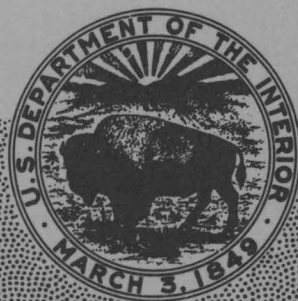


GEOLOGICAL SURVEY CIRCULAR 717-B



Seismic Engineering Program Report, April-June 1975

Prepared on behalf of the
National Science Foundation

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Program Report,
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National Science Foundation

United States Department of the Interior
THOMAS S. KLEPPE, *Secretary*



Geological Survey
V. E. McKelvey, *Director*

PREFACE

This Seismic Engineering Program report is an informal document intended to keep the ever-growing community of strong-motion data users apprised of the activities and data recovered by the U.S. Geological Survey in the Seismic Engineering Program of strong-motion instrumentation supported by the National Science Foundation in cooperation with other Federal, State, and local agencies and organizations.

This report contains a list of the accelerograph records recovered during the first quarter of 1975, some additional records from 1974, an abstract of a recent report, and other notes pertinent to the Strong-Motion Program.

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Seismic Engineering Program Report, April–June 1975

ACCELEROGRAPH RECORDS

SUMMARY OF RESULTS

By RICHARD P. MALEY AND BARRY L. SILVERSTEIN

During the first quarter of 1975, 37 accelerograph records were obtained from the strong-motion instrumentation network operated by the U.S. Geological Survey for the National Science Foundation in cooperation with other Federal, State, and local agencies and organizations. This total represents the data recovered from 17 earthquakes that occurred in California and Alaska ranging in magnitude from 2.9 to 6.4. Table 1 presents a chronological summary of the records including the maximum accelerations for those records in which peak accelerations equaled or exceeded 0.05 *g* on the ground or 0.10 *g* on a structure.

The results from most of the accelerograph records obtained in 1974 were summarized in the previous program report (Circular 717-A). Some additional results from events that occurred in 1974 and were not previously reported are summarized in table 2. Generally, these are records with low values of peak acceleration or records from events that occurred late in the year.

Several changes have been made in the record summary format compared to that used in previous program reports. These include (1) the elimination of calculated epicentral distances, (2) the introduction of trigger minus *S*-wave time intervals, when available, and (3) a measure of the duration for which the acceleration peaks equaled or exceeded 0.10 *g*.

Epicentral distances were omitted because of the variable quality of data available when this summary was prepared. Many of the epicenters listed under the "Event" column are preliminary. They may come from one or more of the following sources: (1) the Pasadena Seismological Labora-

tory, (2) the Berkeley Seismological Laboratory, (3) the USGS Central California Network, (4) the National Earthquake Information Service, (5) the Hawaii Volcano Observatory, and (6) the Palmer or Adak Seismic Observatories. The accuracy of the calculated epicenter locations is directly related to the number of operating seismographs located near the earthquake source. This is particularly true for smaller events. If surface rupture does occur during an earthquake, the distance from the fracture zone to the accelerograph station will be noted in the table.

S-wave minus trigger times will be reported from information recorded on instruments with electronic vertical triggers. Our own experience and that reported by Dielman, Hanks, and Trifunac (1975) indicate that these accelerographs are triggered within one-tenth of a second of the initial *P*-wave arrival. In many instances, the measured *S*-wave minus trigger times may be relatively accurate indicators of hypocentral distances, especially for earthquakes, such as those off the coast of California, that are poorly located by teleseismic networks.

The time interval during which acceleration peaks equaled or exceeded 0.10 *g* is now being routinely reported to provide an impression of the duration of the stronger motions. For instance, in the present summary table, although the Petrolia, Calif., general store record of January 11, 1975, showed an acceleration of nearly 0.2 *g*, it occurred as a single peak with all other accelerations less than 0.10 *g*. This measure of duration should not be used to supplant more sophisticated analyses of recorded data, but it does provide a quick impression of the duration of the significant part of the record for most engineering purposes.

REFERENCE

- Dielman, R. J., Hanks, T. C., and Trifunac, M. D., 1975, An array of strong-motion accelerographs in Bear Valley, California: *Seismol. Soc. America Bull.*, v. 65, p. 1-12.

ABSTRACTS OF RECENT REPORTS
TIME-DEPENDENT SPECTRAL
ANALYSIS OF THIRTY-ONE STRONG-MOTION
EARTHQUAKE RECORDS¹

By VIRGILIO PEREZ

ABSTRACT

Velocity response spectral analysis as a function of time for 5 percent critical damping is presented for the horizontal components of 31 earthquake records (61 components). A nomograph that allows conversion of the velocity response envelope spectrum is also presented. Included among the records analyzed are such important accelerograms as those from El Centro, 1940; Olympia, 1949; Taft, 1952; San Francisco, 1957; Parkfield, 1966; San Fernando, 1971; and Managua, 1972. Time-duration response spectra showing the number of cycles of response above different levels also are presented. The effects on the response spectra of the time at which peak acceleration occurs are examined.

NOTES ON RECORD INTERPRETATION
AND DATA SOURCES

CONVENTION ON DIRECTION OF MOTION

A question has been raised regarding a statement in the previous program report (Circular 717-A) concerning the "U.S. Geological Survey convention of correlating up motion on the record with the direction of pendulum motion." This convention has been used in the strong-motion program reports for about 40 years and is an unambiguous definition of the relation between the motion of the accelerometer mass and the indication of motion on the record. It is not involved with the question of interpretation of the relation between the pendulum motion and the ground motion or ground acceleration. This convention does apply to all data reported in these Seismic Engineering Program reports and should not be confused with other conventions used in conjunction with teleseismic instrumentation.

AVAILABILITY OF DIGITIZED DATA

The February 9, 1971, San Fernando earthquake strong-motion records and most of the

significant records prior to that earthquake have been digitized by the California Institute of Technology (CIT). The digitized data are presently available through CIT and the Environmental Data Service (EDS) of the National Oceanic and Atmospheric Administration (NOAA) in the following forms:

California Institute of Technology:

Volume I form of data (uncorrected) is available on four magnetic tapes at a total cost of \$400.

Volume II form of data (corrected) is available for 329 records on 3 magnetic tapes at a total cost of \$300.

Data are available on 7-track 800 BPI formatted tape in BCD; a few other formats are available including 9-track 1600 BPI.

Inquiries should be addressed to:

Earthquake Engineering Research
Laboratory
California Institute of Technology
Mail Code 104-44
Pasadena, California 91125
(213) 795-6841, ext. 1232

Environmental Data Service:

Volume I form of data (uncorrected) is available in punched card form (about 2,000 cards each) for \$20 per event and on magnetic tape (7 or 9-track) for \$60 per tape. The complete file of approximately 400 records is available on 6 magnetic tapes for \$360.

Inquiries should be addressed to:

National Geophysical and Solar-
Terrestrial Data Center
Code 62
EDS/NOAA
Boulder, Colorado 80302
(303) 499-1000, ext. 6472

Significant strong-motion records obtained since the San Fernando earthquake are being processed by the USGS. The digitization and data reduction capabilities are currently being improved, and as soon as the systems are fully operational, all significant ground-level records generated since 1971 will be routinely digitized and analyzed. The availability of such data will be announced in subsequent program reports.

¹Available as open-file report No. 74-48, U.S. Geological Survey, November 1974.

TABLE 1.—Summary of accelerograph records: January–March 1975

Event	Station location		S-t time ¹ (sec)	Comp	Max accl ² (g)	Duration ³ (sec)
	Name	Coord				
2 January 1975 33.55N, 117.65W Magnitude 3.8 and 33.53, 117.63W Magnitude 3.3	Small-amplitude records were obtained at San Juan Capistrano, City Hall.					
6 January 1975 Parkfield 35.93N, 120.53W Magnitude 4.4	Parkfield Grade	35.98N 120.48W	1.1	S67W Down S23E	0.08 0.02 0.04	-
	Vineyard Canyon	35.92N 120.53W	-	N64W Down S26W	0.09 0.04 0.09	-
	Small-amplitude records were also obtained at Slacks Canyon; Hidden Valley Ranch and Parkfield, CDF Fire Station.					
11 January 1975 Cape Mendocino 40.22N, 124.26W Magnitude 4.4	Petrolia general store	40.32N 124.29W	-	N75E Down N15W	0.19 0.04 0.13	1 peak - 1 peak
	Petrolia Cape Mendocino	40.35N 124.35W	-	S60E Down N30E	0.10 0.04 0.09	1 peak - -
	Small-amplitude records were also obtained at Ferndale: City Hall.					
12 January 1975 Anchorage 61.4N, 150.5W Magnitude 4.8	Small-amplitude records were obtained from Anchorage: Westward Hotel; and Post Office, 605 W. Third St.					
12 January 1975 32.80N, 117.97W Magnitude 4.5	A small-amplitude record was obtained at San Juan Capistrano: City Hall.					
13 January 1975 Lakewood 33.82N, 118.08W Magnitude 3.5	Long Beach VA Hospital	33.78N 118.12W	2.0	South Down East	0.06 0.03 0.02	-
	Small-amplitude records were also obtained at Long Beach State University and at Norwalk Fire Station.					
23 January 1975 Brawley 32.96N, 115.49W Magnitude 4.8	El Centro Imp. Val. Irr. Dist. 302 Commercial St.	32.79N 115.55W	-	Up South West	0.02 0.05 0.07	-
	El Centro Imp. Val. Irr. Dist. 302 Commercial St.	32.79N 115.55W	-	S52W Down S38E	- 0.03 0.06	-
	El Centro Meadows Union School 2059 Bowker St.	32.80N 115.47W	-	S52W Down S38E	0.09 0.02 0.08	-
	Imperial Imp. Valley College Admininstration Bldg	32.83N 115.50W	-	S52W Down S38E	0.11 0.04 0.05	1 peak - -

TABLE 1.—Summary of accelerograph records, January–March 1975—Continued

Event	Station location		S-t time ¹ (sec)	Comp	Max accl ² (g)	Duration ³ (sec)
	Name	Coord				
23 January 1975 Brawley 32.96N, 115.49W Magnitude 4.8 — Continued	Small-amplitude records were also obtained at El Centro, Community Hospital and at Niland, Fire Station.					
January-May 1975 Gilroy	A small-amplitude record was obtained at Gilroy, Gavilan College from an earthquake of unknown location and magnitude.					
3 February 1975 northern Montana 48.1N, 114.1W Magnitude 4.6	A small-amplitude record was obtained at Hungry Horse Dam: Abutment.					
12 February 1975 Hollister 35.97N, 120.14W Magnitude 3.4	A small-amplitude record was obtained at San Juan Bautista, Fire Station.					
18 Feb-6 Mar 1975 Bear Valley	A small-amplitude record was obtained at Bear Valley, Fire Station from an earthquake of unknown location and magnitude.					
21 February 1975 Aleutian Islands 51.4N, 179.4W Magnitude 6.4	A small-amplitude record was obtained at Adak, Naval Base.					
23 February 1975 Hollister 36.56N, 121.19W Magnitude 3.3	Small-amplitude records were obtained at Bear Valley, Melendy Ranch West and Melendy Ranch Northwest.					
3 March 1975 Inglewood 34.33N, 118.25W Magnitude 3.1	Small-amplitude records were obtained at Inglewood, 600 Prairie.					
6 March 1975 Hollister 36.56N, 121.21W Magnitude 2.9	Bear Valley	36.59N	1.1	S50E	0.12	0.5
	Melendy Ranch East	121.19W		Down	0.07	-
				N40E	0.18	0.3
	Bear Valley	36.59N	1.0	S50E	0.04	-
	Melendy Ranch Northwest	121.19W		Down	0.02	
				N40E	0.05	
	Bear Valley	36.59N	1.1	S50E	0.04	-
	Melendy Ranch West	121.19W		Down	0.03	
				N40E	0.06	
	Bear Valley	36.64N		S50E	0.05	-
	Stone Canyon East	121.24W		Down	0.09	
				N40E	0.04	
	A small-amplitude record was also obtained at Bear Valley, Fire Station.					

¹S-wave minus trigger time.²Unless otherwise noted, maximum acceleration recorded at ground or basement level. Data from the records are summarized only if the maximum acceleration is greater than 0.05 g at ground stations or greater than 0.10 g at upper floors of buildings.³Duration for which peaks of acceleration exceed 0.10 g.

TABLE 2.—Summary of additional accelerograph records from 1974

Event	Station location		S-t time ² (sec)	Comp	Max accl ³ (g)	Duration ⁴ (sec)
	Name	Coord				
7 February 1974 Bear Valley 36.57N, 121.19W Magnitude 3.2	A small-amplitude record was obtained at Bear Valley, CDF Fire Station with an S minus t time of 0.6 sec.					
8 Feb-31 Oct 1974 Los Angeles Unknown location and magnitude	Los Angeles	34.05N	1.2	N30W	0.06	-
	533 South Fremont	118.26W		S60W	0.25	0.25
	(basement)			Up	0.06	-
				N30W	0.19	0.25
	(sixth floor)			S60W	0.16	0.15
				Up	0.10	1 peak
	(roof-11th level)			N30W	0.07	-
				S60W	0.12	1 peak
				Up	0.10	(5)
11 February 1974 Los Angeles 34.10N, 118.54W Magnitude 3.5	A small-amplitude record was obtained at Los Angeles, 700 W. 7th St.					
1 Apr-16 Jul 1974 Los Angeles Unknown location and magnitude	Los Angeles	34.06N	-	N41W	0.06	-
	Bunker Hill	118.25W		Down	0.05	
				S49W	0.09	
5 May-7 Nov 1974 southern Alaska	Small-amplitude records were obtained at Anchorage, Westward Hotel from an earthquake of unknown location and magnitude.					
12 August 1974 Aleutian Islands 51.5N, 178.1W Magnitude 5.9	A small-amplitude record was obtained at Adak, Naval Base.					
14 August 1974 Los Angeles 34.43N, 118.37W Magnitude 4.3	Small-amplitude records were obtained at Los Angeles, 14800 Ventura					
10 November 1974 Aleutian Islands 51.6N, 178.1W Magnitude 6.4	Adak	51.88N	-	North	0.03	-
	Naval Base	176.58W		Down	0.03	
				West	0.05	
28 November 1974 Hollister 36.91N, 121.50W Magnitude 5.2	A small-amplitude record was obtained at SAGO Vault (near Hollister)					
6 December 1974 Calif-Mexico brdr 32.72N, 115.40W Magnitude 4.8	A small-amplitude record was obtained at El Centro, Imperial Valley Irrigation District.					
6 December 1974 Los Angeles 34.10N, 118.22W Magnitude 3.5	Small-amplitude records were obtained at Los Angeles, 1526 N. Edgemont.					

TABLE 2.—Summary of additional accelerograph records from 1974—Continued

Event	Station location		S-t time ² (sec)	Comp	Max accel ³ (g)	Duration ⁴ (sec)
	Name	Coord				
29 December 1974 southern Alaska 61.6N, 150.5W Magnitude 5.6	Small-amplitude records were obtained at Anchorage, Westward Hotel; Government Hospital; and Post Office, 605 W. 4th St.					
31 December 1974 southern Alaska 61.9N, 149.7W Magnitude 5.9	Anchorage	61.19N	-	S45E	0.07	-
	Alaska Methodist Univ.	149.80W		Down	0.04	
				N45E	0.09	
	Anchorage	61.19N	-	South	0.07	-
	Government Hospital	149.89W		Down	0.05	
				East	0.06	
	Anchorage	61.22N	-	East	0.05	-
	Post Office	149.89W		Down	0.03	
	605 W. Fourth			North	0.05	
	Anchorage	61.22N	11.2	N45W	0.08	-
	Westward Hotel	149.89W		Down	0.02	
	(basement)			S45W	0.05	
				N45W	0.12	1 peak
	(roof-23 level)			Down	0.14	1 peak
				S45W	0.08	-
	Talkeetna	62.30N	9	N15W	0.07	-
	FAA-VOR Bldg	150.10W		Down	0.09	
				S75W	0.08	
A small-amplitude record from an event of unknown time, location, and magnitude is also present on the above record.						

¹The initial summary of records for 1974 was presented in Circular 717-A.

²S-wave minus trigger time.

³Unless otherwise noted, maximum acceleration recorded at ground or basement level.

Data from the records are summarized only if the maximum acceleration is greater than 0.05 g at ground stations or greater than 0.10 g at upper floors of buildings.

⁴Duration for which peaks of acceleration exceed 0.10 g.

⁵Only a partial record was obtained owing to a faint trace.