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Improving SEISMIC risk management

ASTM's incorporation of earthquake hazards in their forthcoming Property Resilience Assessment Guide may offer clarity and consistency to managers struggling to improve seismic resilience in portfolios.

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The recent 7.8 magnitude earthquake in Turkey and Syria, as well as a smaller 3.8 magnitude earthquake closer to home in Buffalo, New York, underscore the importance of understanding and mitigating for seismic activity in the greater constellation of growing risks brought about by natural disasters and climate change.

In response to growing pressure to document and disclose risk exposures, ASTM International is expected to release a guide later this year that will provide recommendations for property resilience assessments (PRA).

Resilience (the 'R' in ESG+R) refers to how an asset can adapt to the ongoing effects of rising sea levels, changing flood maps, droughts and extreme temperatures, as well as the immediate impact of natural disasters such as hurricanes and wildfires. How does seismic resilience factor into these new standards?

While the relationship between climate change and seismic activity is a topic of debate in scientific circles, there is no doubt that earthquakes have the potential to drive sudden and significant losses to a real estate portfolio. Managers with properties vulnerable to seismic risk should thus take measures to boost the seismic resilience of their portfolios. Accordingly, ASTM International will incorporate seismic resilience in the new PRA standard under a hazard category called 'geologic phenomenon.'

The new PRA standard will address three stages of the risk assessment process: hazard, risk and resilience measures. The hazard stage is the fairly straightforward process of reviewing regional hazard data, including US Geological Survey's seismic hazard maps, California Geological Survey (CGS), the National Oceanic and Atmospheric Administration (NOAA) Tsunami Program, and other state and local sources to identify known hazards to the property.

The challenge in establishing guidance for seismic resilience lies in the risk and resilience stages: standardizing risk assessment, a practice that currently encompasses a number of diverse methods; and defining resilience as it pertains to earthquake hazards.

Standardizing seismic risk assessment

Preceding ASTM committees have standardized and continue to refine the practice of assessing buildings for financial risks from physical seismic damage. Still, different assessment methods and models — yielding different results — do not address resilience and may leave managers

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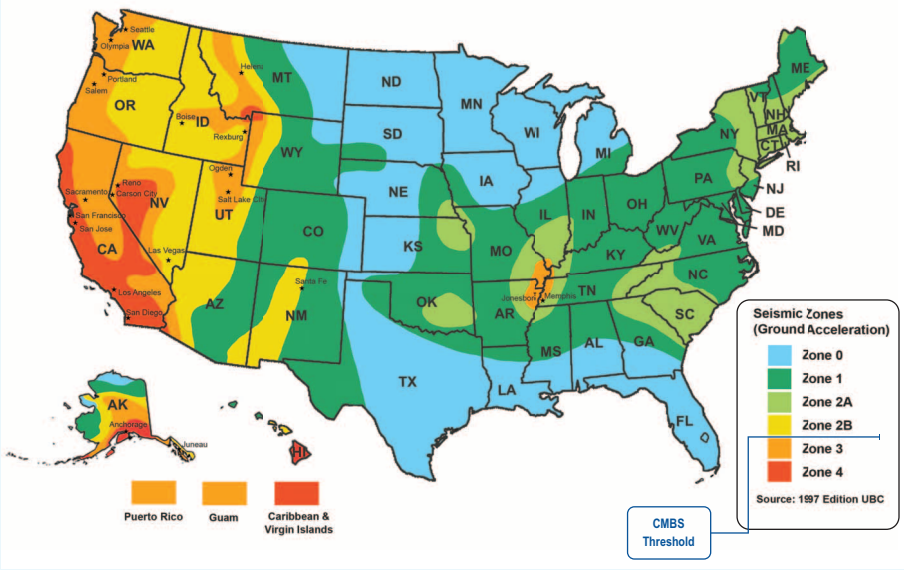
Seismic risk assessment 101

Seismic risk assessments (SRAs) are used by property owners, lenders and others to understand and manage earthquake-related risks. SRAs encompass site stability, building stability and building damageability, though evaluations of damageability of building contents and business interruption can also be completed.

Typically, SRAs are conducted for properties in areas with greater potential for damaging earthquakes, such as seismic zones 3 and 4 on the UBC seismic zone map (see map below). However, some lenders require SRAs in other areas. Freddie Mac and Fannie Mae, for example, require evaluation of seismic risks for properties based on thresholds for 'peak ground acceleration,' a metric available on the United States Geologic Survey (USGS) website.

Unlike a PRA, SRAs typically do not include resilience/recovery components. For properties that would typically require an SRA, seismic should be included in the PRA, and it is time- and cost-effective to complete a PRA and SRA in tandem.

UBC seismic zone map



The problem with PML

One of the most common expressions of earthquake risk is probable maximum loss (PML). PML assessments typically provide a statistical estimate of building damage based on user-defined risk tolerances. Most are performed in accordance with ASTM standards E2557 and E2026, which define common terminology and identify levels of assessment, so they are a useful basis for communication and scoping assessment projects.

However, in terms of risk calculation, they allow multiple methodologies and models including "proprietary methods both disclosed and undisclosed," which can introduce subjectivity and wide variance between outcomes.

Furthermore, many of the loss models used in seismic assessments are based on statistical performance data of large populations of building types, much of which was collected prior to 1980 and have not been updated since. These models do not consider individual building characteristics, recent earthquake performance data or recovery time; therefore, evaluation of potential risks will require significant engineering judgement.

confused as to the best way to evaluate their exposure.

The risk stage of a PRA addresses the specific vulnerability of a real estate asset based on-site and building characteristics as evaluated via site observations. It is noteworthy that the new PRA standard includes a site inspection as part of the minimum scope.

While an increasing number of consultants offer climate resilience assessments, many limit their assessment to a review of regional and local hazard data such as flood maps, seismic maps and historic weather data. This method provides an incomplete picture of risk, as it fails to consider the attributes of the building and building site.

For example, two office buildings on the same city block would be exposed to similar seismic hazards. Using only a seismic zone map, a potential buyer might assume the same level of seismic risk for both buildings. Of course, if one of the buildings is a wood-framed structure and the other is constructed with ductile steel, the buildings would perform very differently during the same earthquake; steel-framed structures can reduce seismic risk. However, even with hazard maps and building plans in hand, the potential buyer may not be able to accurately determine the relative risk of each building.

A reliable assessment must include a site visit to evaluate architectural features, building systems and equipment, as well as building contents that could be considered risk factors. For this reason, the PRA will rely heavily on existing ASTM seismic risk assessment standards and seismic resilience assessment (SRA) results, the necessary performance of which would typically already have been commissioned concurrently during transactional due diligence.

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New tools

In recent years, the structural engineering community has developed new tools to improve seismic assessment. One such tool is FEMA P-58. Developed by the Applied Technology Council (ATC) and funded by the National Science Foundation, this model for seismic assessment and design incorporates almost two decades of earthquake performance research and contributions of over 100 engineers and scientists. P-58 is used for building-specific loss estimates, including structural elements and non-structural elements such as windows, cladding and elevators.

The drive for more accurate and consistent seismic risk assessment has also prompted the development of seismic performance rating systems that include recovery time. Two prominent rating systems have emerged and collaborated, namely the US Resiliency Council (USRC) and the Structural Engineers Association of Northern California's (SEAONC) Earthquake Performance Rating System (EPRS).

> “In defining seismic resilience, it is also important to understand that compliance with building codes and/or local seismic ordinances does not necessarily guarantee resilience.”

Recognizing the inconsistencies between seismic risk assessment models and outcomes, the new PRA guidance provides recommendations for the minimum scope of resilience assessment, minimum qualifications of providers, and parameters to encourage consistent outcomes. Ideally, it will offer investors a comprehensive and holistic means to evaluate seismic risk and discriminate between high seismic risk investments and lower risk investments.

Defining seismic resilience

The resilience stage of a PRA will identify and estimate the cost of specific resilience measures. This is where the definition of resilience comes into play.

Property resilience is the ability of a facility to adapt to and withstand disturbances while retaining the same basic structure, function and self-regulation. Expressions of resilience include the capacity of an asset to adapt, adjust, withstand and recover from various external forces, including global climate change.

However, even this basic definition leaves room for interpretation. What constitutes recovery from earthquake damage? Is it when the structure is restored and cleared for re-occupation? Or is the asset recovered when occupants have resumed operations and cashflow and/or rental income is restored? Return of normal building operations is referred to as ‘functional recovery,’ a concept currently being studied and developed at the national level by NIST-FEMA, ATC and others. Depending on the needs and perspective of the PRA user, either answer could be correct.

In defining seismic resilience, it is also important to understand that compliance with building codes and/or local seismic ordinances does not necessarily guarantee resilience. Modern building codes are written to support life safety and prevent collapse, but offer less guidance regarding damage reduction and recovery.

Similarly, mandatory seismic retrofit ordinances enacted by many West Coast cities were written to protect the public from seismically hazardous buildings that might otherwise collapse in an earthquake. They are not designed to limit building damage or speed recovery time. Furthermore, resistance by building owner and tenant groups concerned about cost and displacement of tenants during such retrofits often results in constrained scopes that balance these concerns against safety objectives. In other words, the level of building resilience achieved by compliance with a mandatory retrofit ordinance likely would not meet resiliency objectives.

Not all PRA users will understand the gap between compliance and resilience, just as not all users would have the same definition of resilience. The new PRA standard will provide guidance for determining the needs and objectives of the PRA user to encourage meaningful, transparent communication of PRA findings. User objectives will also inform measures recommended in the resilience stage of a PRA.

Resilience recommendations

Beyond structural measures, such as seismic retrofit, recommendations for seismic resilience could include recovery measures such as post-earthquake alert and management programs, systems for rapid assessment of earthquake damage, or occupancy resumption planning.

The new PRA standard also addresses community resilience, which considers the impact of a seismic event on neighboring structures and resources that could affect the recovery of the subject property. These resilience concepts and tools can potentially aid compliance reporting, asset risk management and property management, as well as increase investor and stakeholder confidence.

As the commercial real estate industry continues to prioritize ESG+R, including seismic resilience in ESG+R policy and standards can result in reduced repair costs and faster recovery, thereby decreasing economic losses due to physical damage, loss of use, lost rent and business interruption. The engineering and real estate investment communities will both benefit from clarity and standardization in seismic risk evaluation and increased efforts toward seismic resilience. ◆

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