Over the past 25 years, hundreds of thousands of people all around the globe have been needlessly killed by the collapse of their own homes during earthquakes. Typically, concrete frame buildings with masonry infills perform very poorly when subjected to strong ground shaking, as do buildings of unreinforced brick masonry.

An alternative construction technology, using the same construction materials, is CONFINED MASONRY construction. Confined masonry is a construction system where the masonry walls are built first, and the concrete columns and beams are poured in afterwards to enclose (confine) the wall. It has typically performed well in past earthquakes worldwide, when built according to code requirements. Its satisfactory earthquake performance is due to the joint action of masonry walls and their confining elements.

For more information on confined masonry, visit www.confinedmasonry.org. Click on Resources/Existing Guidelines to review guidelines that are in use in various countries.

PROMOTING CONFINED MASONRY CONSTRUCTION IN EARTHQUAKE-PRONE COUNTRIES

Build the Walls First!

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The promise of saving hundreds of thousands of lives is the motivating factor for a new international initiative that will focus on developing a global design standard, construction guidelines, and education and training programs related to confined masonry. To join this initiative, visit www.confinedmasonry.org

Confined masonry house under construction in Indonesia (photo: Build Change).

Above: Building the walls first in Indonesia (photo: Build Change).

Left: Pouring the tie columns after the walls have been constructed (illustration: T. Schacher).

Typical confined masonry construction in Peru (photo: EERI World Housing Encyclopedia, Report #51).


To construct a confined masonry house, a builder begins with the masonry walls much in the same way as with unreinforced masonry construction. The difference is that the builder leaves vertical slots in the walls every three or four meters. After finishing the walls at the first floor, the builder then places steel reinforcing in the vertical slots and along the tops of the wall. Forms (usually wooden boards) are also placed at the same locations and concrete is cast into the wall slots and at the top of the wall. The verticals are called “tie columns” and the horizontals are called “bond” or “tie beams.” Although they look a lot like the more traditional columns and beams of a reinforced concrete frame, their function during an earthquake is quite different. In essence, they confine the masonry and force it to work together with the concrete ties. The result is dramatically better performance during earthquakes and a major reduction in the risk of collapse.

An Alternative

Given the universal popularity of masonry and the widespread availability of cement, reinforcing steel, and aggregate, confined masonry is a simple solution. By making some inexpensive and easy changes to traditional construction materials and procedures, the risk of casualties can be significantly reduced. Very few cases of collapse have been reported in past earthquakes worldwide.

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In many developing countries, masonry is used for housing because of its low material cost and simplicity of construction. Masonry is a sturdy and durable material for wind and vertical loads that houses must routinely withstand. However, if it is unreinforced, earthquake shaking can easily render a masonry building a pile of rubble with obvious serious consequences for the inhabitants (see photo above).

For many years now, reinforced concrete frame construction has also been very popular. In this type of construction, builders add unreinforced masonry walls after they construct the reinforced concrete frame. Intuitively, reinforced concrete frame construction might seem a better solution to resist earthquakes than unreinforced masonry. Unfortunately, these frames require a high degree of skill to build properly. The interaction of the unreinforced masonry infills with the frames causes brittle behavior that is only, at best, marginally better than unreinforced masonry construction.

An International Strategy Workshop on Promotion of Confined Masonry was organized at Kanpur (India) in January 2008 by the National Information Centre of Earthquake Engineering (NICEE) at the Indian Institute of Technology Kanpur, the Earthquake Engineering Research Institute (EERI), and the World Seismic Safety Initiative (WSSI). A small group of experts from India, the U.S.A., Switzerland, Peru, Mexico, China, Indonesia, and Canada developed a strategy to promote confined masonry worldwide, with two major objectives: to improve the design and construction quality of confined masonry where it is currently in use; and to introduce confined masonry in areas where it can reduce seismic risk. A confined masonry network was created at this meeting to promote safe and economical housing worldwide by bringing quality confined masonry into the design and construction mainstream.

This network has now received funding from Risk Management Solutions (RMS) to develop a global design standard, guidelines, and basic training materials. Anyone interested in this construction technology is encouraged to become a part of this exciting new initiative. Visit www.confinedmasonry.org to learn more.

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