Unstable soil could mean more quake damage

Jamie Hansen, California Watch, 4-20-11

Scientists who have surveyed earthquake damage in Japan say the soil condition intensified the destruction, and their findings raise concerns about geologically similar areas in California, Oregon and Washington.

In a report released this week, a team of scientists – Geotechnical Extreme Events Reconnaissance – found extreme cases of an earthquake phenomenon known as soil liquefaction. Liquefaction occurs with soil that is already water-saturated, causing it to act more like a liquid than a solid during a quake. Liquefaction can sink buildings, uproot airport runways and break pipelines.

Scott Ashford, a geotechnical engineering professor at Oregon State University and a member of the research team, said he was struck by how far from the rupture the liquefaction occurred and how the duration of the quake – about five minutes – seemed to exacerbate the problem.

Scientists have found areas from Washington to Southern California that are susceptible to liquefaction. The most extensive regions in California are the Bay Area, Monterey Bay, the Delta, and the Imperial Valley, said Tom Holzer, engineering geologist with the United States Geological Survey. But liquefaction zones also exist in localized pockets throughout the state, including parts of Los Angeles.

Danielle Hutchings, who coordinates the Earthquake and Hazards Program for the Association of Bay Area Governments, said much of the Bay Area is vulnerable to earthquake liquefaction, including some bridges and the San Francisco and Oakland airports.

"It's something we're always thinking about, especially with the soft sands along our shorelines," she said.

A recent California Watch investigation detailed the regulatory breakdown in the state's enforcement of seismic safety in public schools. The report includes a map that shows fault lines and liquefaction zones in each county.

The Bay Area in particular, while prone to shorter quakes than Japan, is susceptible because of the proximity of liquefaction zones to faults. Structures that are vulnerable to liquefaction are those built on sandy fill and close to sea level, as well as along large creeks, where the soil is wetter and looser. In particular, liquefaction could affect the Bay Area's pipelines.

"Liquefaction wreaks havoc with buried utilities," said Ashford, describing how broken water pipes compromised San Francisco's ability to fight fires in past earthquakes. "It's something we have to take very seriously."

There are ways to mitigate such effects, but they are costly. Most methods involve either drilling deep into the earth, past the unstable layer of soil, to anchor a structure, or solidifying the soil itself by shaking it or pouring grout into it. For homeowners who find themselves in vulnerable areas, the fix can be cost-prohibitive.

The Geotechnical Extreme Events Reconnaissance team, funded by the National Science Foundation, heads into major disaster areas shortly after they occur. The team’s goal is to gather data before it disappears in the cleanup.