FEMA Fact Sheet

Informing Earthquake Risk with FEMA P-366

Overview of the Report and How to Use It

Earthquake risk continues to rise in the United States. To address this risk, FEMA and the U.S. Geological Survey (USGS) are providing better ways to find and use information on earthquake losses and risk. The FEMA P-366 report released in April 2023 lays out these methods.

Introduction

The United States has had 28 earthquakes with a magnitude of 6.0 or greater in just the last decade. These earthquakes have caused considerable damage, loss of life and economic disruption. There is a need for more focus on preparing for, mitigating against, responding to and recovering from earthquakes. To help address this need, FEMA, along with the National Earthquake Hazards Reduction Program and the USGS, released the updated FEMA P-366 report on Hazus Estimated Annualized Earthquake Losses for the United States in April 2023. This is the fourth iteration of the report and uses the most up-to-date data and methods to discuss earthquake risk and the targeted mitigation efforts that reduce it.

Earthquakes can have large impacts spanning entire regions and disrupting communities over an extensive recovery period. They have the ability to physically alter an entire area and disrupt key infrastructure, including transportation, businesses, schools, homes and more. Recent earthquakes around the world have claimed tens of thousands of lives. They have also led to hundreds of billions of dollars in losses and rebuilding costs. Figure 1 highlights how much these impacts could cost a U.S. state or territory in a given year.

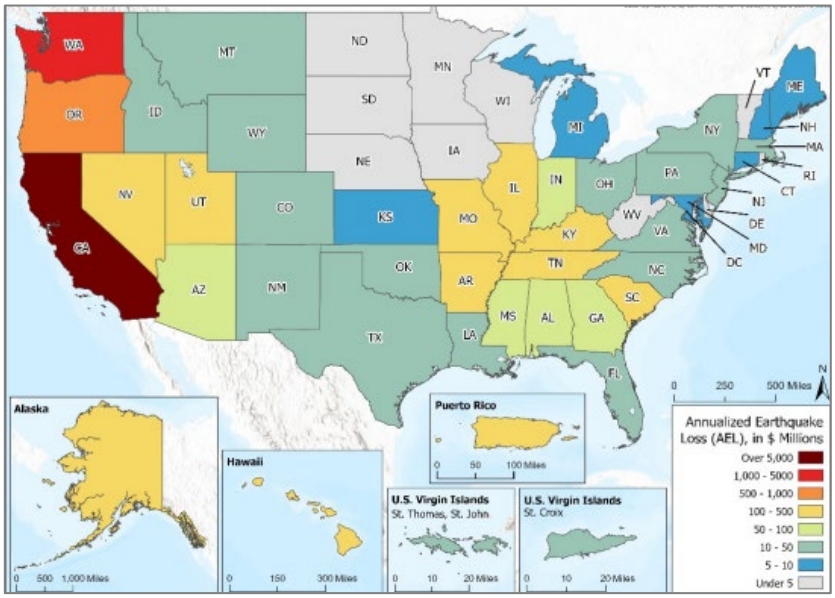

Figure 1: Annualized Earthquake Losses (AEL) by State

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REPORT BACKGROUND

This report details a study that assessed current and future earthquake potential losses. The results can help with earthquake mitigation planning, emergency management and policy development. Its goal is to increase public awareness of earthquake risk so that communities can prioritize mitigation actions and reduce risk. Any action taken now can provide significant benefits in the future. Consider the following:

- Each $1 spent on existing building seismic retrofit can avoid an average of $3 in losses.
- Each $1 spent on new buildings in compliance with current codes and standards can avoid $12 in losses (National Institute of Building Sciences).

STUDY INSIGHT

The study in this report uses Hazus, a geographic information system-based earthquake loss estimation tool that FEMA developed. It uses the most recent version of Hazus (6.0), and the latest inventory and hazard data.

To learn more about Hazus, check out the What is Hazus Fact Sheet and reference the information provided at the bottom of this page.

ANALYZING EARTHQUAKE RISK

The study estimates seismic risk by using two indicators:

1. **Annualized Earthquake Loss (AEL)** estimates long-term losses measured in U.S. dollars per one year. It combines historical patterns of frequent, smaller events and infrequent but larger events. This gives a balanced estimate of earthquake risk. The loss estimates are specific to each geographic area. They are based on that area's earthquake risk and general building stock value. This helps community officials, developers and other stakeholders understand and plan for earthquakes in terms of economic and hazard risk.
2. **Annualized Earthquake Loss Ratio (AELR)** takes the AEL and makes it a fraction. It does so by using the value of replacing a geographic area's building inventory after an earthquake event. This levels the value so that estimated losses can be compared across different geographic regions. States with low hazard risk and high-value building inventories (e.g., New York) can have annualized losses comparable to states with greater risk but smaller inventories (e.g., New Mexico). This helps to equitably understand earthquake risk regardless of the size and value of an area's building stock.

Updated Study Results Indicate High Seismic Risk

The study communicates seismic risk data for the entire U.S. and Caribbean territories. It assesses potential earthquake loss at a national, statewide, metropolitan, county and census tract level. Overall, findings show that seismic risk has increased more drastically in the western United States. Some of the key national statistics shared are:

- The total economic exposure, or the total cost in buildings exposed to earthquake risk, for the nation is approximately $107.8 trillion.
- The Annualized Earthquake Loss for the national building stock is $14.7 billion per year.

The study assesses and gives loss estimates for AEL per capita. It also offers estimates of debris, displaced households, shelter requirements and casualties. Figure 2 shows AEL losses by region. For more results and graphics, review the full P-366 report. To learn more about what data were used in the study, read pages 64 to 65 of the P-366 report.

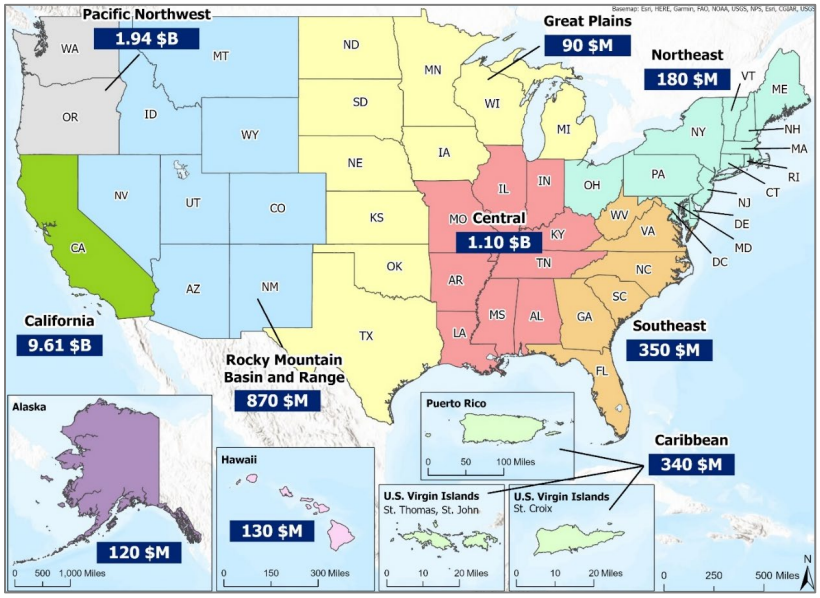

Figure 2: Distribution of Average Annualized Earthquake Loss by Region

Use the results from the study to help inform your earthquake risk!

View the results in the FEMA P-366 Hazus Estimated Annualized Earthquake Losses Report and Data Resources Page to get a detailed look at earthquake risk across the U.S.

Find and download all of the data from this study in the Hazus Loss Library. To learn more about the Library and how to download the data, check out FEMA's Hazus Loss Library Fact Sheet.

Communities, states and regions can use the data to do a more customized risk assessment. This could include further modeling or gathering additional data to do a more in-depth, localized study.

Applying the Report

Tools are available to help apply the findings of this study. Examples of how it can be used to reduce risk and advance FEMA's goal of building a more resilient nation are provided in the table below.

Application	How to Apply It	Benefits
Perform outreach to raise awareness of risk and mitigation options in high-risk communities.	Use the report data and graphics to work with local stakeholders on communicating earthquake risk in their community.	▪ This helps communicate risk to local officials, developers and other decision makers who carry out seismic mitigation projects. It also helps residents understand their risk and the importance and investment benefits of these projects.
Assess the costs and benefits of adding seismic provisions in building codes.	Discuss the findings of the study with local building officials. Determine the best course of action based on the community risk.	▪ This helps communities take informed action. ▪ It offers the tools to support decision making in mitigation actions that reduce seismic risk across communities.
Support disaster response and recovery planning.	Use the results of the study to inform local Emergency Operations Plans. The results in section 3.6 of the report can help identify key resources for earthquake disaster response.	▪ It helps communities prepare for an earthquake event. ▪ Having a plan in place can limit the impacts of an event. It can streamline disaster response efforts and save lives.
Compare seismic risk with that of other natural hazards.	Use the information from this study to inform the hazard mitigation plan update process. Decide mitigation project funding based on immediate need and risk.	▪ This gives local officials information on risk and cost to support seismic mitigation work. ▪ Knowing a community's risks and vulnerabilities makes it easier to plan and focus resources and funding.

CONCLUSION

This study is a vital tool in the effort to compare seismic risk across regions of the United States. It informs mitigation best practices and policies, and contributes to an increased understanding of earthquake risk in the U.S.

Hazus Resources

The Hazus Program offers technical guidance, training, and information about ongoing and recent projects to help stakeholders complete successful risk assessments. Please review the resources listed below for assistance using Hazus and reach out to the Hazus Team with questions.


Self-Guided Course Materials


YouTube Videos


Sign up for Risk Assessment Guidance


Visit the Hazus Loss Library


User & Technical Manuals


Contact the Hazus Team