EARTHQUAKE

Building for safety in earthquake zones

BACKGROUND

Tests show steel framing can withstand force 9 earthquakes

According to international consensus the tragic loss of life caused by earthquakes often comes down to design deficiencies of the homes and buildings we live and work in.

Across the globe, scientists, engineers and designers have been working to develop new building systems and structures for earthquake prone regions.

One of the most successful systems developed so far revolves around cold-formed steel framing.

Compared with traditional masonry and timber frame construction, lightweight steel frame homes can often be much safer during a seismic event.

Being lightweight, the frames are able to flex in the event of an earthquake and absorb lateral movement without compromising the structural integrity of the building.

INDEPENDENT TESTING

The performance of lightweight steel framing was recently independently verified in a series of large-scale scientific tests simulating different kinds of earthquakes at different magnitudes.

Full scale shaking table tests simulated earthquakes up to magnitude 9 on the Richter scale, without causing any serious damage to the structure of the building, which was constructed using FRAMECAD steel framing with a brick veneer cladding.

The tests were conducted at the University of Melbourne, Australia, in collaboration with the University of Auckland, Building Research Association of New Zealand, the New Zealand Building Council and the National Association of Steel Framed Housing (NASH).

Full results of the tests have been published in detail in Australian and New Zealand industry publications and can be viewed at www.framecad.com.

QUICK FACTS

- Approximately 40 countries in the world have high seismic regions, where reinforced concrete and masonry are the traditional materials of choice for housing and other building construction.
- Studies of earthquakes in the last few decades have revealed major deficiencies in these buildings, some of which led to catastrophic collapses.
- Many traditional concrete buildings in regions of high seismic risk, such as Latin America, southern Europe, North Africa, the Middle East and south-east Asia, have been built poorly, without adequate technical supervision or understanding about the engineering principles that mitigate seismic risk.
- Modern cold formed steel framing design and construction techniques have been widely acknowledged as a safer, more cost effective solution to building in earthquake zones.

The house used in the tests measured approximately 2.6 x 2.8m in plan and 2.4m in height, with a brick veneer cladding and plasterboard interior lining. A roof slab weighing 1,500kg was placed on top and was supported by the steel frame to simulate the equivalent mass of a house roof in a typical full-scale single storey brick home.

In countries subject to seismic activity, building design, engineering and construction must be specifically tailored to withstand those unique environmental hazards and I think the world is teaching us about that, –FRAMECAD Design Services Manager, Dr Darrin Bell.

Using FRAMECAD technology, Metecno developed a simple 32 sq metre house that could be built quickly, economically and in large numbers to provide urgent relief following the 2005 Pakistan earthquake

PAKISTAN

FRAMECAD™

FRAMECAD a proven solution for disaster relief

BACKGROUND

Steel framed structures faster and easier to build

The earthquake that struck northern Pakistan in October 2005 was one of the most devastating ever recorded, because the quake was centered at a shallow depth and therefore had greater destructive intensity.

Tens of thousands of people died and more than 3 million were left homeless.

While international aid agencies responded quickly, it was a local Pakistan company using FRAMECAD technology that was one of the first groups to provide emergency housing.

Here's how it happened, according to New Zealand based FRAMECAD building consultant, Glen Tasker:

FAST RESPONSE

"I received a phone call here in New Zealand in the middle of the night from a government minister in Pakistan seeking our urgent assistance.

"We had sold FRAMECAD equipment to a company in Pakistan, Metecno, and had been closely involved in training their people in the operation of the machinery and cold steel frame construction techniques.

"The company had been using our technology successfully for about a year or so when the earthquake struck.

"Fortunately, we had a technician on site in Pakistan, and after discussing the situation with him, we developed plans for a fast track barracks-style building, 33m x 12 metres, with a central corridor and five rooms off each side of the corridor.

"It was the most practical solution to an urgent problem to get some facilities up and running as quickly and simply as possible.

"I sent the plans the next day and they immediately went ahead and built quite a number of these units in a very short space of time.

"The barrack-style building was a temporary fix, but it lead to a more permanent, long term solution.

"Using the FRAMECAD system, Metecno developed a simple, fast-build 36 sq metre steel framed house which they were able to construct in large numbers quickly and economically.

"The FRAMECAD system was ideally suited because it's simple, economical, quick, and most importantly, homes can be designed and engineered for earthquake conditions providing greater protection and safety should another seismic event occur."

QUICK FACTS

- Northern Pakistan lies in the area of collision of the Eurasian and Indian tectonic plates. The geological activity created by this collision is also responsible for the birth of the Himalayan mountain range and is the cause of unstable seismicity in the region.
- Subsequent satellite analysis of the mountain parts directly above the epicenter of the 2005 quake have shown that the Himalayas have risen significantly, and continue to rise. Geological surveys suggest further seismic events are likely in the future.
- FRAMECAD has recently developed a mobile steel frame fabrication factory ideally suited for emergency relief and sustainable reconstruction following natural disasters.
- Housed in a modified 20ft-shipping container, the FRAMECAD™ Mobile Factory can quickly deployed into virtually any location and made operational within 24 hours.

With its own diesel generator and computer-operated steel frame fabricating machine, FRAMECAD's mobile factory can manufacture precision engineered framing at a rate of 700 metres per hour, allowing construction of structures such as hospitals relief centres and homes to begin immediately and proceed quickly.

Innovation Integration Sustainability

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