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Designing for the Next Quake

Angela Saini
United Kingdom
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The magnitude-7.9 earthquake in Sichuan Province in China in May left more than 60,000 people dead, thousands injured, and millions homeless. No stranger to natural disasters, China has had an earthquake building code since the 1960s. But given the widespread damage caused by the May quake, seismologists and engineers are now picking through the damage to draw lessons that can be used next time a tremor strikes.

"Every earthquake is a live experiment, hitting different populations and infrastructures." -- Tiziana Rossetto, University College London

"Buildings in Sichuan may have been resistant, but only up to a certain degree," says Tiziana Rossetto, a structural engineer and lecturer in earthquake engineering at University College London (UCL). "Every earthquake is a live experiment, hitting different populations and infrastructures. We've only been recording earthquakes since the 1920s, and the science has evolved significantly since then."

Earthquakes are no more frequent than they were a decade ago, but booming urbanization in seismic zones means the losses associated with each one are larger. Earthquake engineers such as Rossetto play a vital role in understanding how to control the damage earthquakes cause.

STUDYING EARTHQUAKES

"Earthquake engineering is so interesting because it is multidisciplinary. All of the problems we encounter require us to think from

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an engineering perspective but also economically and socially," says Thalia Anagnos, an engineering professor at San José State University in California and president of the international Earthquake Engineering Research Institute (EERI), which has more than 2000 members worldwide.

Such multidisciplinarity was the inspiration for a new master's course in earthquake engineering and disaster management launched this year at UCL. Uniquely, it has been training students in not only the civil and structural engineering principles of earthquakes but also the social aspects, such as how to work with nongovernmental organization (NGOs) and understand the behavior of earthquake victims.

Tiziana Rossetto interviews victims of the 26 December 2004 tsunami.

"It is holistic. We are not just looking at one side of the problem," says Bhupinder Sehra, a graduate development officer at UCL.

Elsewhere in the United Kingdom, the University of Bristol's Earthquake Engineering Research Centre stands out for its unique laboratory facilities, which include a giant shaking table that has been used to run countless seismic simulations, from the wobbling of bridges to the behavior of the contents of a house. Imperial College London (ICL) offers a 2-day course every September to bring earthquake experts up to speed with Europe's latest design codes.

Outside Europe, most research is concentrated in seismic zones. For example, the Earthquake Engineering Research Center at the University of California, Berkeley, and the Architectural Institute of Japan are both involved in developing quake-resistant buildings in their respective regions. New Zealand is also a renowned hub for international earthquake engineering, with research focused at the University of Auckland.

Rossetto began her career as an undergraduate civil engineering student at ICL before embarking on a master's degree in structural dynamics and earthquake engineering in 1999. At the time, she recalls, it was the only course of its kind focusing on earthquakes.

Today, her research lies on the cusp between engineering and social science, analyzing the psychological aspects of earthquake design. "In a field like mine, you have to think about people. I have seen brand-new earthquake-resistant homes that simply haven't been used because they don't fit in with how people live," she says. "For example, you may need small windows to protect women's modesty or a ground floor that is for livestock and an upstairs for the family," says Rossetto, whose job has taken her to some of the world's worst disaster zones, including Gujarat in 2001 and Pakistan in 2005.

JOB OPPORTUNITIES

Britain may seem an unlikely place for so much earthquake expertise, but in fact these skills are in high demand across seismically placid Europe. Insurance companies hire earthquake engineers to predict likely levels of structural damage. The nuclear power industry also needs them because all nuclear reactors in Europe are required to be earthquake-proof, however low the risk.

Studying earthquake engineering is by no

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Tiziana Rossetto

means a prerequisite for a career in the field. All earthquake engineers are essentially experts in structural dynamics, which is taught in civil engineering courses. Zygmunt "Ziggy" Lubkowski, an earthquake engineer at the consultancy Arup, learned the foundations of his job by studying civil engineering at London's Kingston Polytechnic (now Kingston University). Then, in 1990, he joined Arup on a 2-year scheme that allowed him to study part-time for a master's in earthquake engineering at the University of Bristol.

Arup has only a few dozen engineers who specialize in earthquakes, but many hundreds more deal with the same issues as part of their work. For the company's 228 engineers working in mainland China and 746 in Hong Kong where earthquakes are frequent, construction with consideration to seismic risk is routine.

Lubkowski's role is to determine the magnitude of earthquake likely to hit a building and make sure its foundations can withstand the tremors. Second-guessing the magnitude of the next big quake has taken him all over the world, juggling dozens of projects at a time. In the past decade, he has helped design different structures such as the expensive Maison Hermes in Tokyo and an offshore oil platform in the Philippines. "It can be just a day's worth of work to check that the philosophy is right at the start of a project. Sometimes it's just about using materials effectively," he says.

Big corporations are not the only ones seeking the help of earthquake engineers. One of the most rewarding aspects of Lubkowski's job is the opportunity to collaborate with NGOs in disaster zones. Following the December 2004 tsunami, his team helped a charity in Banda Aceh, Indonesia, advise local people how to rebuild their homes to withstand the next disaster, in light of the area's changed geography.


Ziggy Lubkowski traveled to Banda Aceh, Indonesia, to advise local people on rebuilding their homes following the December 2004 tsunami.

"For large structures, the cost of building to withstand an earthquake can cost as little as 5% on top. It is a sensible investment," Lubkowski says. And that small investment multiplied many times over is translating into more jobs for earthquake engineers, according to EERI's Anagnos. She predicts that the field will continue to expand as demand grows and as standards for earthquake-resistant buildings improve.

In the end, the real test of an earthquake engineer's skill comes when a structure is actually struck by a natural disaster: "You've got to watch how a building responds in an earthquake and learn from that," says Lubkowski. For him that moment came in 1999, when a magnitude-7.4 earthquake hit in Turkey near a Toyota car plant he had helped design. Long before the building was built, he and his team had spotted a geological fault line that ran through the middle of the site.

"We simply moved the building along, so that the fault ran next to the plant instead of under it. By the time the earthquake hit, the structure was effectively undamaged," Lubkowski remembers proudly. "The plant was back up and running within a month."

Angela Saini is a journalist in London.	Comments, suggestions? Please send your feedback to our editor.
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