

Because it reduces shaking, this system is growing more popular in seismically active cities. Builders increasingly are using it in critical facilities such as hospitals or emergency services offices. To Heaton, however, the base-isolation design seems ill-suited to handle a large displacement pulse.

During the Northridge quake, the five base-isolated buildings already completed in the Los Angeles area rode through the vibrations quite well. But the closest structure, a wing of the University of Southern California Hospital, sat a comfortable 35 km from the epicenter.

If the same building had stood in Sylmar, much closer to the fault, it would not have fared as well, says Caltech's Iwan. The displacement pulse measured in Sylmar would have moved the hospital 40 cm during the quake. But the gap between the building and a surrounding concrete enclosure allows only 26 cm of movement, notes Iwan. The hospital would have crashed into concrete walls at a speed of

1.3 m per second. For comparison, consider walking at a brisk pace smack into a concrete wall.

"One would have to have serious concern about the performance of that structure had it been located in Sylmar," Iwan says.

As chairman of the California Seismic Safety Commission, Iwan can do something about the new findings. After the

directly address the issue of rapid displacements that occur during seismic fling.

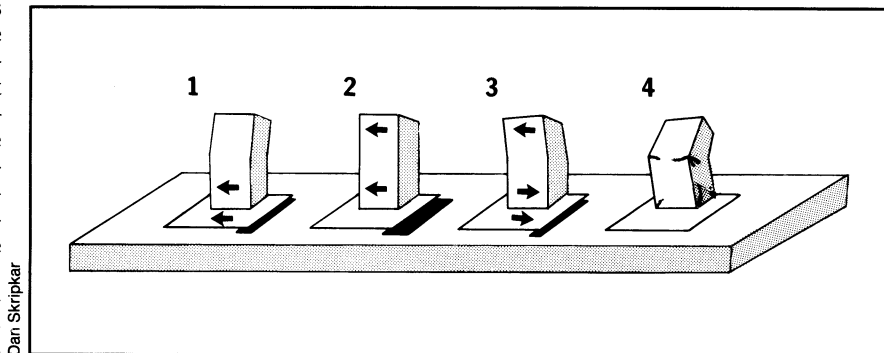
The issue of fling is not just a southern California concern. Scientists and engineers in the San Francisco Bay area must also grapple with this phenomenon, because several quake-producing faults underlie this region as well.

Iwan and others note that seismic fling

doesn't threaten an entire area shaken by a quake, because large displacements only occur in the "near field"—the land closest to a fault. But he says researchers have not yet defined how far the near field area extends from a fault.

Answering the question "How close is too close?" is particularly difficult in the Los Angeles Basin, a region riddled with known and unknown faults.

"If you have the possibility of these earthquakes anywhere in the basin," asks Iwan, "do you zone the whole basin for this kind of motion? And if so, what does that mean? Does it mean restrictions on types of structures or heights of structures? I don't know the answer to that." □



When a displacement pulse passes a tall building and pulls the lower floors to the left, the top floors remain stationary (1). Soon the upper stories catch up and the entire building moves to the left (2). Then the pulse reverses, pulling the lower floors to the right even as the top floors continue to the left (3). As the ground returns to its original position, the building deforms and may collapse (4).

Northridge earthquake, Governor Pete Wilson asked the commission to recommend needed changes in the building code. As currently written, the code deals primarily with the forces generated during an earthquake and therefore does not

Environment

Global warming: Beyond termites

Over the last dozen years, scientists have debated how much termites might contribute to the threat of global warming. These insects emit methane—a potent greenhouse gas.

In 1990, an international team of researchers quantified methane emissions for six species of Australian termites. Their conclusion: Such bugs probably cannot produce enough of the gas collectively to play an important role in what had been a steady growth in atmospheric methane (SN: 4/28/90, p.268).

Now, in the June 7 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, two European biologists reopen the debate. Their study indicates that insects and their kin indeed "can contribute substantially to atmospheric methane." But to understand how, they add, requires looking beyond termites.

Working at the Catholic University of Nijmegen, the Netherlands, Johannes H.P. Hackstein and Claudius K. Stumm measured methane releases from 110 types of arthropods—a phylum of segmented animals that includes insects, spiders, and crustaceans. "We expected to find methanogens [methane-producing bacteria] in all arthropods," they say. Instead, only four classes—termites, millipedes, cockroaches, and scarab beetles—possessed the symbiotic microbes.

But even within these classes, not all species produced methane. Those that did tended to be tropical, suggesting that methane-producing symbionts might not survive colder climes.

Based on the new measurements, each of the three additional classes of arthropods "may contribute more or less the same amount of methane as do termites," Hackstein told SCIENCE NEWS. He and Stumm now estimate that land-based arthropods produce at least 10 teragrams (trillion grams)—and

perhaps as much 300 teragrams—of the roughly 500 teragrams of methane released into the global atmosphere annually.

Moreover, Hackstein points out, "tropical cockroaches caught in Africa have been reported emitting at least four times the amount that I measured in the lab and report here," while roaches collected outdoors in temperate regions produced no methane. "Our studies... show that [temperate] cockroaches living in houses can produce tremendous amounts of methane—nearly as much as tropical ones." To err on the side of caution, he explains, the new estimates make no attempt to account for methane from indoor, temperate roaches.

Good news about some gray whales

On June 15, the Fish and Wildlife Service (FWS) removed the California gray whale from the federal endangered species list. Since the 1973 Endangered Species Act (ESA) became law, only 16 other species have been "delisted"—and all but three of those because they were presumed extinct.

Grays are one of 13 species of large whales, all of which had been considered threatened or endangered. There are now some 21,000 California grays, which migrate in the eastern Pacific from the Bering Sea to Baja California. Federal estimates indicate that this is probably as many grays as existed there in prewhaling days. The remaining, "Korean" stock—numbering perhaps a few dozen grays—will stay on the ESA list.

Two birds also show signs of recovery. Last fall, FWS proposed delisting arctic peregrine falcons. Within weeks, the agency also plans to propose reclassifying the bald eagle in part of its range from endangered to simply threatened.