CLASSROOM ACTIVITY

On Shaky Ground: Building a Safer Future in Haiti

In November 2010, ten months after a magnitude 7.0 earthquake flattened huge sections of Port-au-Prince, Haiti, a team of geologists commissioned by the United Nations set out to make the first detailed soil map of the city. Armed with sledgehammers and vibration sensors, the scientists surveyed how soils throughout Port-au-Prince either amplify or muffle seismic vibrations. The resulting map can now be used to guide reconstruction efforts. In this Science Bulletins feature, learn how geologists and engineers in Haiti and San Francisco are improving our resilience to powerful shifts of Earth's crust.

CLASS DISCUSSION

Establish Prior Knowledge

Remind students that in 2010 Haiti experienced a 7.0 magnitude earthquake. Ask students to share what they remember about the destruction the earthquake caused. Point out that in some areas there was almost no destruction of buildings and in other areas there was total destruction. Have students speculate why this might be the case. Tell students that in the video they are about to see geologists study the relationship between the geology of an area and the level of destruction caused by an earthquake.

Exploration

Have students take notes as they watch the video. Use the following questions to guide a class discussion.

- What causes an earthquake?
  (Answer: An earthquake is caused by a slip in the earth that creates seismic waves that travel from deep within the earth outward. As the waves come up they move out of the rock and through the soil.)
- Why do geologists try to characterize the stiffness of the soil?
  (Answer: Stiffness has an effect on the level of the ground shaking. The stiffness determines how fast waves generated by the earthquake travel through the soil.)
- How do scientists test for soil stiffness?
  (Answer: Geophones that measure vertical motion, are set up along a line. A sledgehammer is used to generate surface waves. As they travel beneath the geophones the geophones vibrate so geologists can determine the speed of the waves as they travel from sensor to sensor. The speed and depth of the wave determine soil stiffness.)
- Based on their data, what did geologists conclude?
  (Answer: Most of Port-au-Prince has good stiff soil. However, in downtown Port-au-Prince near the coast, the soil is softer. The softer soils will generate more shaking. In those areas structures need to be designed to withstand more severe shaking.)
- How is the geology of San Francisco similar to Port-au-Prince?
  (Answer: Both cities are in active fault zones, have similar soil conditions and fairly hard bedrock material. The level of ground shaking during an earthquake would be comparable.)
- How are building designers in San Francisco constructing buildings to withstand earthquakes?
  (Answer: Continuous cables are embedded in cement walls to compress and stabilize the wall. During an earthquake, as the building sways, the cables bring the structure back to its original position.)

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On Shaky Ground (cont'd)

Wrap-Up
Use the following question to wrap up your discussion:

- The structural engineer in San Francisco claims that this technology is available to all societies throughout the world doing concrete structures. Do you think this technology could be incorporated into building design in Haiti? Why or why not?
  (Answers will vary. Students may say that Haiti does not have the financial resources to build these types of buildings. Other students may suggest there are other less costly building designs that could withstand earthquakes.)

Extend
Encourage student volunteers to research and report on earthquake resistant buildings by visiting these websites:

http://articles.architectjaved.com/earthquake_resistant_structures/building-planning-earthquake-resistant-buildings/

http://www.reidsteel.com/information/earthquake_resistant_building.htm

http://greenbuildingelements.com/2011/02/24/building-earthquake-resistant-buildings-is-best-for-the-environment-and-the-people/