DLA PIPER

THE ABCs OF SEISMIC BUILDING CODES IN THE UNITED STATES

Seismic building codes are one of the most obvious ways to increase building integrity and ensure the future safety of communities. Codes are not a panacea for all problems, so it's helpful to know how they work and what they can do. Incorporating new or additional seismic safety provisions in codes for new buildings has been easier than designing, enacting, and implementing requirements for retrofitting existing buildings, but even if all new buildings are built well, older buildings remain hazardous. Where huge stocks of old buildings are very vulnerable to earthquakes, as in the East and Midwest, net improvements in seismic safety will be marginal if seismic elements in codes apply only to new buildings.

WHAT SEISMIC BUILDING CODES CAN DO

Seismic building codes result in earthquake-*resistant* buildings, but not earthquake-*proof* buildings. Seismic codes are intended to protect people inside buildings by preventing collapse and allowing for safe evacuation. Structures built according to code should resist minor earthquakes undamaged, resist moderate earthquakes without significant structural damage, and resist severe earthquakes without collapse. Codes only recently began to address mitigation of nonstructural, or content, hazards in buildings, which can cause casualties and expensive damage.

BUILDING COLLAPSE IS NOT THE ONLY PROBLEM

Even if a building does not collapse in an earthquake, it can still seriously hurt or kill people. Buildings are full of nonstructural components—light fixtures, heating ducts, windows and suspended ceilings—that can fall on people or block escape routes. Finally, plaster, falling bricks, parapets, window glass, or the facades of buildings can seriously injure people walking by or exiting.

EVEN CODE-COMPLIANT BUILDINGS CAN BE DAMAGED

The contents and interiors of code-compliant buildings may be extensively damaged in an earthquake and the building may not be functional until repairs and clean-up are completed. Therefore, damages to code-compliant buildings can be costly. Comprehensive safety and loss reduction programs include properly designing and bracing nonstructural elements.

NEWER BUILDINGS ARE GENERALLY SAFER THAN OLDER BUILDINGS

Because they are built under more advanced codes, newer buildings are usually (but not always) safer than older buildings. Steel-frame high-rises and newer wood-

frame low- rises are usually (but not always) the safest structure types. Exceptions to those generalizations are due to variables such as the configuration of the building, the quality of the construction, the design of the joints, and the manner in which seismic waves strike a particular site.

OLDER BUILDINGS ARE FREQUENTLY NOT SEISMICALLY SAFE

Generally speaking, seismic codes did not come into wide use in the eastern US until the early or mid 1990s. In the western US, seismic codes made substantial improvements in construction as early as the mid 1970s. Buildings constructed prior to these respective dates in each area are probably not seismically safe. Retrofitting buildings to achieve seismic resistance is possible, but often costly, so choices must be made about which buildings are most important to fix. It makes economic sense to target the most dangerous structures or the most dangerous features of those structures, such as flimsy parapets.

SEISMIC CODES VARY ACROSS THE UNITED STATES

The seismic provisions of building codes are based on earthquake hazard maps that show the probabilities of certain levels of earthquake shaking in particular areas. The code requirements reflect the fact that some places are more likely than others to have strong earthquakes. The entire country is not required to meet the same seismic design standards as the state with the greatest risk: California. Places that have less severe and less frequent earthquakes have less stringent design requirements. For example, seismic codes require less in Boston than in Los Angeles. Conversely, seismic code requirements in southern Illinois, near the New Madrid seismic zone, are much stricter than in Chicago, which is less likely to have a strong earthquake.

ADHERENCE TO SEISMIC CODES IS NOT AS EXPENSIVE AS MANY THINK

Complying with a seismic code adds relatively little to the costs of a structure. The most recent study estimates that it adds less than 1% to the purchase price of a home, and from 1%-2% to the total cost of new commercial and industrial buildings. (See ***Promoting the Adoption and Enforcement of Building Codes***, in the **Further Reading** section.)

SOME STRUCTURES ARE MORE IMPORTANT THAN OTHERS

Buildings with high occupancy, critical response services (fire, police, hospitals), and vulnerable populations (schools, nursing homes) should be built to code, or above it. It is also important to protect utilities and infrastructure. Damages to critical structures lead to more life loss, larger economic loss and greater social disruption, and slow community response to earthquakes.

BUILDING CODE ADOPTION IS A STATE OR LOCAL RESPONSIBILITY

All states have a legal right to regulate building safety as a matter of public welfare. In most states, the day-to-day aspects of this rest with local governments. Some states require local adoption and enforcement of building codes; others do not. Just because codes are required, it does not guarantee that all localities comply. And in states that do not require codes, localities are free to do as they wish. In fact, many earthquake-prone communities in the US do not have up-to-date building codes with seismic provisions.

CODES CHANGE OVER TIME

The model building codes and the seismic provisions are revised every three years to incorporate new knowledge. In order to have a code that reflects the current state of the art in seismic design, state and local governments need to incorporate the latest seismic details into their codes.

BUILDING CODES VERSUS SEISMIC PROVISIONS

Localities can adopt a model building code, but leave out the seismic requirements. Or they may have an older version of the code, written prior to inclusion of seismic provisions. It is important to verify that the locally adopted code contains the most recent seismic provisions.

A BUILDING CODE MUST BE ENFORCED IN ORDER TO BE EFFECTIVE

Building plan review, construction inspection, and a qualified and trained building department staff are necessary for code enforcement.

MODEL BUILDING CODES

When a municipality decides to adopt or revise a building code, it generally chooses a model construction code and amends it in various ways into its codes and ordinances. In 1994, the International Code Council (ICC) was established to develop a single set of comprehensive and coordinated national model construction codes, among which is the International Building Code (IBC). The founders of the ICC are the Building Officials and Code Administrators International, Inc. (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building

Code Congress International, Inc. (SBCCI). These three organizations previously administered three different codes: the National Building Code (NBC), the Standard Building Code (SBC), and the Uniform Building Code (UBC). The presence of three model building codes had the disadvantage of allowing widely divergent code standards across the country. Recently, the National Fire Protection Association developed a national model code, the NFPA 5000. States and localities that currently write their own codes or amend the model codes have begun adopting the International Codes and the NFPA 5000. Both the IBC and NFPA 5000 contain up-to-date seismic provisions; adoption and enforcement of either of these codes will lead to higher quality construction and consistent code enforcement in earthquake-prone areas.

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