

On Monday, Jan. 17, 1994, at approximately 4:31 a.m. an earthquake measuring 6.6 on the Richter Scale struck California. The quake's epicenter was Northridge, a community northwest of Los Angeles in the densely populated San Fernando Valley. The quake, which lasted 30-40 seconds, caused 55 deaths and an estimated \$30 billion in damage to property.

We spoke with a number of construction professionals in the Los Angeles area who provided a detailed damage assessment, based on their personal observations.

Ken Harges of Ken Harges Plastering Company, Northridge stated, "The earthquake damaged drywall, plaster and a lot of plumbing. The drains and all the toilets broke. Door jambs buckled. We have some cracks in the roof and lots of glass breakage. (That's tempered plate glass.) Much of the carpet was damaged by glass and other debris as well as flooding from the broken plumbing fixtures."

"Most of the calls I'm getting are from people who want to know how to repair the plaster," said Dick Gorman of the Plaster Information Bureau. "During inspections, I've seen where the plaster just popped off the studs, or the lath ripped away from the stud. Damage ranges from total destruction to simple hairline cracks."

"The damage doesn't relate to the plaster application; it has more to do with the forces the earthquake exerted on the plaster. For example," Gorman continued, "I looked at a 10,000-square-foot house on Mulholland where the damage was absolutely horrendous. Yet, the house next door had no damage at all."

Jack West, owner of the Jack T. West Company, observed, "The raised foundations, houses built over crawl spaces, took the most damage. Those that were built on a slab, like my own home, did pretty well. In fact, I only have about five or six cracks on the outside and about the same on the inside."

West's company and home are both located in Northridge. "Of

course, the contents of the entire house are spilled on the floor. Every drawer came open and every shelf fell down. Now I'm installing locks so that won't happen with the next one."

"I've been going over properties with my customers—builders and owners—giving them estimates for repairing all the damage to the plaster," said West, whose company specializes in interior and exterior plastering of large estate homes, many in Bel-Air and Malibu.

Assessing the Damage

"I was in some houses in west Los Angeles that sustained only a few cracks, but the fireplaces are all down in the entire neighborhood. The concrete block walls—even those with steel reinforcement—and fireplaces all went down. Even with all the steel in the fireplaces, the brick still didn't hold."

Gorman agreed: "The fireplaces took the brunt of it. Older brick houses had a great deal of damage, while those with wood frames which were bolted properly to foundations fared well."

"The three-story apartment building in Northridge that made the news was wood frame over a sub-

terranean garage. The exterior was lath and plaster," West said.

"The buildings on both sides of the apartment building had minimal damage. It seems that the supports under this particular building completely gave way. Now it's a two-story building without a garage. The second story balconies are on ground level."

Barry "Bud" Rutherford, owner of Flannery, Inc., a manufacturer of trims for drywall and plaster has lived in California for the last 30 years and has grown used to the quakes. "I had a lot of damage right here in my building," Rutherford said. "The building itself, a concrete tilt-up structure, is in good shape, but the interior suffered a lot of damage from collapsed pallet racks."

After Rutherford took a bicycle ride through the Cal State campus, he observed, "It's quite a mess. After the quake, the inspectors had a good look at the campus buildings really quick to evaluate their safety, and the ones that were red-tagged were red-tagged right away."

According to Rutherford some 250 apartment buildings in Northridge were condemned, mostly 30-unit student housing. "Most of the apartment buildings are wood

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EART

The Northridge Earthquake: Another Test for California Construction

by Kathy B. Sedgwick

Frank Lloyd Wright Had Feet of Clay

Now, don't get me wrong. I admire Frank Lloyd Wright. I really do. On a road trip, I'll drive hundreds of miles out of my way to see a Wright house. He was a great architect and a great man.

But sometimes one man's greatness gets a little blown out of proportion, creating a sort of halo surrounding every deed, every project until the facts tend to get a little hazy. Wright's so-called quake-proof Imperial Hotel design is a perfect example. And this particular myth is one that, unfortunately, a number of publications, popular and scholarly, have perpetuated.

The story began in 1915 when Japan's emperor commissioned Wright to design a great hotel, his showplace, to be built in swampy, earthquake-prone Tokyo. The building site was a boggy area with a base of soft clay. Mr. Wright theorized that the clay would create a sort of soft cushion, and the Imperial would float on the top of the moving earth like a ship on waves. His design, therefore, called for light materials and supporting pylons that were not sunk deeply into the soft ground.

Mr. Wright's theory was soon to be tested. During the hotel's gala opening on Saturday, Sept. 1, 1923, at 11:58 am, an earthquake measuring 8.3 on the Richter Scale struck Tokyo. The quake lasted five minutes. Many people were in the midst of lunch preparations, and fires from their coal-fed stoves burned nearly 70 percent of the city to ash. More than 140,000 died.

At the time, it was widely reported that the hotel had survived the disastrous quake completely "unscathed."

These reports were inaccurate. In fact, the entire central section of the hotel settled two feet, floors throughout bulged, and the building continued to sink until it was demolished in 1986.

So Mr. Wright's "floating ship" theory was a flop. The Imperial Hotel was "scathed," and all due to Mr. Wright's clay feet.

I say, so what? Everyone's entitled to make a mistake now and then. Frankly (if you'll excuse the pun) a lot contemporary building designers still haven't learned that building on loose or soft fill isn't a good idea. Consider that some of the worst damage from the Loma Prieta quake of 1989 occurred in the marina district where structures had been built on deep fill.

The Imperial Hotel sank, which is, after all, a pretty big problem. But, let's give Mr. Wright some much-deserved credit for a number of quake damage-reduction innovations that worked beautifully. Many are commonly used today.

■ *The hotel's double shell walls were constructed of brick outer layers bonded with a core of steel reinforcing bars and poured concrete. It worked! Unreinforced masonry is one of the weakest and most dangerous types of construction in an earthquake zone.*

■ *Wright chose light copper for the roof. Flying roof tiles had caused many deaths in earlier quakes.*

■ *All of the decorative stonework was hollow (for lighter weight) and attached to the structure with concrete and reinforcing bars. Only a few of the Imperial's thousands of statues and other decorative features fell during the quake.*

■ *Quakes break electrical lines and pipes which can lead to out-of-control fires. Wright designed centralized trenches through which electrical wires and plumbing pipes ran. The lines were laid out in gentle, sweeping curves to eliminate sharp joints where lines are likeliest to snap. During and after the quake, all the mechanical systems in the hotel performed flawlessly.*

All things considered, Mr. Wright's design for the Imperial Hotel was more Wright than it was Wrong.

And, in my mind at least, that means k still belongs firmly placed on his pedestal as a great architect and a great man. He may not have been perfect, but k was definitely way ahead of his time.

—KBS

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frame," he said. "Some that came down were only two or three years old, so everything should have been up to code with proper seismic restraints."

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What Will It All Cost?

Repairing even minor damage may prove costly to homeowners and businessmen. Rutherford estimated it will cost more than \$40,000 just to repair and repaint cracked drywall in his home.

What about earthquake insurance? According to West only about 25 percent of homeowners have the insurance. "It's very expensive, and the deductibles are so high, ranging from 10 percent to 15 percent of property value. So, as in my case, the damage doesn't cover the deductible. Earthquake insurance works when the property is completely destroyed."

"I've heard that this is the most expensive disaster in the history of the United States, somewhat because the quake hit such a densely populated area. Estimated damage goes up in the billions," Gorman said. "And these estimates are based on only about 60 percent of the expected claims. They're estimating \$35 million worth of damage to the coliseum alone."

Building Codes: Few Changes Anticipated

According to Gorman, "During the rapid construction growth of the 1980s, a lot of buildings just weren't fully inspected. That's not the case any more. Because of the proliferation of lawsuits, the building officials have become more cautious in giving their approvals."

"They're looking closer at things than they used to," Gorman said. "Houses built in conformance with the current code did okay."

Gorman believes the state of California and the city of Los Angeles are going to require that all new multi-story buildings have shear panels on the first floor. Existing multi-story buildings that don't have the plywood shear panels on the first floor will have to be retrofitted.

"Fry Reglet is coming up with a new accessory to allow for retrofiting, adding plywood sheathing to the first level," Gorman added.

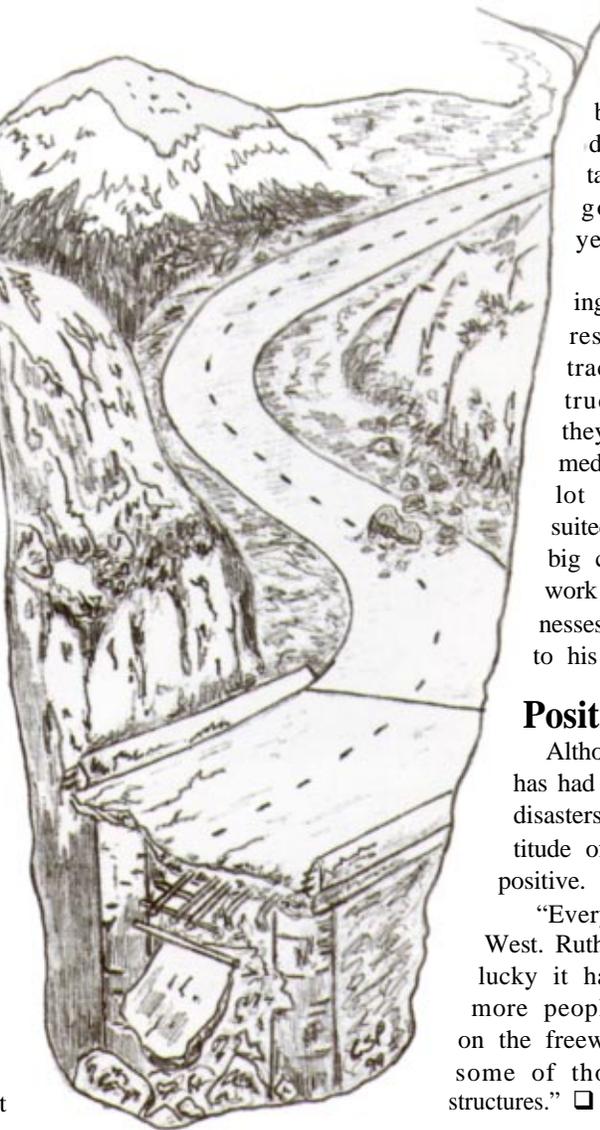
Scott Young, Western regional vice president for Fry Reglet, a manufacturer of drywall and plaster accessories, described how the shear panels are added during retrofit. "You saw-cut the stucco off at the second floor line. Then you take the stucco off down to the ground and put sheets of plywood there. This puts the first floor exterior wall out of plane by the thickness of the plywood. A kind of step is created there."

"We've developed a reglet that creates a nice clean transition from the first to the second floor plane. This molding gives the contractor an aesthetically pleasing method of making the transition and also provides a ground for the plasterer to finish to."

"We also have a two-piece molding," Young added. "It will give

them deflection between that first and second floor. A lot of hospitals have seismic connections between floors. This molding will provide movement to help prevent the stucco from cracking."

Young said, "This will be something these guys are going to need to do all this repair."



Quake's Effect on the Construction Market

Young described the positive effect the quake may have on the local construction market. "Certainly the plastering and lathing trades are go-

ing to have more to do," Young added. "It's too bad that something like this is a stimulus, but unfortunately that's the case."

Gorman noted: "There was a lot of damage, which means there'll be a lot of plaster repair. Our contractors are very busy right now."

"It's putting a lot of people back to work," Young said. "One plasterer told me that by noon on Monday the day of the earthquake, he'd had 40 phone calls to come out and inspect and bid. Every plasterer I've talked to is buried, working on Saturdays, bidding on stuff and taking off plans. I think 1994 is going to be a pretty good year."

Young explained, "It's going to help the market become resegmented. The small contractors working out of their trucks have more work than they can do in two years. The medium size contractors have a lot of jobs that they are best suited for, and the same for the big contractors. There's plenty of work to fit the size of their businesses, and everyone can go back to his own particular niche."

Positive Attitude

Although it seems that California has had more than its share of natural disasters these past 12 months, the attitude of many residents is generally positive.

"Everybody is pitching in," said West. Rutherford concluded: "We're just lucky it happened when it did. Many more people would have been killed on the freeway or if they'd been inside some of those buildings and parking structures." □

About the Author

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