GeoHazards International

2015 Highlights

Students in Nepal attending class in one of the hundreds of Temporary Learning Centers (TLCs) that were erected post-earthquake. PHOTO: ROOM TO READ

Back to School in Nepal: Lessons in Building Resilience

Nepal's schools collapsed by the thousands in April and May 2015, when a magnitude 7.8 earthquake and its aftershocks hit central Nepal. The hundreds of school buildings that had been retrofitted to be earthquake-resistant, however, withstood the shaking.

This was thanks in part to the innovative earthquake safety plan for Kathmandu Valley that GeoHazards International and National Society for Earthquake Technology - Nepal (NSET) initiated in 1997.

Earthquake-resistant schools surely protect lives during an earthquake. Less obvious is the fact that these same schools play a crucial role in community resilience.

Education is critical for economic and social development, and has been a priority for the government of Nepal. This is reflected in increasing literacy rates, especially for women. For example, among Nepalis aged 45–49, 77% of men and only 36% of women are literate. Among those aged 15–19, however, 94% of boys and 86% of girls are literate (2011 Nepal Demographic and Health Survey).

While students avoided harm because schools were not in session, the 2015 earthquake wreckage is taking its toll. More than 1 million Nepali children are now without a permanent school building. Temporary shelters have been erected, but it is unknown how effective this solution will be as winter sets in.

Training leaders to build correctly *before* an earthquake. The heroes in Nepal's story are the people who supported strengthening the schools. Exactly as hoped for in the earthquake safety plan that GHI and NSET developed so many years ago, seismically-retrofitted schools are functioning and preserving educational opportunities. During the immediate crisis, they provided refuge, sanitation, and staging areas for the community's food and aid supplies. And that's only part of the story.

"Our goal was not just to build a stronger school, but to create the demand for earthquake-resistant construction, and to train local masons who would fulfill that demand in the village and beyond," said Dr. Brian Tucker, GHI President.

Dr. Amod Mani Dixit, NSET executive director, noted that "The process of making a strong school building is very important—it teaches everyone, it makes one think, it compels one to think to improve the system, it helps to make the entire community safer."

Masons trained on the school projects taught peers, and *(continued on page 3)*

Many Thanks!

Your contributions to GHI are the seed that makes our work grow. In our 25th year, we continue to help vulnerable communities prepare for natural disasters, with the goal to end preventable death and suffering.

- Brian Tucker, President

Spectacular Mountain Views, Risk Included

Cities built among steep hills have a downside when it comes to disasters: they risk abrupt isolation. An earthquake may sever water and power lines across miles of rugged terrain. Landslides or floods may block access and limit relief.

"Hill cities have unique exposures," said Dr. Janise Rodgers of GHI. "It's also technically challenging to build in steep settings, and it's critical that these cities gain expertise to manage safe growth."

GHI's work has supported local professionals' efforts to reduce hill city vulnerabilities in Aizawl, India; Thimphu, Bhutan; Quito, Ecuador; and Kathmandu, Nepal.

In Aizawl, planners are using landslide hazard maps and site development regulations created with GHI, and local geologists are training to assess suitability of construction sites and improve slope stability. GHI interns documented vulnerabilities across the entire water system.

In the Himalaya and northeast India, GHI is researching earthquake behavior of hillside building types. This will support engineers who want to build safely on hillsides but lack standards and tested design solutions. And due in part to GHI's advocacy, India's National Disaster Management Authority is adding hill city risk mitigation to its national plan.

Steep terrain in Aizawl, India challenges people, buildings and infrastructure. PHOTO: GINA MARIE BELAIR

GHI's work in Aizawl is funded by reinsurer Munich Re. Internships are funded by Heising-Simons Foundation. Research on behavior of hillside buildings is funded by Thornton Tomasetti Foundation.

The earthquake-protective desk was designed by Arthur Brutter and Ido Bruno and tested under collapsed building simulations. PHOTO: TZUR KOTZER

This Desk is a Winner

The award winning earthquake-protective desk will debut in Bhutan next year, in a project that aims to test whether local firms can produce it to design specifications, and whether the "made in Bhutan" price is affordable to agencies that purchase school desks. If so, everybody wins.

The desk can withstand exceptionally heavy loads and shelter two children. It has passed rigorous strength testing at University of Padua, Italy.

Earthquake-protective desks are not a substitute for safe buildings. In the short term, though, they can provide safer cover in earthquake-vulnerable schools. Thousands of children in Bhutan would immediately benefit.

The designers will train Bhutanese manufacturers to produce the desks. In a new role with GHI, AIR worldwide, a Verisk Analytics company, will provide project funding as well as in-kind analyses of school risk reduction efforts and costs over time.

Field Report: Kathmandu Valley Health Facilities

Hari Kumar, GHI South Asia Coordinator, visited Nepal health facilities in June 2015, as part of the post-earthquake reconnaissance team mobilized by the Earthquake Engineering Research Institute (EERI).

"Each facility we visited had completely evacuated in the emergency. The large aftershock of 12th May affected morale. After this, staff didn't want to go back inside, though there were few deaths from building damage," he said.

Machinery and surgical lamps fell, pipelines broke, and medical gas tanks stored in corridors crashed to the floor.

Judith Mitrani-Reiser of Johns Hopkins University found that one of the hospitals was better prepared than many she had seen in the U.S. It had power and water backup, and even backup power for its backup water. In contrast, the city's main hospital had just one water source and no backup power to run its pumps.

"Leadership proved key in restoring services," said Mr. Kumar. "Though the maternity hospital suffered extensive damage, its superintendent quickly rented wedding tents to shelter patients outdoors. Other hospitals waited up to 5 days for tents to arrive from aid agencies."

"Seeing these facilities after a disaster affirmed for me why GHI helps hospitals prepare," he reflected. "We help leaders understand the scenario of what can happen. They can then fix some problems in advance, and they can adapt in a crisis."

The EERI report on Performance of Nepal Healthcare Facilities is at EERI.org.

Tested in the Nepal Earthquake and Aftershocks, April and May 2015

Green-tagged "Safe" in Nangkhel, Nepal: (L) the first school seismically retrofitted in 1997 through a program to train masons; (R) a new school built in 2000 by masons who had trained in the program. PHOTO: HARI KUMAR / EERI

After the April 2015 earthquake, exam results for buildings at Shree Bhuwaneshwory Secondary School in Nangkhel, Nepal were posted next to students' exam results. A green "Safe" tag from the Government of Nepal allowed classes to resume without delay.

Nangkhel has the first school retrofitted by National Society for Earthquake Technology-Nepal (NSET) in the GHI-NSET program that trained local masons in seismic-resistant techniques. While the masons worked, villagers watched and engaged in the project. That was in 1997. Safer features steadily appeared in new homes. In 2000, village masons built a new school applying principles learned on the retrofit. Both schools survived strong shaking in 2015.

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villagers wanted the methods applied in their own homes. Follow-up visits have found that safer practices continue to percolate into village construction.

Using a design developed by NSET, the non-governmental organization *Room to Read* built 1,065 community schools in Nepal. In the earthquake zone areas, where 70% of the school buildings suffered damage, only 7% of the *Room to Read* buildings were affected.

Next steps. The Nepal Department of Education plans to replace thousands of damaged schools. Across Nepal, another effort will be needed to strengthen an additional 40,000 school buildings that are vulnerable to damage in the next earthquake. Thousands of local masons will require training in seismic-resistant construction techniques to enable the work. This approach fosters a culture of earthquake safety, both in and beyond the school buildings.

We never know when an earthquake will strike, but we do know how to build safe schools. The Nepal earthquake showed that GHI's focus on safe schools strengthens communities too.

A library (right), built for earthquake resistance by Room to Read, stands next to the rubble of 6 unreinforced stone masonry classrooms that collapsed in Nuwakot, Nepal during the April 2015 earthquake. PHOTO: ROOM TO READ

The Impact of One Skilled Mason

A colleague visited Nangkhel, Nepal in June 2015 while conducting post-earthquake reconnaissance. He sent GHI this note:

"When I was in Nepal, the Department of Education and NSET (National Society for Earthquake Technology - Nepal) took us to several retrofitted schools, including the first retrofitted school in Nepal. GHI's name is on a sign there. We met Ram Krishna Kasula, a mason who worked on the retrofit and participated in the training programs. He is from a village of masons across the field.

He built his house using techniques learned in the program. He also advocated for and built the new school, using the improved techniques, that stands next to the original retrofit. Note the concrete bands at head and sill and at corners. He noted he is in high demand now following the earthquake.

This was one of the nicest stories I heard while I was there. My compliments to GHI."

Bret Lizundia, Executive Principal
Rutherford + Chekene

These girls in Haiti will have a safer future if their community takes steps to prepare for earthquakes. GHI's work in Haiti will help develop clear messages about how to stay safe during an earthquake . PHOTO: VERONICA CEDILLOS

In Haiti, A New Approach to Developing Earthquake Safety Messages

The Haitian proverb *little by little the bird builds her nest (piti piti zwazo fe nich li)* expresses pride and hope in planning for the future. It also speaks to GeoHazards International's new 2-year project in Haiti, which will support community-based efforts to improve earthquake safety.

The project will create messages about how to stay safe during an earthquake. For example, should people take cover inside or run out of the building? Knowing what to do, and practicing it beforehand, may save their lives.

Earthquakes will continue to occur in Haiti, but it is the combination of shaking and fragile building stock that causes disasters. During the magnitude 7.0 Haiti earthquake in 2010, unsafe buildings caused the deaths of an estimated 130,000-300,000 people (depending on the data source).

"Haiti clearly needs to address building safety, but an earthquake could happen before people strengthen their buildings. We'll work with the community to develop messages that describe the safest actions for their buildings and environment," said GHI's Dr. Janise Rodgers.

A one-size-fits-all global message may not match the context at hand. In areas where most buildings are vulnerable to collapse during an earthquake, staying safe requires difficult decisions.

Sheltering inside is safer if the building remains standing, but being inside during a collapse is very dangerous. Running out of a building poses danger too, if outside walls or nearby buildings are shedding glass and pieces of the facade.

The actions people take when in danger are called "protective actions." Taking the right protective action is essential, because the stakes are so high.

Communities need to decide which action will protect the most people, then develop and practice a consistent message. Individuals need to understand which protective action suits their circumstance. And officials need know what advice to give.

A Local Approach

"All earthquakes are local. When the ground shakes, local customs and beliefs shape behavior. Local hazards and local construction define the danger. No outsider, regardless of how informed and well meaning, understands this context as well as those in the community," said Tom Tobin, GHI senior advisor.

"GHI can explain the pros and cons, but most important, we can encourage people to think in advance about earthquakes and best-chance actions for survival."

Last year, GeoHazards International evaluated the conditions in which a specific protective action will save the most lives. An international team of social and earth scientists, engineers and professionals responsible for safety messages contributed to *Guidance on Developing Messages for Protective Actions to Take During Earthquake Shaking*. It outlines a local process and factors to consider.

GeoHazards International staff and partners in Haiti will apply the guidance to create protective action messages that their community trusts and practices. The goal is to motivate people to act safely during an earthquake.

This project is made possible by the generous support of the American people through the United States Agency for International Development (USAID). GHI's "Guidance on Developing Messages for Protective Actions to Take During Earthquake Shaking (2015)" and background papers for the guidance are at www.geohaz.org.

Welcome, Garmalia!

Garmalia Mentor-William has joined GHI as Haiti Representative and will work on projects in Haiti and abroad. A medical doctor, she also has a masters degree in Emergency and Disaster Management. Her extensive public health and risk reduction experience includes projects in Haiti, Port Authority of New York & New Jersey, and Cuba. Garmalia is a 2014 Housner Fellow of the Earthquake Engineering Research Institute. She is a native of Haiti and speaks fluent Creole, French, Spanish and English.