

Earthquake-safe Buildings

Article 19. Importance of Checks during the Design of Buildings

People make mistakes. Most mistakes don't have serious consequences, but some do. Mistakes arise from many sources. They may be unintentional, like from a lack of care or concentration, or perhaps due to a lack of understanding. Some mistakes are intentional. People take shortcuts, don't follow plans or use inferior materials for financial gain. In the building industry mistakes can cost lives, especially during a damaging earthquake. A mistake made during the design process or during construction may not show up right away. But that defect may make the difference between a building remaining standing or collapsing during an earthquake (Figure 1).



Figure 1. Severe damage during an earthquake could occur if several reinforcing bars are missing from this reinforced concrete wall.

Some industries, in an attempt to reduce mistakes and increase safety, implement a system of checks. Airlines are a good example. Read the job description of a co-pilot and you see that checking is a significant part of the job. There are so many aspects of flying that need to be checked. If one aspect, say fuel requirements, is missed, the result can be catastrophic. Checklists are a crucial tool to ensure safety.

None of us like to have our work checked by others but this process is necessary, especially where mistakes can be dangerous. The design and construction of buildings is such an area. While it is relatively straight forward for a civil engineer to design a building to resist ordinary day-to-day forces, it is more difficult to design for movements during a large earthquake. A higher level of knowledge, understanding and experience is required and mistakes are more likely. Some form of checking, independent of the original designer is needed. Calculations, plans and specifications need checking to ensure they comply with local codes and standards (Figure 2).



Figure 2. During both design and construction these reinforced concrete walls were checked by engineers to ensure the structural design was sound and that construction was in accordance with the plans.

Ask your civil engineer what checks have been done. Has the work been checked independently by a qualified person in the same firm, or even better, by an engineer in another firm? If not, it should be, even though you will be charged for it. After checking, the construction documents are ready for a building permit application. Even if the Building Department doesn't do a technical check for safety before they issue a building permit, you can be reasonably confident of an earthquake-safe building provided the construction documents are followed on site.

About this article series:

This is a series of articles about earthquakes, their effects on buildings, and how to ensure that buildings are safe against earthquakes. They are intended for potential owners of new houses and larger buildings and others involved in the building industry. The articles are written by Andrew Charleson and colleagues from the World Housing Encyclopedia (<http://www.world-housing.net/>) which is sponsored by the Earthquake Engineering Research Institute (<https://www.eeri.org/>) and the International Association of Earthquake Engineering (<http://www.iaee.or.jp/>).