

## EXPERT AID IN THE REAL WORLD

### Cal Poly Professors Travel to Quake Sites in Chile and Haiti

By Matt Lazier

After powerful earthquakes rocked Haiti and Chile this year, the world took action. Among those rushing to the disaster sites were three Cal Poly professors who lent their expertise to studying the effects and learning to better prepare for and respond to such catastrophes.

Architectural Engineering Professor James Mwangi, Civil and Environmental Engineering Professor Robb Moss and City and Regional Planning Professor William Siembieda all are connected with organizations that study various physical and societal impacts of major earthquakes, and all were invited to the recent quake zones to study several perspectives of the aftermaths.

Mwangi spent two weeks in Haiti in March, a few weeks after the magnitude-7.0 quake that devastated the island nation Jan. 12. Moss went to Chile in early March, just days after a magnitude-8.8 quake struck Feb. 27, and Siembieda followed a week later.

The three collected stories from victims; gathered knowledge to share with students; and helped shed light on how similar quakes could impact California.

Their research is featured in reports on the disasters. All have given presentations on their findings. And Mwangi returned to Haiti in July to work for the next year.

"It was a tremendous opportunity, on several levels, for all of us," Siembieda said. "We were able to share our expertise in a humanitarian way. We've brought back real-world stories to recount to our students. And by continuing to give presentations on our findings, we help to bolster Cal Poly's already strong reputation."

#### James Mwangi



Cal Poly professor James Mwangi (right) works in a mine in Haiti shortly after the country's devastating quake in early 2010. Mwangi identified mines in Haiti that were providing poor materials for the country's construction industry and urged officials to switch to other, better mines.

A certified disaster safety worker through the California Emergency Management Agency, Mwangi volunteered for a two-week stay in Haiti, sponsored by the Mennonite Central Committee, a non-governmental agency helping coordinating relief efforts. What he saw in the capital city of Port-au-Prince was beyond anything he expected.

"Words can not describe the devastation," he said. "It was much worse than what people saw on the news. Most buildings in Port-au-Prince and surrounding cities were destroyed. Most multi-story concrete buildings had upper floors that pancaked onto floors below, killing the occupants.

"Most of the people I saw were living outside in tents. There were no jobs, and most people spent their days in long lines waiting for handouts of food, water and blankets from the United Nations and NGOs."

Nevertheless, Mwangi found most of the people he encountered to be in high spirits – just thankful to have survived.

Mwangi spent his first week inspecting buildings and identifying the reasons for the mass collapses (in short, sub-par materials and shoddy workmanship and quality control).

He then met with Haiti's minister of Public Works, suggesting that the country close mines where low-quality sand and gravel were being harvested for use in construction. "This was done the same day," Mwangi said, "and we were able to suggest the use of the better quality river sand and river rock for the concrete mixes."

By his second week, Mwangi was leading workshops with architects, engineers and contractors on how to construct quake-resistant buildings.

Back at Cal Poly, Mwangi shared his experience and observations with his students and discussed the issue of quake-resistant, confined-masonry construction in Third World nations such as Haiti.



An aerial view of the damage left in the wake of the Chile Earthquake in early 2010. All photos courtesy Robb Moss, William Siembieda and James Mwangi

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But as the spring quarter ended, the professor was on his way back to Haiti, where he will spend the next year.

"I intend to extend the training program I started, with additional learn-by-doing demonstrations on construction and proper design theory for earthquake-resistant buildings," he said.

And there may be an opportunity for some students to experience the disaster zone. Mwangi has talked with Cal Poly's chapter of the Structural Engineers Association of California about student members visiting during the coming Spring Break.

### **Robb Moss**

An earthquake engineer specializing in liquefaction, Moss is accustomed to visiting international quake sites. His longtime involvement with the Geo-Engineering Extreme Events Reconnaissance Association has sent him to Mexico, Turkey, China and India, as well as sites in California and Alaska.

In February, GEER offered his first chance to visit Chile – an opportunity he seized in part because of the familiarity of the coastal nation.

"It's a spitting image of California – the coastline, the Mediterranean climate, the geology, the topography," Moss said. "Because of that, the area affected looks a lot like what California could look like the next time we have a big earthquake."



Cal Poly professor Robb Moss in a plane as his team of experts survey the Chile quake damage from the air.

Moss was shocked to find a disaster area running 600 km north to south and about 150 km east to west. An equivalent area in California would stretch nearly from San Francisco to Los Angeles. "I've never seen such a massive area impacted," he said.

For two days, Moss worked with the Chilean Air Force to fly over the affected area and survey the damage. Then he and other GEER team members drove to local communities.

Their work happened after rescue efforts but before recovery began in earnest – the perfect time for what they hoped to examine. "Soon after a quake, there is an immediate effort to repair infrastructure damage, buildings and telecommunications. But that can cover up evidence of what caused the damage."

For its intensity, the Chile quake killed relatively few people (about 520, compared to roughly 250,000 in Haiti). But economic losses from structural damage were huge.

"It's what we call 'performance issues,'" Moss said. "For example, about every 10 kilometers along the interstates, they had bridge failures that impacted traffic flows and commerce."

GEER published a report on the Chile quake that includes research and observations from Moss and the other experts.

And the experience gave Moss real-world stories to share with students in his Quake Engineering courses. This helps Cal Poly's budding engineers see the immediate impact of the discipline they're studying.

"Seismic codes are boring to talk about," Moss said. "But when students see pictures of this kind of thing, the concepts behind the codes click. When I got back from Chile, I immediately gave presentations on my research and worked photos into my lectures."

### **William Siembieda**

Just days after Moss, Siembieda joined at team with the Earthquake Engineering Research Institute, tasked with examining Chile's disaster area from the perspectives of social science policy and recovery. Specifically, his group sought impacts the quake might have on Chile's urban planning policies.

"We rented a car and drove from town to town," Siembieda said. "We took pictures, and we talked with people on the streets about their experiences."

They found self-sufficient residents in tightly knit communities. Not wanting to leave their neighborhoods, people displaced by quake damage frequently pitched tents together in nearby parks. And people moved quickly to fix their properties, he said, rather than waiting for government aid.

"Recovery was moving a lot more quickly than what we usually see," he said. "There was much less bureaucracy."

Damage was widespread in the affected area, Siembieda said. But much of it was fixable, not catastrophic. The exception was the immediate coastal area hit by a quake-caused tsunami. There, entire homes were wiped away by waves and debris, and structures, cars and boats were moved great distances.

Siembieda's trip was quick, but the work he began there continues. His findings were included in an EERI newsletter after the quake, and he is working with a researcher at Pontificia Universidad Católica de Chile, studying potential improvements to land-use planning in two states hit by the tsunami.



Cal Poly professor William Siembieda (far left) speaks with Chilean residents who were forced from their homes by earthquake damage and set up temporary residences nearby.

Siembieda has given several presentations on the quake since returning, including a National Science Foundation workshop in August. He is advising an NSF research project on the quake, and he is planning a return trip early next year for further research as a Fulbright specialist.

In the meantime he, like Moss and Mwangi, is sharing his experience with students to help breathe life into the theories they are studying. And like Moss, Siembieda believes the Chile quake is providing a wealth of knowledge applicable to California.

“There are lessons to be learned here, and that’s why California wants to study Chile. We know that by looking at their experience, we can know how we should react here.”

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