GeoHazards International

A Nonprofit Working Toward Global Earthquake Safety

GHI Newsletter - December 2009

GHI's New Reporting Formats

This year, GHI redesigned and expanded its website (www.geohaz.org), launched its "e-news" quarterly email updates that showcase a GHI project currently making news, and reconceived this year-end Newsletter. The aim of these changes has been to communicate more effectively to members and friends ***how*** GHI is working to reduce loss of life and suffering around the world in communities most vulnerable to geologic hazards. In this Newsletter, GHI President Brian E. Tucker reflects on 2009 project activities, lessons learned, and ongoing innovations in GHI's preparedness, mitigation and advocacy efforts. We welcome your response.

Tsunami Preparedness in Padang, West Sumatra, Indonesia

I have been studying earthquakes and working on earthquake preparedness for nearly forty years. Among all of the communities I've studied over this period, Padang, West Sumatra is unique – on several counts. Padang faces both a major earthquake risk and the world's highest tsunami risk. Additionally, and most interesting to me, it has one of the most affordable and effective options for reducing its risk.

Earth scientists who have been studying the Sunda Megathrust fault, lying 200 kilometers offshore Padang, estimate that there is a 1-in-2 chance of a tsunami wave 5-10 meters high striking the coast of Padang during the life of children living there today. People will have about 30 minutes, after feeling strong shaking from the earthquake that generates the tsunami, to reach safe ground. Of the estimated 100,000 Padang residents living in the inundation zone, about half could get to high ground quickly enough to survive; the others would be unable to escape, because they're too old, too young, too infirm or taking care of such people. So, if a tsunami were to hit Padang today, an estimated 50,000 people would die!

Hope lies in the affordability of methods that exist for reducing this expected loss of life – methods that include accelerating an evacuation "horizontally" and "vertically." In a horizontal evacuation, people escape inland, to high ground. In a vertical evacuation, people mount a structure located within the city and taller than the tsunami wave, such as a building, freeway overpass or earthen berm.

Team members Kelly Wood (right, Stanford University) and Fengky Satria Yoresta (2nd from left, Andalas University) review building drawings with mosque keeper and a community resident, to assess the suitabililty of the mosque to serve as an evacuation structure.

This past year, with project funding from Geoscientists Without Borders, GHI worked with Stanford University's chapter of Engineers for a Sustainable World on an interdisciplinary project to study how Padang should prepare for the expected tsunami. Part of the project was a course offered at Stanford in the Spring semester that presented twelve guest lecturers, including architects, earth scientists, structural engineers, and even a sociologist who discussed how innovations diffuse through society. The course then developed recommendations for Padang. GHI's project manager, Veronica Cedillos, and a team of three Stanford students went to Padang in August to determine the feasibility of implementing those recommendations.

Tsunami Preparedness in Padang, West Sumatra, Indonesia (*continued*)

On September 30 and October 1, 2009, two large earthquakes caused about 1200 deaths, when buildings collapsed in Padang and landslides covered surrounding villages. The September 30th event, while occurring on the Sunda fault, didn't trigger the expected tsunami, because it was too deep to cause rupture on the ocean floor. Preliminary evidence suggests that this event did nothing to reduce the probability or severity of the expected tsunami and could, in fact, have increased both.

In the aftermath of these earthquakes, the GHI-Stanford team went back to Padang, as part of a reconnaissance team organized by the Earthquake Engineering Research Institute and funded by the U.S. National Science Foundation. On November 10, 2009, team members Veronica Cedillos (*pictured at left*), Greg Deierlein and Scott Henderson presented findings from that reconnaissance visit at a free informational event held in GHI's offices.

This project is just one of a handful of GHI efforts, working with a network of university professors around the world, to train a new generation of engineers. In Pakistan, for example, GHI, UC Berkeley and Stanford are in the third year of a three-year project to improve engineering training and curricula – for practicing engineers and students – at the NED University of Engineering and Technology in Karachi. In India, we just completed a project training engineers in Delhi's Public Works Department and involving the Indian Institute of Technology campuses in Roorkee, Kanpur and Chennai.

Strengthening School Buildings in Europe and Islamic Countries

Although GHI has been working on school earthquake safety for almost 15 years, much remains to be done to strengthen school buildings in earthquake-prone places around the world. "Grass roots" initiatives to retrofit schools in a particular community are valuable, but lasting change in school design and construction will only come about as the result of a centralized, coordinated effort to set new standards and then to enforce them vigorously.

Several years ago, I began thinking about how to get governments to become watchdogs and cheerleaders for each other on school earthquake safety. I knew that existing groups of governments, such as the 30 member countries of the Organization of Economic Cooperation and Development (OECD) in Europe, had set norms for each other in a host of areas and measured themselves against these norms. On seeing how OECD had used this mechanism to make progress in fighting corruption and improving school curricula, I thought that they could also set a norm for school earthquake safety.

This could be a powerful tool: rather than GHI knocking on the door of a government to urge it to implement an effective school earthquake safety program, what if the government representatives themselves agreed on a norm of school earthquake safety and pledged to meet that standard? These governments would have a self-interest in setting and maintaining high standards and in gaining trust amongst themselves. A joint program would have the governments working together to reduce the losses in schools after earthquakes. As a consequence, in 2005, GHI and OECD launched a School Earthquake Safety Program.

Following this success, in December 2008, I approached the Economic Cooperation Organization (ECO), which is comprised of ten Islamic Central Asian countries – the Islamic Republic of Afghanistan, Azerbaijan Republic, Islamic Republic of Iran, Republic of Kazakhstan, Kyrgyz Republic, Islamic Republic of Pakistan, Republic of Tajikistan, Republic of Turkey, Turkmenistan and Republic of Uzbekistan.

Map of ECO Member States (center, in bright colors)

Strengthening School Buildings in Europe and Islamic Countries (*continued*)

Its secretariat is located in Tehran, Iran. ECO countries became acutely aware of earthquake risks in October 2005, when a 7.6 magnitude earthquake occurred in Pakistan. About 73,000 people died, including at least 17,000 schoolchildren. Other ECO countries face similar earthquake risks. If you add up all of the children in ECO countries who go to school every day in buildings that face similar risk of collapse in earthquakes, that total comes to 40 million. With this history, ECO welcomed my proposal to collaborate with GHI and OECD to create a similar program for ECO.

In December of this year, I will be meeting with ECO and OECD representatives in Paris to agree on a collaborative project to adapt and put into practice a variation of the OECD initiative in ECO, and to agree on plans to seek funding.

Stone Slab Construction: Applying Lessons Learned from the 2008 Sizchuan, China Earthquake to School Construction Practices in India

In 2008, China's Sichuan region experienced an 7.9M earthquake that killed about 90,000 people, many of them students. Some of the schools in China had floors that were concrete slabs resting on beams. During the 2008 earthquake, the beams supporting the slabs separated more than the design would allow. The concrete slabs fell from the upper to lower floors, killing the children below.

Collapse due to precast floor panels slipping off the supporting wall (May 2008 earthquake - Wenchuan, China). GHI identified a similar risk in Indian schools.

GHI has been working in India on school earthquake safety for more than a decade, and we therefore could pass on information about the lessons learned from the Sichuan earthquake to our various Indian partners. The area around Delhi, India is in Seismic Zone IV, which denotes the second highest earthquake risk in the country. There was little concern over the seismic risk in Delhi, until the 2001 Bhuj earthquake damaged the city of Ahmedabad. Ahmedabad is located about the same distance from the Bhuj epicenter as Delhi is from the Himalayan region.

We discovered that there are schools in and around Delhi that use the slab-and-beam method, and that retrofitting them could save thousands of lives in a future earthquake. The slab-and-beam design is not permitted in the Indian building code, but because the process of getting approval for a permanent school to be designed and built takes such a long time, and because schools are needed for the city's rapidly growing population, many "temporary" schools, which don't need to meet the building code, have been constructed. The GHI team realized that these temporary schools had a dangerous stone slab construction and conceived of a retrofit that would strengthen the buildings, while maintaining their "temporary" status for the city's planning purposes.

I'm particularly proud of this work, because it exemplifies how GHI contributes – by passing along new knowledge quickly and by coming up with an innovative solution that addresses both the engineering problem and local political realities.

GHI continues to work on other school earthquake safety projects with Bechtel engineers in Gurgaon, one of four satellite cities around Delhi. In this work, which originated in 2008 and is proposed now to continue through 2010, GHI-trained Bechtel employees inspect schools for earthquake falling hazards and train teachers and students in what to do if an earthquake strikes.

Hospital Earthquake Safety Manual

Intensive Care Unit, Hindu Rao Hospital, New Delhi, India. Sensitive equipment is vulnerable to earthquake shaking.

As I mentioned, Delhi is located in the second-highest zone of seismic hazard in India. Delhi's health sector is therefore vulnerable. Earthquake damage to hospital equipment, building systems, architectural elements, and furnishings can incapacitate hospital operations, even if the building structure is undamaged. The consequences of earthquake damage can include: key building systems being rendered non-functional; patients or staff being injured or killed by falling objects or by disconnected life support systems; and expensive equipment being damaged or destroyed. Hospitals have just begun to address their risk.

GHI has worked (with funding from Swiss RE) to develop a culturally-specific *Hospital Earthquake Safety Manual*. The manual instructs on how to anchor and brace medical equipment, building systems, mechanical equipment, furnishings, and architectural elements to resist earthquake shaking. The goal is to reduce risk through technical education by providing hospital administrators, staff, engineers, and construction contractors with ways to mitigate nonstructural earthquake hazards. The handbook is in production and will soon be launched with a series of trainings.

'Tele-Engineering' for Remote Communities

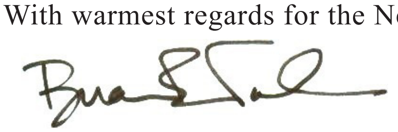
It's important for GHI's engineers to have face-to-face contact with engineers in developing countries, but taking a GHI team around the world is costly in terms of dollars, time and energy. It's also important for the most qualified engineers in developing countries – often practicing in major cities – to have face-to-face contact with their colleagues in more remote areas. The experts rarely get out to remote places, such as Northwest Pakistan. Political and physical conditions can make travel to those areas difficult, even dangerous. Yet that is where the need is often greatest.

In December 2008, I attended the Clinton Global Initiative (CGI) in Hong Kong. At CGI, non-governmental organizations like GHI were able to meet with one another and with philanthropists, and to propose solutions to global problems.

I proposed a tele-engineering project that would use existing tele-medicine infrastructure to inspect health clinics in remote places, and to propose retrofits to those buildings to make them safer from earthquakes. I had heard a lot about tele-medicine, which uses video transmissions to allow doctors in cities to communicate with specialists and patients in rural villages and even to perform operations remotely. I wanted to develop a way for engineers to do the same thing – to come into virtual contact with vulnerable structures and local engineers, so that they could work together to assess a building's seismic vulnerability and its possible retrofit solutions. With tele-engineering, an engineer in the capital or in another country could work with local engineers, to see, "feel" and measure a vulnerable structure.

GHI has now proposed to implement a tele-engineering project in Pakistan. If we're successful there, then we will go to India and China. If the idea works as we hope, then we will be able to help those countries to inspect schools and health clinics, providing recommendations for retrofitting, and re-inspecting after repairs have been made. We will reduce the dependence on – and expense of – sending experts from the United States or Europe to remote towns and villages, while also improving the training of engineers in those countries. Everyone will benefit.

With warmest regards for the New Year,



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