

EFFECT AND RESPONSE IN NEVADA TO THE GREAT 1906 SAN FRANCISCO, CALIFORNIA EARTHQUAKE

Craig M. dePolo, Nevada Bureau of Mines and Geology

Phillip I. Earl, Nevada Historical Society

Overview

The Great 1906 San Francisco Earthquake caused long-period ground motion in western and central Nevada and triggered a significant earthquake sequence, but the catastrophe generated a much larger social and political response in Nevada to San Francisco's plight.

The Effects of the 1906 Earthquake in Nevada

"In towns along the east base of the Sierra Nevada and within 25 or 30 miles of the base, the shock was distinctly felt, movable objects were seen to swing and heard to bump or rattle, and a very small number of persons were awakened." Louderback (1908)

These effects occurred from Sierra Valley to Lone Pine.

"Perhaps the most important of the physical signs reported is the disturbance of smooth water surfaces. In five instances at three different localities, ditch tenders or irrigators noticed an agitation of quiet water surfaces and that the water lightly splasht against the sides as if from low waves, or as in a vessel of water when it is slightly tilted." Louderback (1908)

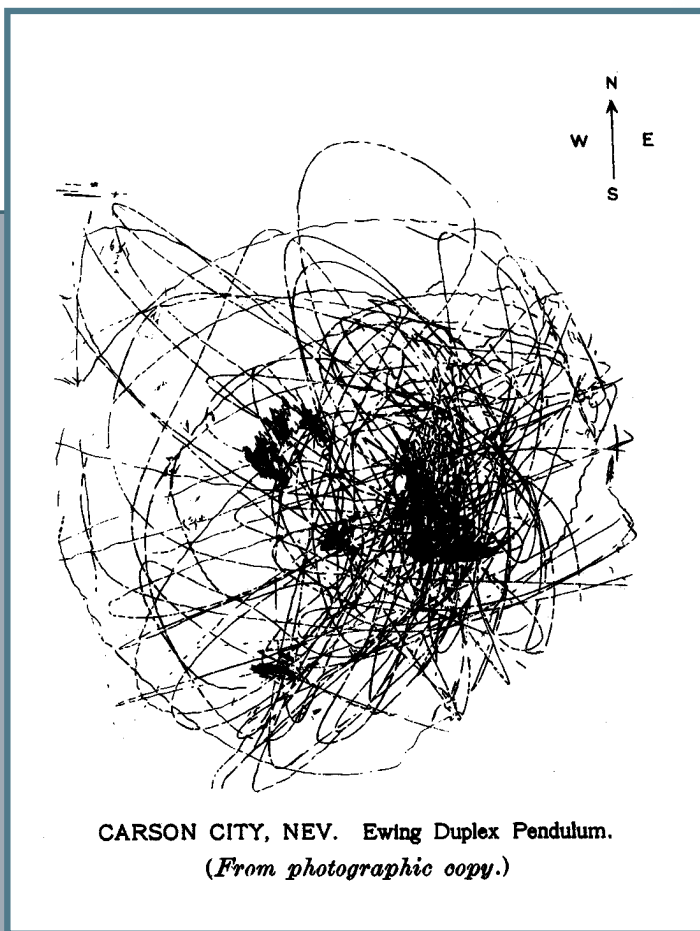
Further east into Nevada, suspended objects were noticed to swing, but the earth waves were not felt by people. The furthest east these effects were noticed was Winnemucca, Nevada, about 340 miles (544 km) from the San Andreas fault system.

Hot Springs near the Sierra Nevada increased in temperature and springs as far east as Elko County were agitated and ran a different color.

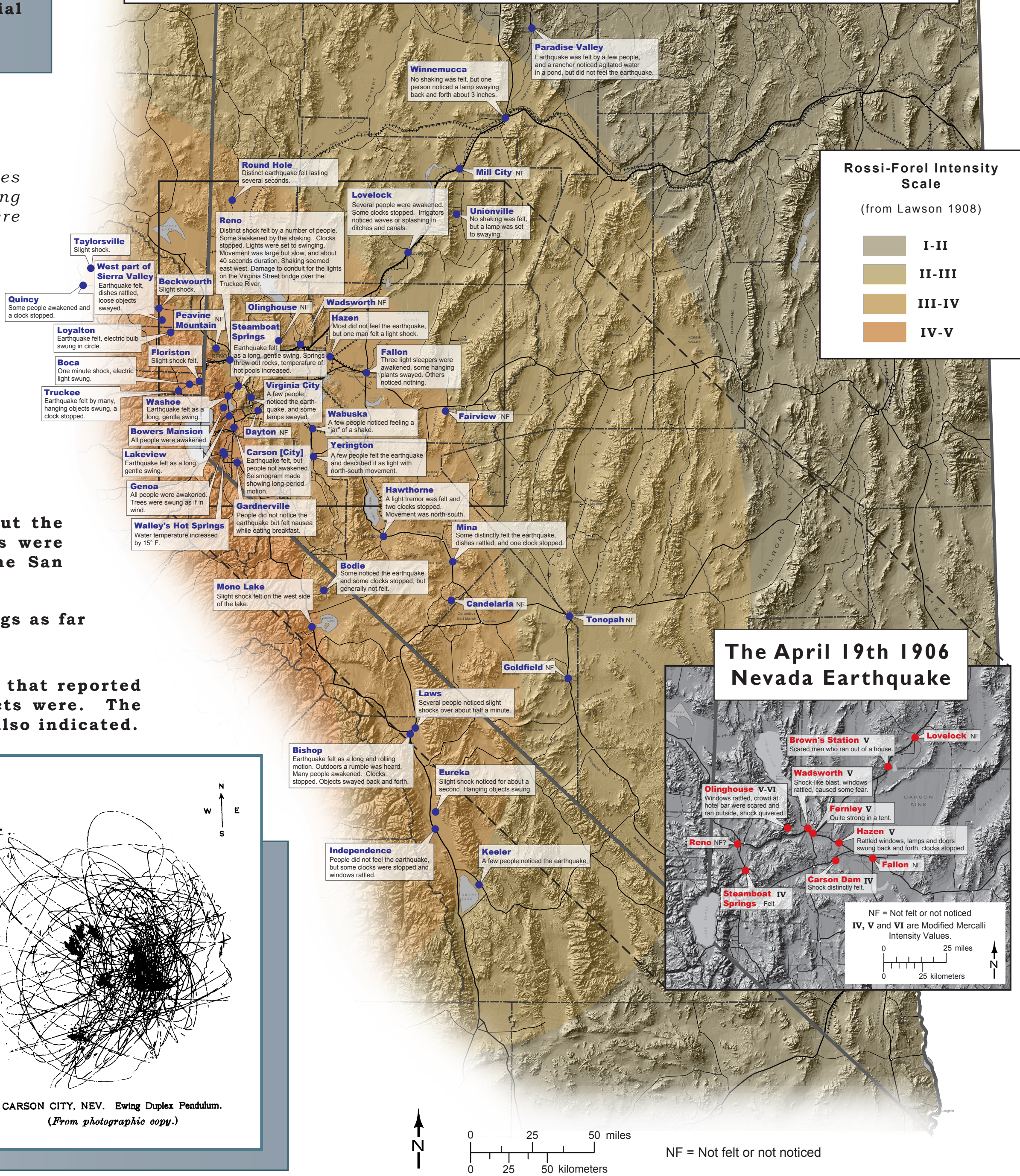
The map to the right shows locations in Nevada and eastern California that reported whether or not they noticed the earthquake, and if so what the effects were. The original Rossi-Forel Intensity isoseismal areas from Lawson (1908) are also indicated.

Carson City Seismoscope Record

This record was made on a Ewing-Duplex seismoscope located in Carson City and operated by C.W. Friend, one of Nevada's first scientists. Carson City is about 181 miles (290 km) from the earthquake. The instrument had an equivalent undamped period of 3.7 to 3.9 seconds and effective dampening of 0.15 to 0.2 when engaged on a smoked glass plate (Jennings and Kanamori, 1979); thus, it was a fairly long-period instrument. The record shows many long-period oscillations consistent with the "long, gentle swing" or "large but slow" motion felt by people near the Sierra Nevada.



Effects of the April 18th 1906 San Francisco Earthquake East of the Sierra Nevada



Nevada Earthquakes Triggered by the 1906 Event

A few small- to moderate-sized earthquakes in Nevada were likely triggered by the passage of waves from the 1906 San Francisco Earthquake. These began at 2:05 p.m. (PST) on April 19th, 33 hours following the great event, and were located to the east of Reno, in the Walker Lane. The mainshock of the Nevada events occurred at 8:15 p.m. (PST) and rattled windows, set lamps and doors to swaying, stopped a clock, and scared people at Olinghouse and Browns Station, causing them to run outside. Three aftershocks were also felt over the next two hours. These accounts come from Louderback (1908) and Townley and Allen (1939). Louderback states, *"Judging from the aerial distribution, it is suggested that this earthquake is related to the fault along the east base of the Virginia Range."* This is the area where the northwest-striking, right-lateral Pyramid Lake fault system is located. Overall, the area of strong shaking was limited, constraining the earthquake size to about magnitude 5 or less.

Financial Impact to Nevada

Nevada's financial health was threatened by the 1906 earthquake with the loss of company offices, bank closings in San Francisco, and the loss of potential investors.

Lieutenant Governor Lemul Allen issued an official proclamation declaring a "public holiday" for five days starting on April 24th to close banks and help prevent a run on bank deposits. Upon returning to Nevada, Governor Sparks allowed the banks to open for a couple of days before extending the "holiday" to May 7th.

Although there was a distinct impact on the Comstock mines in Virginia City, the overall financial effect on Nevada was limited to a few months because the boom areas, Tonopah, Goldfield, and Pioche, had headquarters and investors outside of San Francisco. An example of a Comstock mine where the company offices were destroyed, shutting down production, was the C & C Shaft. San Francisco bank closings affected the Ophir Mine, the Consolidated Virginia Mine, and the Hale and Norcross Mine causing men to have to go a full month without pay. Things were back to normal in the Comstock in about two to three months. The mining camps of Wonder and Fairview were in the early phases of mine development, which was delayed several months because of the San Francisco catastrophe.

The Social Response in Nevada

Nearly every Nevadan had a relative or friend who lived in San Francisco in 1906, and many mining companies had their headquarters there. San Francisco was, and still is, a sister city to western Nevada.

With heavy hearts people crowded around telegraph and train stations upon hearing about the disaster to gain word of loved ones' and friends' fates. Some left immediately on westbound trains to find and assist people.

Within days over \$38,000 (1906 dollars) was reported collected by Nevada communities for San Francisco disaster relief. The towns of Reno, Lovelock, and Winnemucca along the railroad line fed and clothed refugees traveling east. Free rail transportation was given by the Virginia-Truckee and the Southern Pacific Railroads, and tons of clothes, bread, beef, potatoes, blankets, coffee, and other supplies were shipped to San Francisco. Refugees were given shelter in Reno, Carson City, Virginia City, Gold Hill, and Silver City. Many displaced men were given jobs in the Western Pacific Railroad that was building through Nevada and in the mining industry.

Epilogue

Nearly every Nevadan had a relative or friend who lived in San Francisco. Nevada needs to keep the potential of large California earthquakes in mind when constructing facilities that are sensitive to long-period motion. Further the possibility of local triggered earthquakes exists from such events. Nevada can also anticipate giving aid, relief, and shelter to Californians in times of disaster. Nevadans are compassionate people that help their neighbors in a time of need.

Sources of Information

- Jennings, P.C. and Kanamori, H., 1979, Determination of local magnitude, ML, from seismoscope records: Bulletin of the Seismological Society of America, v.69, p. 1267-1288.
- Lawson, A.C., 1908, The California Earthquake of April 18, 1906: Carnegie Institute of Washington, 451 p.
- Louderback, G.D., 1908, East of the Sierra Nevada, in Lawson, A.C., The California Earthquake of April 18, 1906: Carnegie Institute of Washington, Part II, p. 321-325.
- Nevada Newspapers: the Reno Evening Gazette, the Tonopah Bonanza, the Tonopah Daily Sun, and the Morning Appeal (Carson City).
- Reid, J.A., 1908, Observations of J.A. Reid, in Lawson, A.C., The California Earthquake of April 18, 1906: Carnegie Institute of Washington, Part II, p. 325-326.
- Rowley, B., 2006, The big quake: Nevada Magazine, March/April, p. 36-37.
- Townley, S.D. and Allen, M.W., 1939, Descriptive catalog of earthquakes of the Pacific coast of the United States: Bulletin of the Seismological Society of America, v. 29, p. 1-297.

Acknowledgments

We would like to thank Jeff Lusk of the Federal Emergency Management Agency for suggesting this topic of research. The Nevada Earthquake Safety Council and the Federal Emergency Management Agency supported this study. We would like to thank Jon Price and Guy Rocha for their enthusiasm and support. We would also like to thank Jennifer Mauldin for drafting the figures and making up the poster.