

Earthquake Risk Shakes Mortgage Industry

by **Haresh C. Shah and Daniel Rosenbaum**

THE SEISMIC SHOCK THAT rolled through Northridge, CA, on January 17, 1994, lasted less than half a minute, but the financial toll wrought by the 6.8-magnitude earthquake continues to reverberate.

The 20 seconds of shaking killed 60, injured more than 7,000, caused \$12.5 billion in insured property damage in the greater Los Angeles area (\$20.8 billion counting uninsured losses) and cost the mortgage industry perhaps as much as \$400 million in homeowner defaults.

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Earthquake damage—unlike that caused by fires, windstorms and riots—is one of the perils specifically excluded from a regular homeowner insurance policy. Although owners can purchase supplemental earthquake insurance, the high cost typically discourages many from obtaining sufficient coverage, if any at all.

Consequently, thousands of borrowers in the Los Angeles area could not manage both their mortgage payments and the cost of rebuilding their homes, even after government assistance. Others decided it was easier to walk away from their damaged properties—and their mortgages—rather than make repairs. Still others escaped with minimal property damage but

defaulted after losing critical job or rental income because of the disaster.

Until Northridge, the mortgage industry had emerged financially unscathed from disasters such as Hurricane Andrew, the Oakland fires and the Midwest floods. This time, however, the insurance industry was under no obligation to pay. As the number of loan defaults mounted, the mortgage industry effectively became the insurer of last resort. After foreclosure expenses, property repair costs, lost income from interest, write-downs of loan balances and additional administrative costs, mortgage-related losses totaled, by our estimates, \$200 million to \$400 million.

Determined to avoid earthquake losses in the future, some mortgage holders are fundamentally changing the way they manage earthquake risk. If most mortgage market participants adopt similar strategies, the entire housing-finance system will benefit. The effectiveness of these changes fades, however, unless they are coordinated with similar changes taking place in the property-insurance industry and state and federal governments.

Pre-Northridge Perceptions of Industry Risk

Before the Northridge earthquake, most mortgage industry participants believed that the extent of their exposure to earthquake risk was minimal. This view was rooted in the industry's historical loss experience: Although several large earthquakes have hit the United States over the past half century, the ensuing mortgage losses have proven negligible (Table 1).

Following Northridge, which seismologists classify as a moderate-sized earthquake, portfolio lenders and secondary mortgage market institutions began questioning their perception of earthquake risk. A few mortgage finance institutions moved to re-examine their earthquake risk and to figure out ways to manage it.

Some companies began by hiring earthquake risk specialists to evaluate the vulnerability of their mortgage portfolios. These ongoing investigations have led to three unsettling findings.

First, sheer luck played a large role in sparing the mortgage industry from large losses during the previous 50 years. Several of the historical earthquakes struck too far from large concentrations of people and houses to trigger significant mortgage defaults. However, recent earthquake research suggests that each of these events had an equal probability of occurring very

TABLE 1: MAJOR U.S. EARTHQUAKES AND ASSOCIATED LOSSES

Year	Event Location	Richter Magnitude	Property Losses* (1996 \$M)	Mortgage Industry Losses* (\$M)
1811-12	New Madrid, MO	7.8	NA	0
1868	Hayward, CA	7.5	NA	0
1886	Charleston, SC	7.0	\$132	0
1906	San Francisco, CA	8.3	\$6,800	0
1933	Long Beach, CA	6.3	\$475	0
1949	Puget Sound, WA	7.3	\$160	0
1964	Anchorage, AK	8.4	\$2,475	<\$1
1965	Puget Sound, WA	6.6	\$65	<\$1
1971	San Fernando, CA	6.6	\$2,100	<\$1
1989	Loma Prieta, CA	7.1	\$8,600	<\$1
1994	Northridge, CA	6.8	\$20,800	\$200-400

*Risk Management Solutions estimates.
 Note: Each step in magnitude equals a tenfold amplitude increase in ground-displacement motion.
 Sources: Hareesh C. Shah and Jame M. Gere, *Terra Non Firma: Understanding and Preparing for Earthquakes*, 1984; Insurance Services Office; U.S. Geological Survey; Risk Management Solutions, Inc.

FIGURE 1: HISTORICAL EPICENTERS OF U.S. EARTHQUAKES WITH RICHTER MAGNITUDES OF 5.0 OR GREATER



close to an urban center instead of where it actually took place.

Second, the industry did not go back far enough in time to correctly assess its true exposure. When the historical record is extended backward a full 100 years or more, several major earthquakes appear that surely would result in mortgage industry losses well in excess of the Northridge damage if they recurred today (Figure 1). For example, a repeat of the 7.8-

in southeastern Missouri in 1811 and 1812 now would result in significant damage to St. Louis and Memphis. Similarly, a recurrence of the earthquakes that hit Hayward, CA, in 1868 (6.8 magnitude), Charleston, SC, in 1886 (6.7 magnitude) and San Francisco in 1906 (8.3 magnitude) would emanate from epicenters now located directly beneath or alongside large communities housing millions of people.

Third, a high probability exists that a serious earthquake will happen in the near future. The U.S. Geological Survey places the odds at 65 percent to 70 percent of an earthquake of 7.0 magnitude or higher hitting the San Francisco Bay area within

TABLE 2: 30-YEAR PROBABILITIES OF MAJOR EARTHQUAKES BY REGION

Region	30-Year Probability of Major Earthquake
Southern California	80–90%
San Francisco Bay Area	65–70%
Midwest	20–22%
Puget Sound Area	18–20%
Southeast	4–6%

Note: Earthquakes categorized as major have a Richter magnitude of 7.0 or greater.
Sources: U.S. Geological Survey; Seismological Society of America; Risk Management Solutions, Inc.

the next 30 years (Table 2). An 80-percent to 90-percent chance exists, according to the Southern California Earthquake Center, of an earthquake striking Southern California before 2020. Outside California, the near-term probabilities of a big earthquake decrease but are significant nonetheless. In the Midwest, for example, the probability is about 20 percent to 22 percent. In the greater Seattle area, it is about 18 percent to 20 percent. Even in the Southeast, the chance of a major earthquake is about 4 percent to 6 percent.

A New Approach Takes Shape

Farsighted mortgage players, from portfolio lenders to mortgage securities issuers and holders, now are convinced that the Northridge earthquake was not an anomaly but rather a harbinger of things to come. Taking the offensive, they are quantifying portfolio vulnerabilities, identifying key factors that drive earthquake risk and implementing formal policies to mitigate and transfer the risk.

To assess total portfolio risk, some investors have run their holdings through computer simulations that predict default performance under a range of historical and hypothetical seismic events. The earthquake-analysis models combine information on location, property construction and the principal balance of each loan in the portfolio with structural engineering, soil and geotechnical data. Besides quantifying the risk associated with minor, moderate and intense seismic activity, the technology can identify concentrations of loans located in areas of high earthquake risk.

To transfer portfolio risk, some are turning to the property insurance market. However, most multi-peril insurance coverage for mortgage portfolios specifically excludes borrower-related losses due to earthquake. Some companies purchase expensive supplemental coverage for loans identified as contributing disproportionately to anticipated losses. Most investors, however, do without.


A longer-term and less costly approach revolves around the implementation of explicit risk-mitigation policies and procedures. One insurance policy mitigates the mortgage holder’s risk by requiring borrowers to carry earthquake insurance. This new requirement may apply to all mortgages on properties located in high-risk areas or only to properties of certain construction types in high-risk areas.

Another risk-mitigation strategy involves increasing the geographic diversification of loan portfolios on the basis of computer-generated correlation factors. The objective is to avoid concentrations of holdings in only a few geographic areas or property types—such as unreinforced masonry and older wood-frame structures—that are at high risk when earthquakes occur.

Prescreening loan purchases according to the earthquake risk of the underlying property constitutes a third mitigation approach. Structural engineering and seismic information about specific properties is weighed against investor-defined criteria for acceptable levels of seismic risk. The mortgage investor either screens the loans before acquiring them or sets forth loan-acceptance criteria for the market to follow (see “Freddie Mac Takes Industry Lead, Tackles Earthquake Risk Head On,” page 17).

At Risk Management Solutions, Inc., we have identified seven steps lenders and investors can take to understand and manage earthquake risk:

- Use computer simulation and analysis to establish a baseline estimate of portfolio risk.
- Determine the level of portfolio risk (for example, dollar risk and portfolio concentrations based on property type and geographic location) that the organization is willing to accept.
- For the current portfolio, design and implement procedures for risk transfer and mitigation that are based on the “acceptable” risk objectives.
- For new business, implement risk-transfer and -mitigation procedures (for example, stringent vs. lax screening of loans) that are based on individual loan risk and its impact on the portfolio.
- Monitor changes in portfolio exposure and risk on a regular basis through computer simulations and analysis. Take corrective action to balance the portfolio, as needed.
- Monitor external “macro” trends (for example, real estate property values and actions by the insurance industry and government agencies) that could affect natural-hazard risk and assess the implications for portfolio risk.



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- Continuously improve the effectiveness of risk assessment by collecting new, improved and consistent natural-hazard-related information.

Keeping an Eye on Other Risk Factors

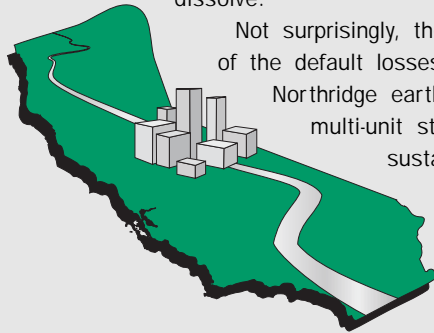
The property insurance industry and both state and federal governments also are concerned about sizeable losses from future big earthquakes and are trying to restructure the amount of risk they assume. It is unclear at this point whether the implications of these initiatives will prove positive or negative for mortgage industry earthquake risk.

Some insurance companies have raised premium rates significantly for earthquake insurance in selected states, including California, Washington, Missouri and Arkansas. The hikes have hit California residents particularly hard, rising by an average of about 100 percent during the post-Northridge period. Although intended to offset property insurer risk, the price changes could increase mortgage industry risk. Some borrowers who traditionally purchase earthquake insurance may balk at higher premiums and decide to do without.

Recent reductions in the benefits provided by earthquake coverage could further increase

Freddie Mac Takes Industry Lead, Tackles Earthquake Risk Head On

The Northridge earthquake proved particularly devastating for condominium owners, scores of whom lost their homes and their equity investments under circumstances unique to this form of homeownership. In most cases, the owners decided to default when their condominium associations—unable to rebuild the common areas of their communities for lack of earthquake insurance or because of inadequate coverage and reserves—ultimately voted to dissolve.



Not surprisingly, the same phenomenon gave rise to many of the default losses experienced by Freddie Mac after the Northridge earthquake. In fact, the company found that multi-unit structures, including condominiums, sustained the greatest damage and

condominiums specifically contributed more to Freddie Mac's default losses than any other property type.

Concerned about these developments, Freddie Mac broke new ground in February 1995. The secondary mortgage market company announced new underwriting criteria for the purchase of loans on individual condominium units, requiring project-wide earthquake insurance for developments located in seismically volatile parts of California.

When a statewide shortage of earthquake insurance offered through U.S. insurers made it difficult for some condominium associations to comply, Freddie Mac took another unusual step. The company sought out insurers in other countries to develop new insurance options for the California market. As a result, unit owners can now obtain earthquake coverage that satisfies Freddie Mac's requirements even when a condominium association does not maintain insurance on the project's common areas or fails to hold enough reserves to cover a policy deductible.

To further ease the insurance availability strain, Freddie Mac will waive, for a limited time, its condominium earthquake coverage requirements when a lender pays a fee in lieu of insurance. The additional loan-delivery fee is 25 basis points or 100 basis points, depending on the circumstances. Unlike an earthquake insurance policy, this alternative does not provide unit owners with a source of compensation for earthquake damage.

By heeding the lessons of Northridge, Freddie Mac reduces its own exposure to earthquake risk. Just as importantly, though, the company is shielding condominium owners from the heartache of losing their homes to forfeitures that they are powerless to stop.—H. Jane Lehman, editor

TABLE 3: COMPARISON OF INSURANCE POLICY FEATURES

Deductible	Pre-Northridge	Post-Northridge
Deductible	5–10%	15%
Primary Structure Damage	Full replacement cost	Full replacement cost
Secondary Structure Damage	10% of primary structure value	No coverage
Contents Damage	50% of primary structure value	\$5,000 limit
Living Expenses	10% of primary structure value	\$1,500 limit

Note: Pre-Northridge refers to the best coverage typically available before the earthquake. Post-Northridge refers to the “mini-policy” proposed by the California insurance commission.
Source: Risk Management Solutions, Inc.

mortgage industry risk. Three years ago, most earthquake homeowner policies carried a deductible of 5 percent to 10 percent, full coverage for the primary structure and significant reimbursement for living expenses and damage to contents and secondary structures (Table 3).

After Northridge, insurers in California and several other states began rolling back their residential earthquake coverage. New business and policy renewals now are restricted to deductibles of 15 percent to 20 percent and to lower coverage

limits on the secondary structure, household contents and living expenses. As a result, homeowners with these policies must fund a greater share of their post-earthquake recovery costs.

State and federal governments are shifting from an emphasis on post-disaster loss relief to pre-disaster loss mitigation. The objective is to reduce long-term government costs by placing primary responsibility for post-disaster funding on the private sector, local communities and individuals. In the future, government assistance to homeowners may exist primarily to finance front-end risk mitigation rather than back-end disaster relief.

At the national level, Congress is considering legislation that would revise the formula for determining the federal share of post-disaster costs. The proposal would link receipt of federal relief funding to compliance with new building codes and to implementation of disaster-mitigation activities. It also would create a private insurance company that would issue catastrophic reinsurance contracts to the insurance industry. Tax incentives for insurance companies that issue all-hazard policies to property owners also are under consideration.

At the state level, California is trying to improve the match between the supply of earthquake insurance and the demand. Under one legislative proposal advanced by the California insurance commissioner, a quasi-state property insurance company would issue residential policies carrying a 15 percent deductible and offering full replacement value for damage to the primary dwelling. The coverage would not extend to secondary structures and would provide minimal compensation for contents and post-earthquake living expenses. The capital to underwrite the policies offered by the state-sponsored company would come from assessments against the insurance industry, reinsurance industry and capital markets.

If either the federal or the California bill becomes law, the anticipated effects on the mortgage industry are roughly parallel. If government-proposed policies cost less than those previously available, thereby prompting more homeowners to buy them, mortgage-industry risk would decrease.

If, however, earthquake insurance penetration actually falls because the policies prove more expensive or insurance companies continue to move policyholders into reduced-coverage policies, then mortgage borrowers would possess fewer resources following an earthquake. This will lead to higher defaults and mortgage-industry risk would increase.

A Clear-Eyed Look Ahead

The mortgage industry's exposure to earthquake risk is not going to disappear. The recurrence of a large historical event or the occurrence of one of the anticipated near-term earthquakes would prove quite costly to the industry. If insurance penetration rates, policy benefits and federal post-disaster relief decline, mortgage-related losses will multiply further.

Some mortgage industry participants are coming to grips with earthquake risk, but many have yet to act. At the very least, mortgage investors should assess their risk to determine whether



they are vulnerable to earthquake-related defaults. Those who are should consider risk-mitigation and -transfer options. Moreover, the mortgage industry as a whole must become more aware of and involved in the risk-reduction efforts of others outside the industry. By working alongside the insurance and government sectors to fashion solutions to the problem of earthquake risk, all participants—especially the nation's homeowners in at-risk areas—will benefit.smm