CALIFORNIA GEOLOGY

August 1984

35¢

MORGAN HILL EARTHQUAKE

Understanding California's Geology - Our Resources - Our Hazards

Morgan Hill Earthquake

Caused Record Shaking Force

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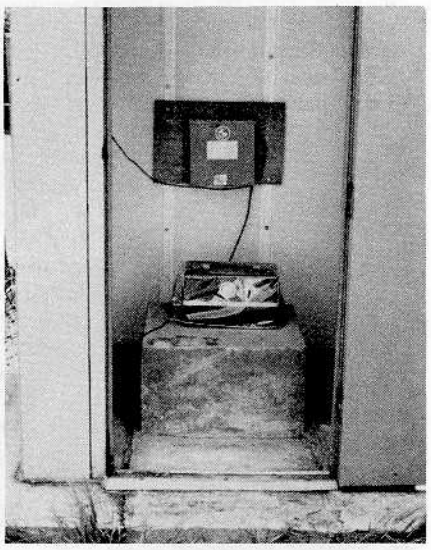
The magnitude 6.2 Morgan Hill earthquake that damaged the San Jose area on April 24 caused the strongest horizontal earthquake acceleration ever measured (Figure 1). The unprecedented measurement of a shaking force one and a third times the force of gravity (1.3g) was recorded by the California Department of Conservation's Division of Mines and Geology (CDMG) on a strong-motion recorder at Coyote Dam, 17 miles south of the epicenter near Mount Hamilton.

The previous maximum recorded horizontal acceleration, 1.25g, was recorded near Pacoima Dam, Los Angeles County, in the M 6.2 San Fernando earthquake of February 9, 1971. If vertical, an acceleration of 1.0g would exactly counterbalance the force of gravity, and make objects weightless; accelerations higher than 1.0g would throw objects in the air.

Seismologists and structural engineers are studying the unprecedented shaking



Interior view of a strong-motion housing like the one at Coyote Dam. The accelerograph is bolted to the concrete pedestal attached to the base; the housing itself is made of light aluminum panels.

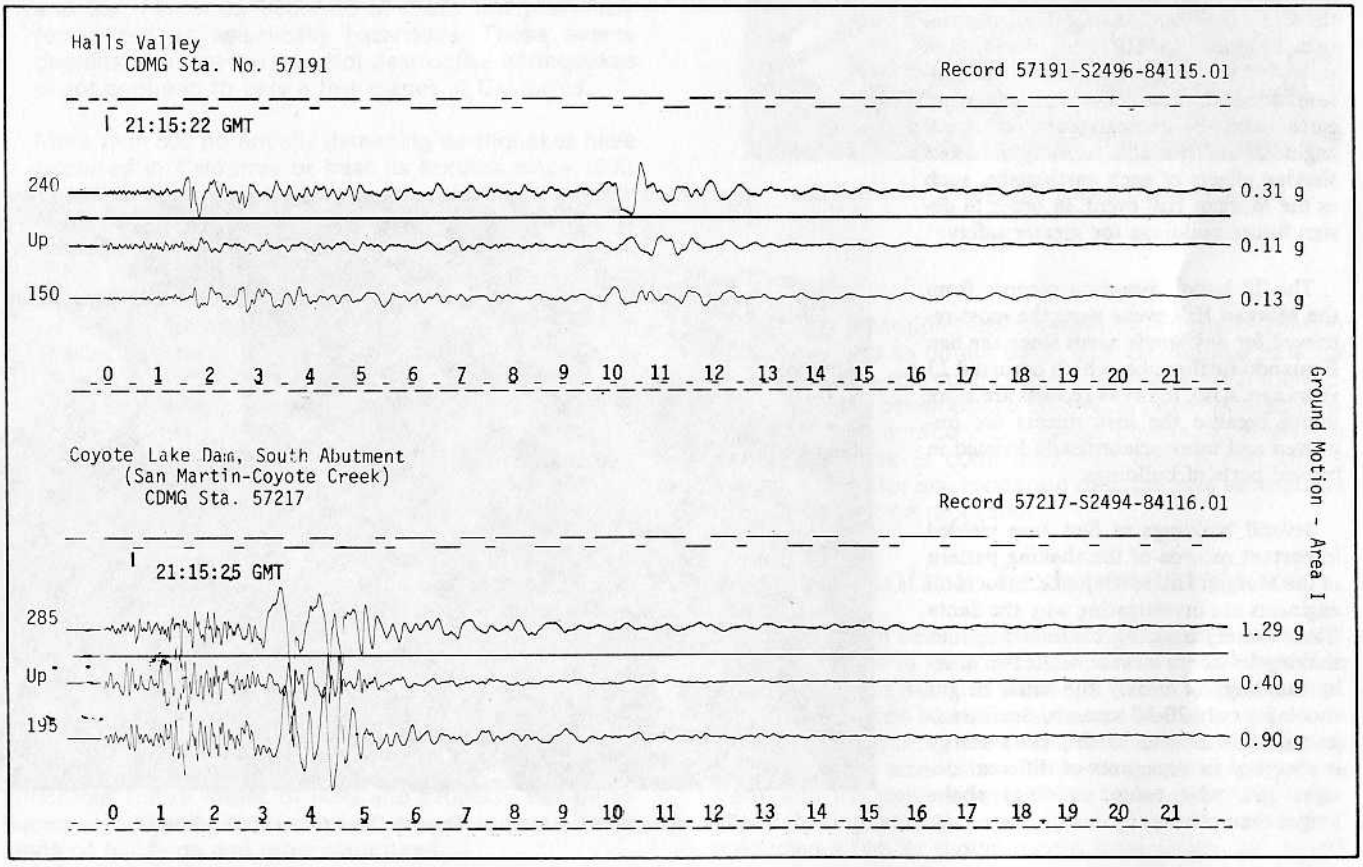


Figure 1. Morgan Hill earthquake of April 24, 1984.

A. Accelerogram from Morgan Hill earthquake, recorded by strong-motion accelerograph located at Halls Valley two miles north of the epicenter, showing acceleration of 0.3g.

B. Accelerogram from Morgan Hill earthquake, recorded by strong-motion accelerograph located at Coyote Dam, 17 miles south of the epicenter, showing acceleration of 1.3g.

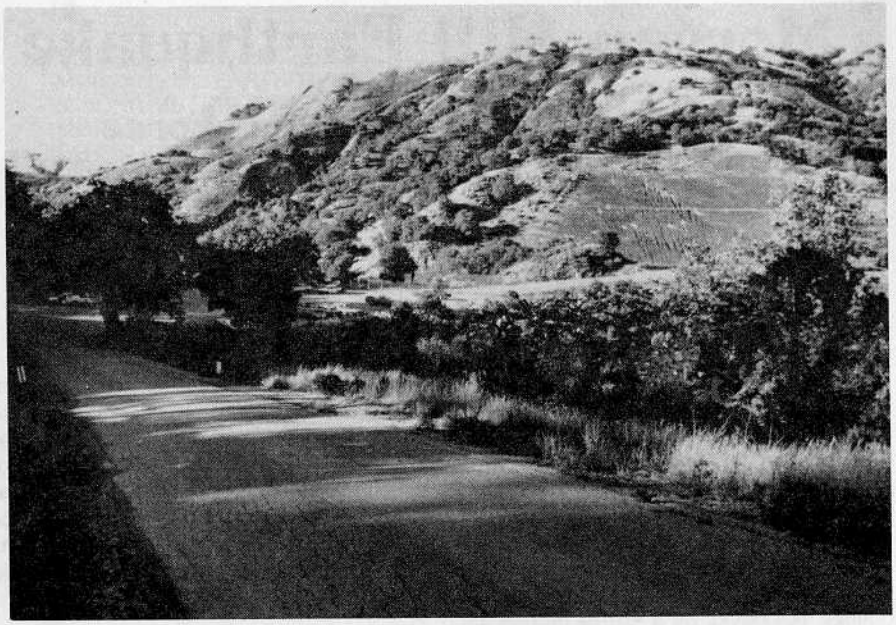
force of the relatively mild Morgan Hill earthquake and are questioning the technical reasons for the earthquake's unexpected powerful punch. Was it due to seismic focusing at the instant the fault slipped, to local topography along the wave path, or to the mass and shape of Coyote Dam itself?

Seismologic theory has predicted an energy-concentration effect called "directivity focusing" which states that an earthquake's force may be concentrated in a particular direction, rather than pulsing equally in all directions. The data from this earthquake may represent the first measurement of that effect, with 1.3g shaking 17 miles south of the epicenter, and only 0.3g at Halls Valley, just two miles north.

CDMG seismologists are studying detailed tracings of the Morgan Hill earthquake's motions as recorded by more than 50 instruments that were placed in ground stations, dams, and typical buildings throughout the shaken region. Since 1971, the CDMG Strong Motion Instrumentation Program (SMIP) has deployed a statewide network of instruments to capture detailed motions of all damaging earthquakes. Seismologists and structural engineers are then able to study the exact shaking effects of each earthquake, such as the Morgan Hill event, in order to design future buildings for greater safety.

The 22 building-motion records from the Morgan Hill event were the most retrieved for any single event since the San Fernando earthquake, which occurred 13 years ago. Also, the 1984 records are more useful because the instruments are improved and more scientifically located in critical parts of buildings.

Several buildings in San Jose yielded important records of the shaking pattern of the Morgan Hill earthquake. Structural engineers are investigating why the Santa Clara County building continued serious shaking for over a minute, while two nearby buildings of nearly the same height shook for only 20-30 seconds. Such studies will show how an earthquake's energy is absorbed in structures of different design, and why some buildings shake longer than others.



Coyote Dam (view to the north) where the high acceleration (1.3g) was recorded during the Morgan Hill earthquake. The spillway cut is on the far (northeast) end of the dam (the water is just out of the picture on the lower right). The strong-motion recorder is located in a housing at the center of the picture.

The instrument housing on Coyote Dam (view to northeast).

Photos by David L. Parke.