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0.1 Reduced earthquake risk and losses as consequences of improved monitoring

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The combination of the earthquake hazard and the vulnerability of the built human environment creates earthquake risk. Earthquake risk is growing at an alarming rate, despite advances in earthquake science and engineering. This phenomenon is the result of unprecedented growth and the lack of focused and applied public policy that would cause the available design and rehabilitation techniques to be properly and universally applied. Earthquakes thus continue to cause an unacceptable level of damage in terms of lives lost, property destroyed and services interrupted (annual earthquake losses in the U.S. are $5.6B, with a single-event losses potentially over $100B).

To better understand the role that effective monitoring plays in risk and loss reduction, the USGS asked the National Research Council in 2003 to study the economic benefits of improved seismic monitoring. The NRC's June, 2005, report concluded:

Seismic monitoring provides the key to understanding how the built environment responds to earthquakes, and improved records offer the potential for fine-tuning the design process so that seismic safety requirements are adequately, but not excessively, met.

The benefits of improved seismic monitoring far exceed the costs, with costs for improved monitor-ing estimated in the tens of millions, but potential dollar benefits are in the hundreds of millions.

Mitigation actions based on improved seismic information –and the resulting reduction in uncertainty- would yield benefits many times costs. In just one benefit area, performance-based engineering, benefits are estimated at $142 million annually –

about three times the cost of operating the proposed Advanced National Seismic System.

In the area of loss estimation modeling, improved monitoring data will greatly reduce uncertainty, potentially decreasing the cost of insurance and reinsurance, and shifting costs from disaster relief payments and grants (publicly financed) to insurance recoveries (financed through premiums).

Improved seismic monitoring can also significantly increase the accuracy of tsunami warnings and reduce the risk of missed warnings or costly false alarms.

The U.S. should rank seismic risk reduction as highly as other critical national programs, should track the growth of risk, and make investments to reduce it.

A fundamental role of monitoring information is to reduce uncertainty, leading to increased accuracy of damage predictions and loss estimation, as the basis for more effective loss avoidance regulations, as well as enabling more effective emergency preparedness and response activities and improved earthquake forecasting capabilities. The modest funding required for significantly improving monitoring should be viewed in light of the potential for reducing the cost of constructing new facilities, strengthening existing structures to achieve proper performance, and losses that will be avoided after major damaging events. Costs should be considered in comparison to the more than $800B invested annually in building construction, the $17.5 trillion value of existing buildings, and estimates of massive earthquake losses from large urban quakes.

Monitoring benefits also come from: Improved loss-estimation model outputs, which increase public knowledge, confidence, and understanding of seismic risk; better correlation between seismic risk and building-code and land-use regulations; more efficient use of insurance to offset losses; and more accurate determination of the nature and growth of seismic risk. Benefits in emergency response and recovery include expediting hazard identification, promoting rapid mobilization, and facilitating the rapid identification of buildings that are safe for occupation and those that must be evacuated. These tangible benefits accrue both to the emergency management community, to governments, and ultimately to residents of seismically active regions. Although difficult to quantify in many cases, the ultimate benefits are lives saved, property spared, and reduced human suffering.