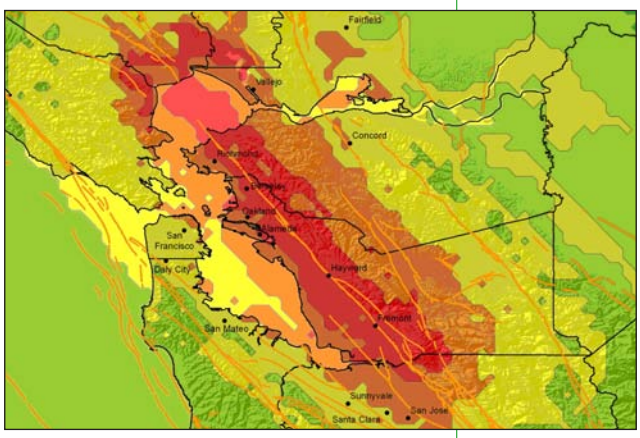
Regional Report

SUMMARY 07-06 SEPTEMBER 2007 U.S. BUREAU OF LABOR STATISTICS

## CHART 1

*Shaking Intensity Zones for a Hypothetical Magnitude 6.9 Earthquake on the Hayward Fault*




**Modified Mercalli Intensity Scale Zone Value**

- *VIII or greater: Severe shaking, moderate/heavy damage*
- *VII: Very strong shaking, moderate damage*
- *VI: Strong shaking, light damage*
- *V: Moderate shaking, very light damage*
- *IV: Light shaking, No damage*
- *Fault lines*

# Labor market risks of a magnitude 6.9 earthquake in Alameda County

According to the U.S. Geological Survey, "On average the Hayward fault generates a damaging earthquake every 150 years..." The last major earthquake on the Hayward fault occurred in 1868 and was known as the "Great San Francisco Earthquake" until the more famous quake of 1906. The Hayward fault is particularly important because it underlies Alameda County, a populous, urban area in Northern California, and is estimated to have a 27 percent chance of experiencing a seismic event by 2032.

Alameda County is home to 41,000 employers, 682,000 employees, and a total quarterly payroll of $9.3 billion. The County also lies over approximately three-fourths of the length of the Hayward fault and is therefore the county in the region most exposed to earthquakes on this fault. The map of shaking intensities measured by the Modified Mercalli Intensity (MMI) scale in Chart 1, delineates the shaking intensity zones that would occur throughout the area in the event of an earthquake of

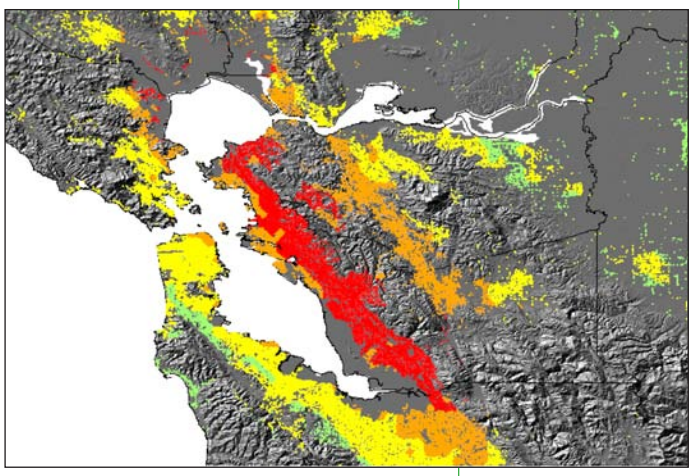
*Continued inside*

## TABLE 1: *Potential Exposure from a Magnitude 6.9 Earthquake along the Hayward Fault: Nine San Francisco Bay Area Counties*

| | *MMI VIII* | | | *MMI VII* | | |
|---|---|---|---|---|---|---|
| | *Severe Shaking, Moderate/Heavy Damage* | | | *Very Strong Shaking, Moderate Damage* | | |
| County | Employers | Employment | Quarterly Wages | Employers | Employment | Quarterly Wages |
| Alameda | 25,753 | 400,462 | 5,141,738,560 | 11,567 | 210,870 | 3,112,142,678 |
| Contra Costa | 3,392 | 36,606 | 340,548,652 | 11,936 | 180,576 | 2,609,854,090 |
| Marin | 154 | 1,807 | 21,803,937 | 2,280 | 29,371 | 416,044,149 |
| Napa | 56 | 446 | 4,189,187 | 618 | 11,423 | 136,324,614 |
| San Francisco | | | | 12,220 | 239,022 | 4,959,257,643 |
| San Mateo | | | | 753 | 24,249 | 653,217,259 |
| Santa Clara | 1,084 | 18,357 | 263,495,223 | 15,263 | 337,954 | 6,836,033,375 |
| Solano | 5 | 21 | 129,180 | 1,605 | 20,314 | 185,098,827 |
| Sonoma | 89 | 1,013 | 10,233,395 | 265 | 6,389 | 87,866,378 |
| **TOTAL** | **30,533** | **458,712** | **$5,782,138,134** | **56,507** | **1,060,168** | **$18,995,839,013** |

## CHART 2

*Employers in Shaking Intensity Zones in a Potential San Francisco Bay Area Magnitude 6.9 Earthquake on the Hayward Fault*



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### About the Modified Mercalli Intensity Scale

Seismic intensity is a measure of the effects of an earthquake at different sites. Intensity differs from magnitude in that the effects of any one earthquake vary greatly from place to place, so there may be many intensity values measured from one earthquake. Each earthquake, on the other hand, should have just one magnitude (often measured by the moment magnitude scale or by the Richter scale). The Modified Mercalli Intensity (MMI) scale is commonly used to gauge the severity of earthquake effects. Intensity ratings are expressed as Roman numerals between I at the least destructive and XII at the most destructive. At MMI-VIII, while damage may be slight in specially designed structures, there is often considerable damage and partial collapse even in substantial ordinary buildings.

*...from cover*

magnitude 6.9 on the Hayward fault. As is apparent, the most intense (MMI VIII+) zone would be primarily within the borders of Alameda County.

Moreover, when we overlaid employers on shaking intensity zones, as shown in Chart 2, we found that a large number of employers are located in areas which are expected to experience the greatest intensity as measured by MMI. (The MMI it correlates closely with measured shaking levels, and is by definition a measure of projected damage.) Using the tabulating tools in geographical information systems *(see table 1)*, we estimate that:

- Total exposures in the counties in the San Francisco Bay Area in MMI-VII (very strong shaking) and MMI-VIII+ (severe shaking) zones, combined, could include 87,000 employers, 1.5 million jobs, and quarterly wages approaching $25 billion.
- In the wide area circumscribed by shake intensity zones MMI-VII or MMI-VIII+, the employment and earnings exposures would fall, in descending order, primarily upon the counties of Alameda, Santa Clara, San Francisco, and Contra Costa.
- Approximately 84 to 89 percent all of the exposure in the shaking zone MMI-VIII+ would fall in Alameda County.

Focusing on Alameda County *(see table 2)*, we estimate that:

- Approximately 90 percent of the businesses, employees, and payrolls are located in or attributed to the most intense shaking zones on the map(MMI-VII and MMI-VIII and higher).
- More than half of the businesses, employees, and payrolls are in the zones characterized as having severe shaking and moderate to heavy damage (MMI-VIII+).
- There are more than 600,000 employees in the most intense shaking zones earning $8.2 billion in quarterly payrolls.
- The interruption to business from a M6.9 Hayward earthquake could affect nearly all businesses and employees in Alameda County.

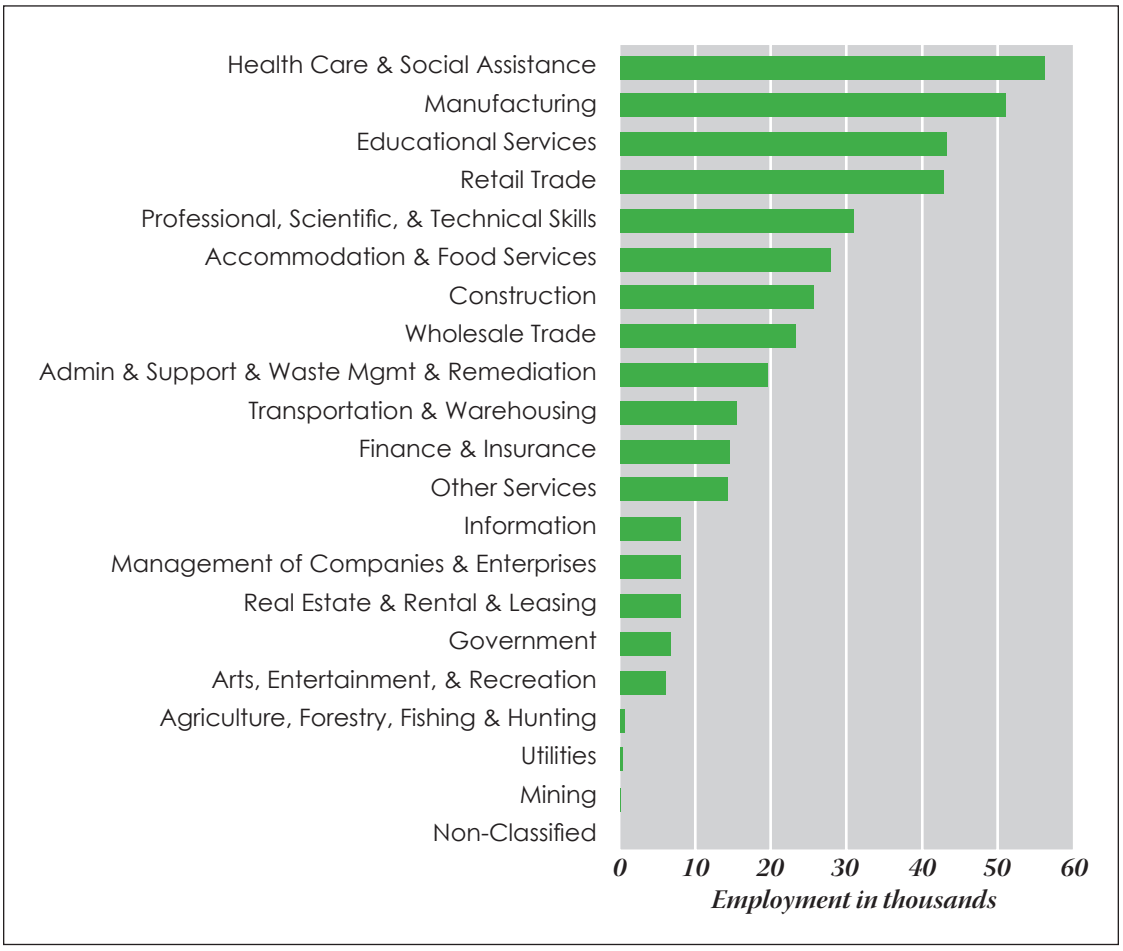
As shown in Chart 3, the exposures of various industries to damage ranges across the board, but affect particularly large numbers of jobs in health care and social assistance, manufacturing, and trade. The potential economic

## TABLE 2: *Exposure from a Magitude 6.9 earthquake along the Hayward Fault*

| *Alameda County, 2006* | *Shaking Intensity Areas* | | | |
|---|---|---|---|---|
| | County Totals | MMI VIII+ | MMI VII | Combined |
| Employers | 40,851 | 25,753 | 11,567 | 37,320 |
| Jobs | 681,821 | 400,462 | 210,870 | 611,332 |
| Quarterly Wages | $9.3B | $5.1B | $3.1B | $8.2B |

## CHART 3

*Potential Alameda County Employment Exposures to MMI VII-VIII+ from a Hypothetical Magnitude 6.9 Hayward Fault Earthquake*




consequences to San Francisco Bay Area employers and workers are widespread and are likely to have an effect on the state and national economies, owing to economic interaction between firms and industries.

***Limitations.*** Our analysis of business exposures due to earthquakes has certain limitations. The Modified Mercalli Index values describe damage levels ranging from predominantly light to widespread heavy damage. In fact, even in the latter areas, not all businesses will sustain damage that will curtail their activities and some businesses that lose capability will quickly return to normal operations. Thus, gauging economic impact by projected MMI levels may overstate the business interruption or losses that will occur.

However, direct damage to a region's businesses understates the interactional effects upon customers or suppliers inside and outside the damaged areas. Some businesses locate in regions to be near their customers and suppliers. If this relationship is interrupted by an earthquake, both customers and suppliers could be severely affected or even put out of business. Therefore, there also may be greater losses inside and outside the region than can be estimated using MMI scales and damage zones.

***Disclaimer:*** *BLS and its associates are not making a specific earthquake prediction. The purpose of this report is to describe the labor market at risk in the event of one possible earthquake scenario. An article analyzing the risk of an earthquake occurring along the Hayward Fault was published by the U.S. Geological Survey Working Group on California Earthquake Probabilities in a 2003 report. The working Group was composed of scientists from the Federal and State governments, private industry, consulting firms, and academia. The projected Modified Mercalli Intensity scale values associated with the hypothetical Hayward earthquake are from the U.S. Geological Survey Shakemap archives.*

The employment data used in this summary were obtained by the Quarterly Census of Employment and Wages in the Bureau of Labor Statistics.

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U.S. BUREAU OF LABOR STATISTICS
Postal Square Building, Rm. 2850
2 Massachusetts Ave., NE
Washington, DC 20212-0001

Official Business
Address Service Requested

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Data presented here are for all workers covered by State and Federal unemployment insurance programs. For additional information, contact Richard Holden, Regional Commissioner, U.S. Bureau of Labor Statistics. E-mail: holden.richard@bls.gov. Telephone: 415-625-2245. Co-authors of this report were Charles R. Real, Supervising Engineering Geologist, California Geological Survey, Seismic Hazards Assesment Program; and Donna Bahls, Research Program Specialist (GIS), California Employment Development Department, Labor Market Information Division.

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