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Earthquake-Resistant Structures and Its Seismic Actions

John Lee*

Department of Architecture and Civil Engineering, Tsinghua University, Beijing, China

***Corresponding author:** Dr John Lee, Department of Architecture and Civil Engineering, Tsinghua University, Beijing, China, E-mail: JohnLee@12.edu.cn

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About the Study

Earthquake-resistant or aseismic structures are built to protect buildings from earthquakes to some degree or another. While no structure can be guaranteed to be earthquake-proof, earthquake-resistant construction tries to create structures that outperform their conventional counterparts during seismic activity. According to building standards, earthquake-resistant structures must be able to survive the most powerful earthquake that has a reasonable likelihood of happening at their location. This means that the loss of life should be minimized for uncommon earthquakes by preventing building collapse, but the loss of functioning should be restricted for more common ones.

To avoid being destroyed by earthquakes, ancient builders had little choice except to create their iconic structures to survive, often by making them extremely rigid and sturdy.

There are currently various design concepts in earthquake engineering that employ experimental data, computer models, and historical earthquake observations to provide the requisite performance for the seismic danger at the location of interest. These include anything from properly measuring the building to ensure it is robust and ductile enough to withstand the shaking with little damage, to installing foundation isolation or employing structural vibration control technologies to reduce forces and deformations. While most earthquake-resistant structures employ the former method, significant infrastructures, landmarks, and cultural heritage buildings require the more complex isolation or control techniques to survive intense shaking with minimum damage.

Robert Reitherman coined the phrase "seismic architecture" or "earthquake architecture" in 1985. The term "earthquake architecture" refers to the degree to which architectural expressions of earthquake resistance or the implications of architectural arrangement, form, or style in earthquake resistance are utilized. It's also used to describe structures whose architecture has been influenced by seismic design considerations. It might be considered a new aesthetic approach to structural construction in seismically vulnerable places.

General guidelines, earthquake actions, and construction rules:

- The seismic design of bridges in which horizontal seismic effects are mostly resisted by bending of the piers or abutments; i.e. bridges supported by vertical or nearly vertical pier systems. It also applies to the seismic design of cable-stayed and arched bridges, albeit its rules should not be construed as completely encompassing these situations.
- To establish standards for assessing the seismic performance of existing building structures individually.
- To explain the process of determining whether remedial actions are required.
- To provide design requirements for retrofitting methods.
- The seismic design of structural aspects of facilities composed of above-ground and buried pipeline systems, as well as storage tanks of various types and uses, as well as for standalone items, such as single water towers serving a specific purpose or groups of silos enclosing granular materials.
- Establishes the standards, criteria, and procedures for earthquake-resistant construction siting and foundation soil. It includes the construction of various foundation systems, the design of earth retaining structures, and the interaction of soil and structure during seismic events.

Because of the unpredictable nature of seismic occurrences and the limited resources available to mitigate their consequences, achieving these objectives is only attainable in part and only measured in probabilistic terms. The amount of protection that can be provided to different types of buildings, which is only measurable in probabilistic terms, is a matter of resource allocation and thus is expected to vary from country to country, depending on the relative importance of seismic risk versus other risks and global economic resources.