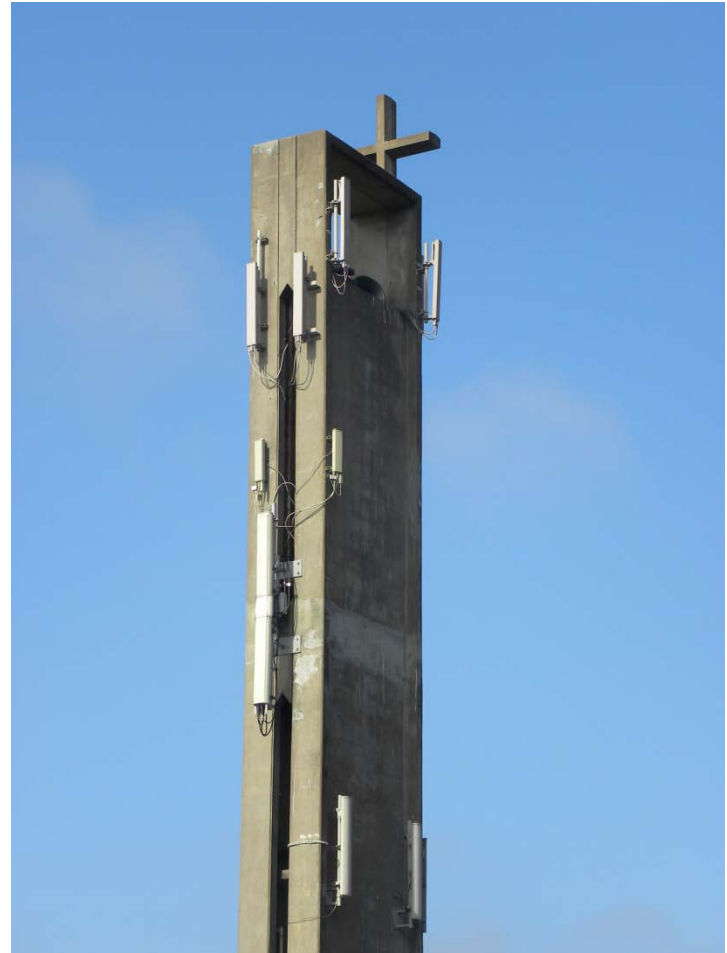
Power, Telecommunications, and Fuel Delivery Systems will be challenged



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Telecommunications Systems Will Be Overloaded

- Telecommunications-
 - Landlines - downed
 - Cellular – overloaded
 - State of CA website says long distance may be restored before local service





Bay Area City Hall Retrofits



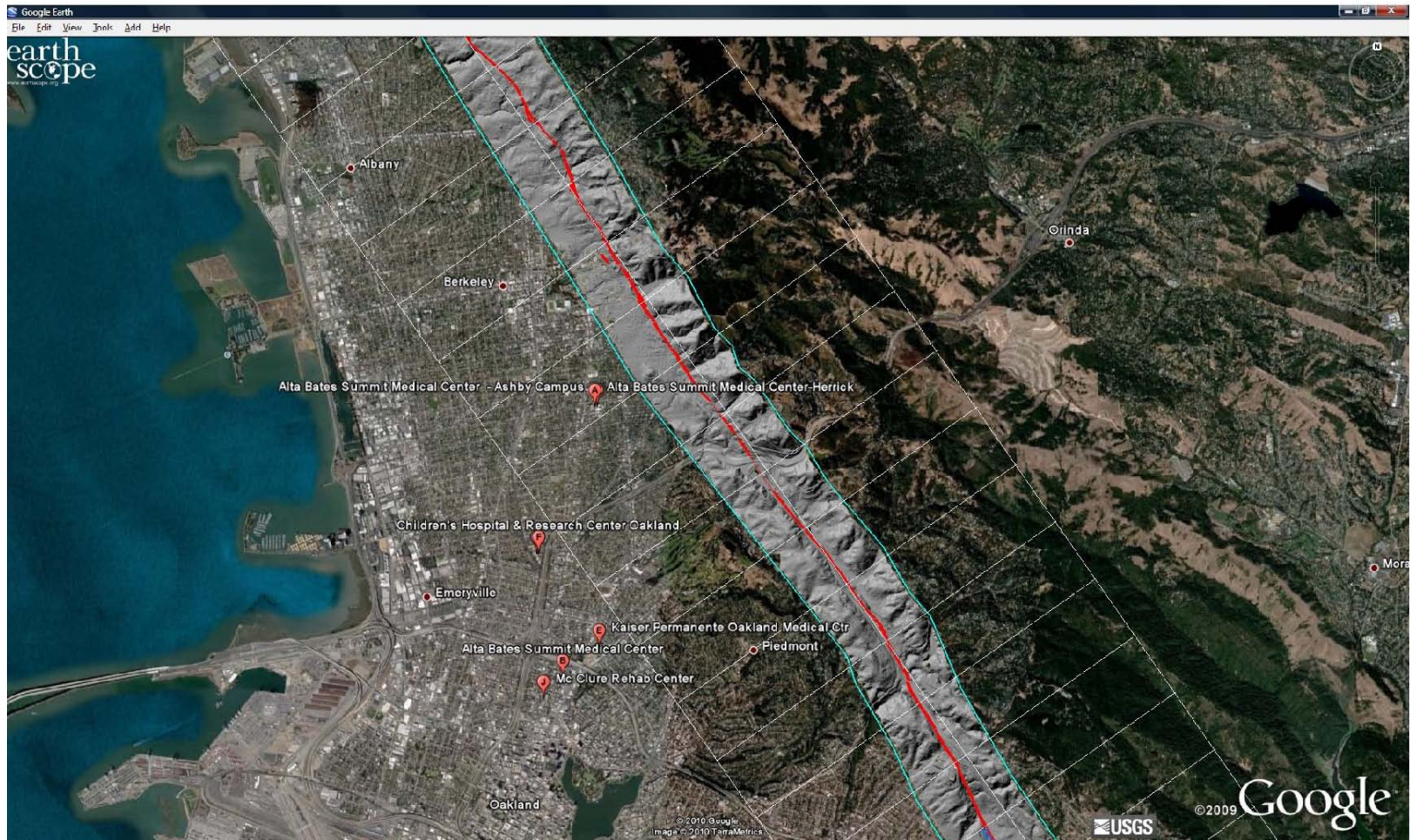
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1973 Hospital Seismic Safety Act



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SB 1953 – 1994 Amendment to Alfred E. Alquist Hospital Seismic Safety Act of 1983



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USGS Information Creates Google Earth Virtual Tour of Hayward Fault



K-12 Seismic Retrofit is Voluntary



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Regional Response

- ❑ 2000 Disaster Mitigation Act
- ❑ Multi-Jurisdictional Local Hazard Mitigation Plan
- ❑ National Incident Management System (NIMS)
- ❑ SEMS guidelines

Multi-Jurisdictional Mitigation Planning

State and Local Mitigation Planning
How-To Guide Number Eight
FEMA 386-8 *August 2006*



FEMA

U.S. Department of Homeland Security
500 C Street, SW
Washington, DC 20472



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Regional Emergency Coordination Plan (RECP)



METROPOLITAN
TRANSPORTATION
COMMISSION

**Metropolitan Transportation
Commission**

**San Francisco Bay Area
Regional Transportation
Emergency Management Plan**

**Baseline Operating Plan
May 2008**

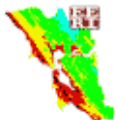


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Emergency Housing Requirements



FEMA/Ed Edahl



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Housing and Social Recovery Remain a Challenge



USGS



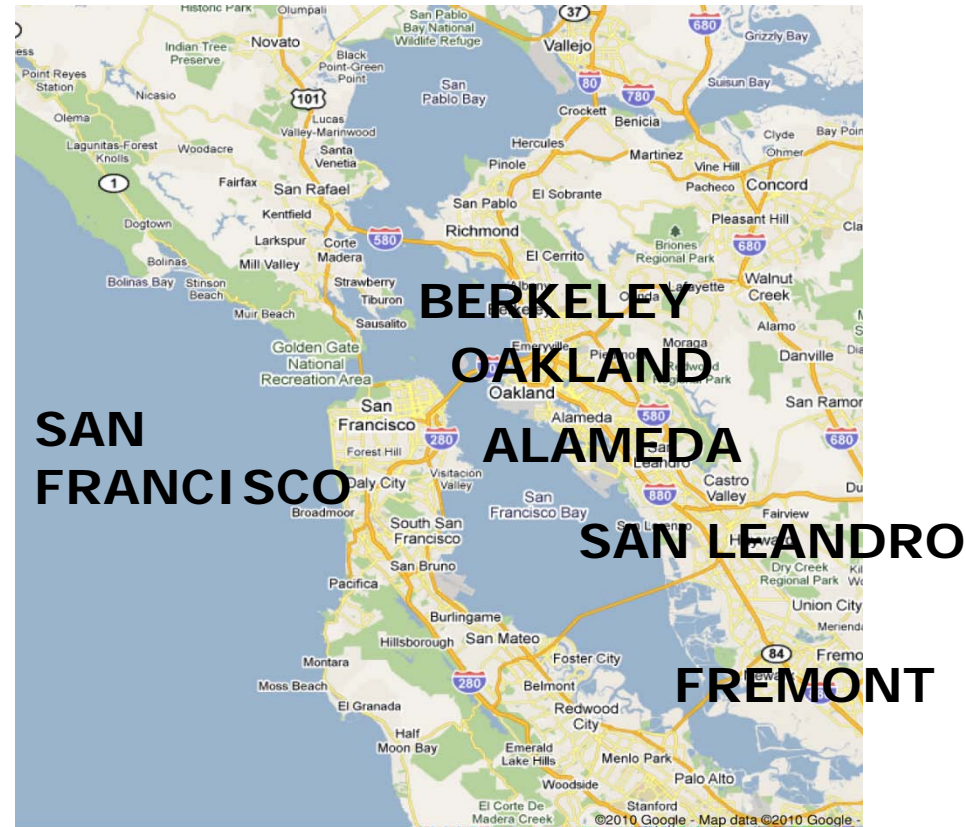
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Soft Story Ordinance

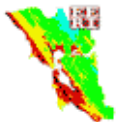
- ❑ Inventory and Information:
 - San Francisco
 - San Leandro
 - Oakland
- ❑ Engineering Reports Required:
 - Alameda
 - Berkeley
- ❑ Mandatory Ordinance Implemented in Fremont



Fire Following Earthquake

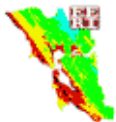


Source: USGS



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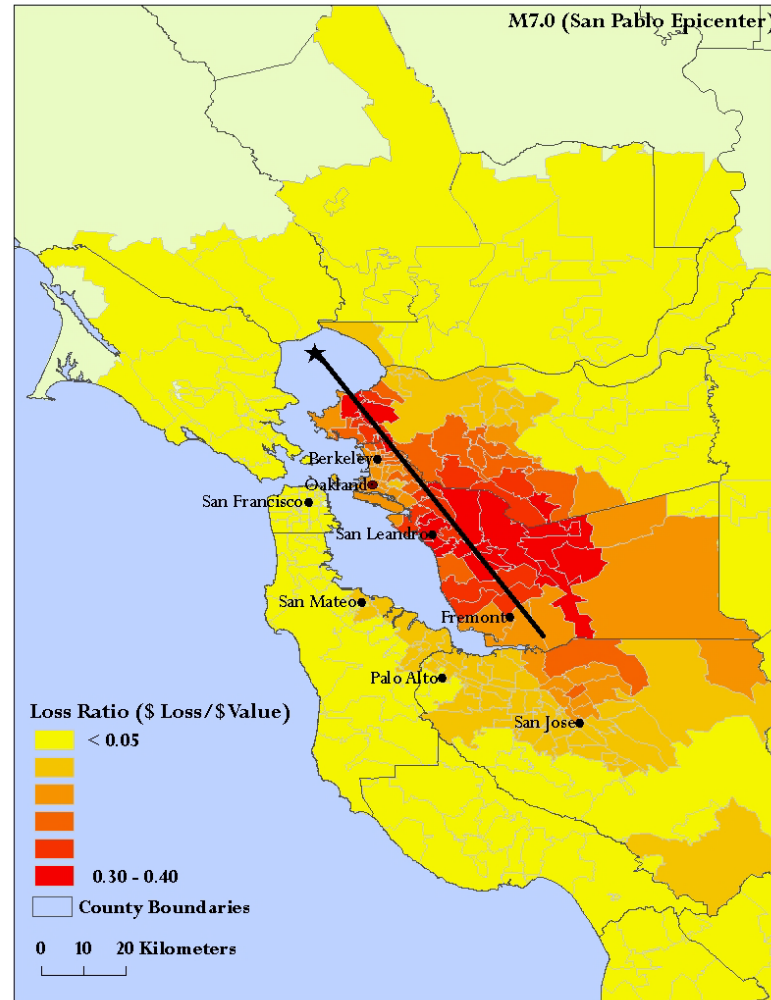
Fire Following Earthquake – Comparison with 1990's Construction in Fire Reconstruction Zone



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Economic Loss Ratio

Commercial and
Residential Buildings



RMS Estimation of Insured Losses

Economic and Insured Losses

Epicenter	Economic Losses (in \$ billions)			Insured Losses (in \$ billions)		
	Residential	Commercial	Total	Residential	Commercial	Total
M6.8 on South Hayward Fault						
(a) Oakland	\$48.3	\$51.6	\$99.9	\$3.2	\$7.6	\$10.8
(c) Hayward	\$45.9	\$49.1	\$95.0	\$3.2	\$7.2	\$10.4
(e) Fremont	\$47.1	\$51.7	\$98.8	\$3.4	\$7.8	\$11.1
M7.0 on full Hayward Fault						
(b) San Pablo	\$90.4	\$96.0	\$186.3	\$6.0	\$15.9	\$21.9
(d) Oakland	\$84.2	\$90.1	\$174.3	\$5.7	\$15.2	\$20.9
(f) Fremont	\$88.6	\$94.0	\$182.6	\$7.3	\$16.1	\$23.4

Losses based on the 2009 RMS US Earthquake and Fire Following Industry Exposure Databases, vintage July 1, 2009. Modeled loss estimates generated using RiskLink v9.0, considering post-event loss amplification. All loss estimates are for property insurance coverages only, casualty estimates are in the Hayward Fault conference report and have not changed. All losses above include shake and fire following earthquake.

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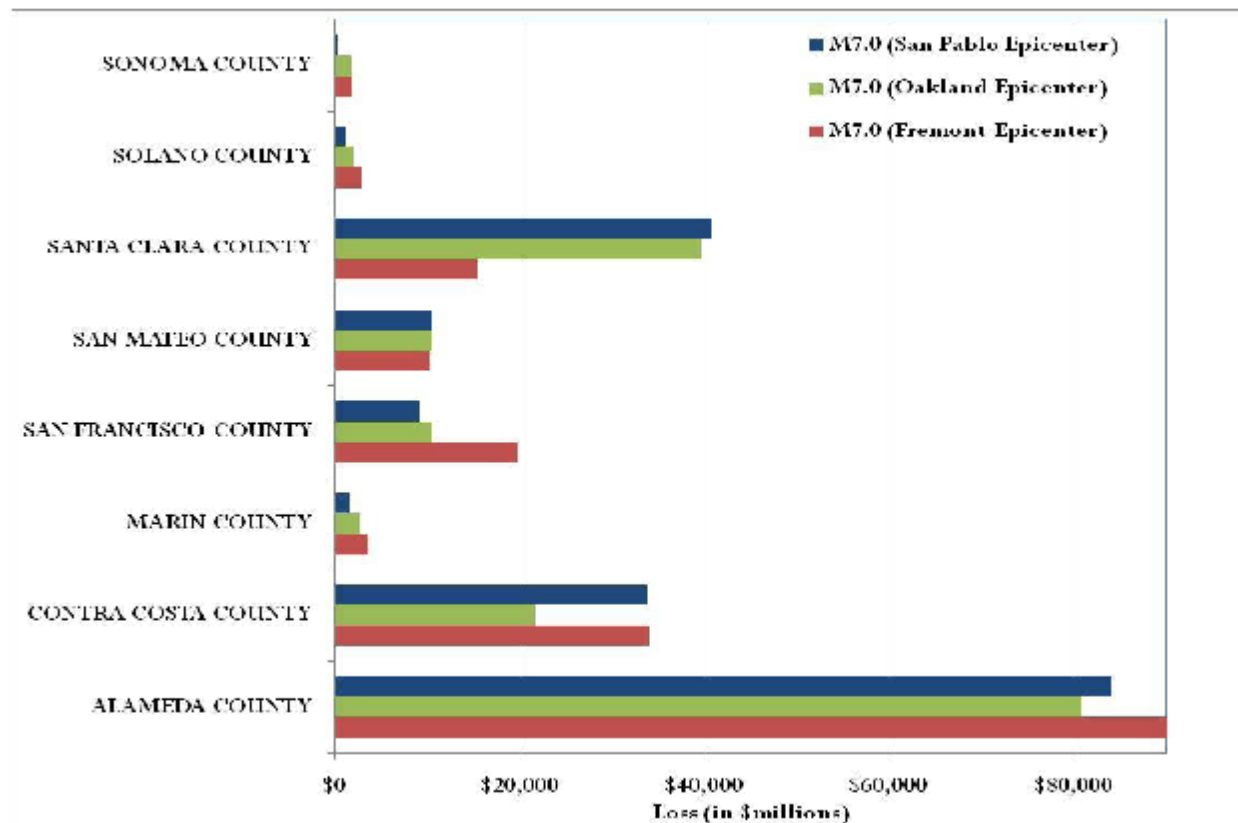
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RMS Estimation of Total Losses

Economic Losses by County (M7.0)



A Call to Action



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USGS

Acknowledgements

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 - Ronald Hamburger, Simpson Gumpertz & Heger
 - Mary Comerio, University of California, Berkeley
 - Colleen Bell, Emergency Planning Coordinator, Oakland Fire Department
 - Charles Scawthorn
 - L. Thomas Tobin

