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GEOLOGICAL SURVEY CIRCULAR 785-C

Seismic Engineering Program Report

September - December 1978

Prepared on behalf of the
National Science Foundation
Grant CA-114

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United States Department of the Interior
CECIL D. ANDRUS, *Secretary*

Geological Survey
H. William Menard, *Director*

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PREFACE

This Seismic Engineering Program Report is an informal document primarily intended to keep the ever-growing community of strong-motion data users apprised of the availability of data recovered by the Seismic Engineering Branch of the U.S. Geological Survey. The Seismic Engineering Program of strong-motion instrumentation is supported by the National Science Foundation (Grant CA-114) in cooperation with numerous Federal, State, and local agencies and organizations.

This issue contains a summary of the accelerograms recovered from the U.S. Geological Survey's (USGS) National Strong-Motion Network during the period September 1 through December 31, 1978. A preliminary report on the Oaxaca, Mexico earthquake of November 29 is presented along with abstracts of recent reports, notes on strong-motion information sources and the availability of digitized data, and other information pertinent to the USGS Strong-Motion Program. The data summary presented in table 1 includes those accelerograms recovered (although not necessarily recorded) during the period September through December 1978; this procedure will be continued in future issues so that the dissemination of strong-motion data may be as expeditious and current as practicable.

Ronald L. Porcella, Editor

U. S. Geological Survey, MS 78

Menlo Park, California 94025

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RECENT STRONG-MOTION RECORDS

by R. L. Porcella

A magnitude 5.7 (M_L) earthquake near Bishop, Calif. on October 4, 1978 triggered eight accelerographs at Pine Flat and Buchanan Dams in the Sierra Nevada foothills northeast of Fresno, Calif. The maximum recorded acceleration was less than 0.05 g (see table 1, end of report). Additional strong-motion data from this event were recovered at six stations owned and operated by the Office of Strong Motion Studies (OSMS), California Division of Mines and Geology (McJunkin, 1978).

Other records recovered during this reporting period include six from stations near the southeast coast of Hawaii, one from the Imperial Valley, and one from the Santa Barbara Courthouse station believed to be an aftershock of the Santa Barbara earthquake of August 13, 1978 (see Seismic Engineering Program Report, U.S. Geological Survey Circular 785-B).

Seventeen accelerograph records were recovered from the USGS Strong-Motion Network during the period September through December, 1978, bringing the yearly total to 88 records; this total compares to a yearly average of 188 records for the period 1972 to 1977, inclusive. This decrease in the reported number of accelerograms recovered in 1978 is in part due to recent state legislation that has given responsibility to OSMS for dissemination of that organization's strong-motion data (Wooton, 1979); OSMS data are not necessarily listed in this Seismic Engineering Program Report.

The current USGS program of strong-motion instrumentation is supported by the National Science Foundation; the cooperation of both private industry and educational institutions as well as various Federal, State, and local agencies and organizations has made the program possible. The primary objective of the program is to record both strong ground motion and the response of representative types of structures during potentially damaging earthquakes and to disseminate these data and information to external users in earthquake engineering research and design practice.

References:

McJunkin, R. D., 1978, Compilation of strong-motion records recovered from the Bishop, Calif. earthquake of 4 October 1978: California Division of Mines and Geology, OSMS report 78-7.1, 29 p.

Wooton, T. M., 1979, Strong motion instrumentation program: California Division of Mines and Geology, California Geology, v. 32, no. 4 (April 1979), p. 77-79.

OAXACA, MEXICO EARTHQUAKE OF NOVEMBER 29, 1978 AND AFTERSHOCKS

by C. F. Knudson, P. N. Mork, and Jorge Prince

During the past 50 years, the state of Oaxaca has experienced numerous destructive earthquakes. In 1928 alone, this region had four major earthquakes: a magnitude 7.5 on March 22, a magnitude 7.8 on June 17, a magnitude 7.4 on August 4, and a magnitude 7.6 on October 9. The region also experienced two major earthquakes in the 1960's, a magnitude 7.5 event in August 1965 and a magnitude 7.1 event in August 1968. Several reports have been recently published about the so-called Oaxaca gap (Garza and Lomnitz, 1978, Ohtake and others, 1977).

On November 29, 1978 at 1952 UTC, a major earthquake occurred south of the city of Oaxaca in southern Mexico. The National Earthquake Information Service in Golden, Colorado (USGS) assigned a Richter magnitude of 7.8 (M_S) to this earthquake and located the epicenter at 16.12° N and 96.43° W, with a focal depth of 44 km. J. Figueroa of the Institute of Ingenieria UNAM (JFA) assigned a lower magnitude of 6.8 to this earthquake and located the epicenter at 15.34° N and 96.19° W. Karen McNally, a senior research fellow at the California Institute of Technology (CIT), has supplied a third epicenter for this earthquake (15.77° N and 96.88° W), using information obtained from a portable network and readings from other teleseismic instruments (Karen McNally, oral commun., February 23, 1979). These epicenters are shown in figure 1.

Early press reports stated that two older buildings collapsed in Mexico City and 750 others were damaged. In addition, the earthquake was reported to have destroyed the towns of San Baltasar Loxicha and Santa Catarina Loxicha in Oaxaca. A reconnaissance team from the Earthquake Engineering Research Institute found that these reports were greatly exaggerated; only minor damage in Mexico City, limited damage in the city of Oaxaca, and no damage to buildings at Puerto Angel were observed. Noteworthy effects of the earthquake found in the Puerto Escondido area consisted

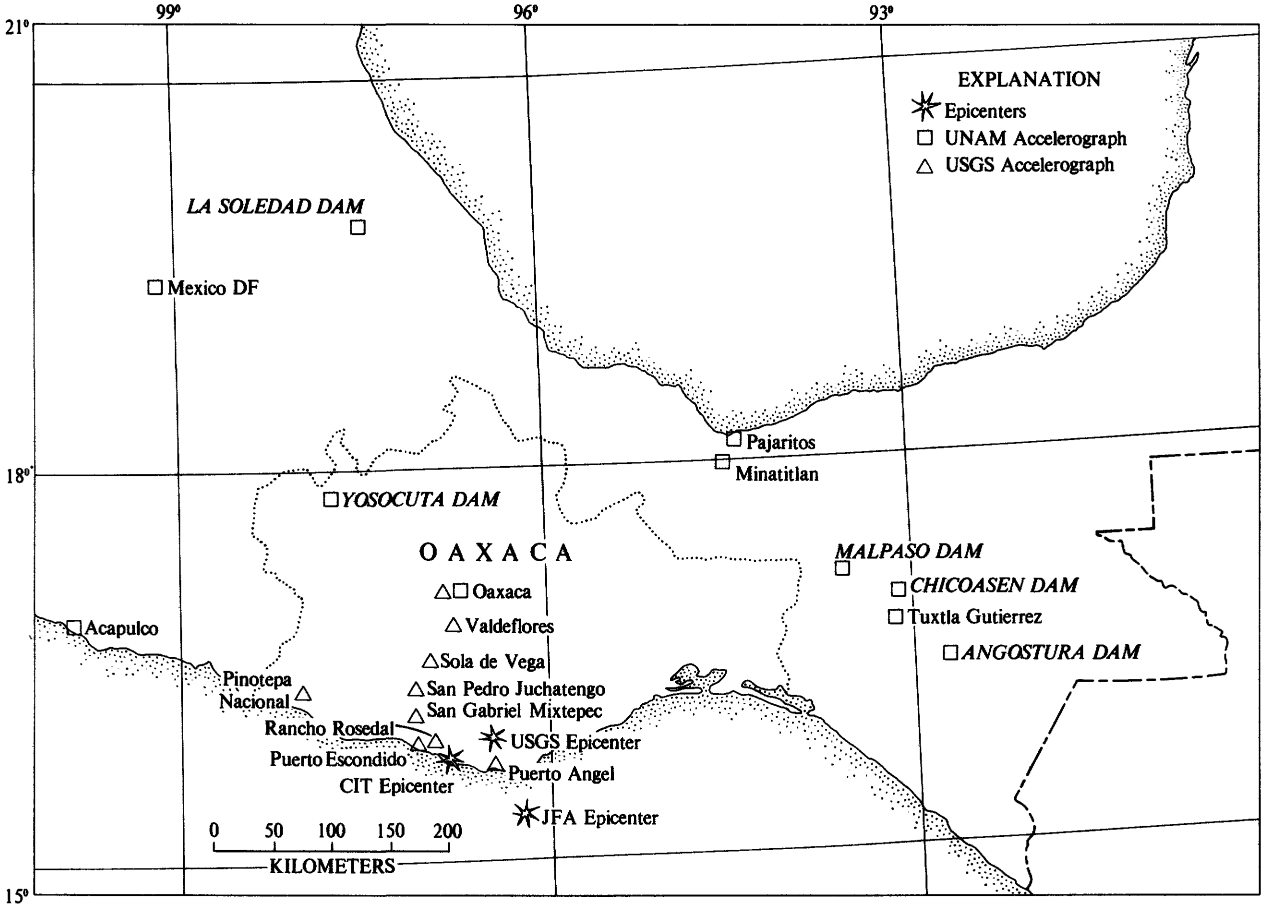

Figure 1. - Strong-motion stations triggered during the southern Mexico earthquake of November 29, 1978 and aftershocks.

of an offset in the short span of a bridge and substantial damage to the two-story administration building at Puerto Escondido Military Station (Nick Forell, oral commun., December 21, 1978).

Eight accelerograph records were obtained from instruments located at Mexico City, Malpaso Dam, Pajaritos, Minatitlan, and Oaxaca City. The maximum acceleration (0.22g) was recorded in the city of Oaxaca (see table 2). A report on the November 29 earthquake, which contains information obtained from the accelerographs listed in table 2 as well as from the Mexican seismic network of instruments located within a radius of 140 km of Mexico City, has been published (Espinosa and others, 1978); records from three of the stations in the Mexican seismic network have been digitized and their calculated spectra are included in the report.

On December 1, 1978, C. F. Knudson and P. N. Mork of the U.S. Geological Survey (USGS) flew to Mexico City to install a temporary accelerograph network in the epicentral area for the purpose of recording large aftershocks. With the assistance of J. Prince and other personnel of the Institute of Engineering of the National University, four accelerographs were installed in an east-west line from Puerto Angel to Pinotepa Nacional near the Pacific coast. Four additional accelerographs were installed along a north-south line from the city of Oaxaca to Puerto Escondido. Since Oaxaca, the largest city in southern Mexico, has a long history of damaging earthquakes, two USGS accelerographs were installed there to supplement the single permanent UNAM accelerograph now in place at the Colegio De Mexico in Oaxaca City (fig. 1).

Numerous small aftershocks have occurred in the epicentral area since the installation of the portable network. Accelerographs at three of the ten locations (Rancho Rosedal, Puerto Escondido, and San Gabriel Mixtepec) were triggered by aftershocks that occurred between December 8, 1978 and January 18, 1979. Time code generators installed on these instruments record the time of the aftershock (correct to within two minutes). All of the 10 aftershocks recorded during this 40-day period were small

Table 2. - *Accelerograph data for southern Mexico earthquakes of November 29, 1978.*

[x, less than 20 gal. From Espinosa and others, 1978.]

Station	Coordinates °North	Coordinates °West	Component	Max. accl. (gal)	Record length (sec)	USGS epic. dist. (km)	Event time (UTC)
Oaxaca City, Oaxaca	17.09	96.72	N-S Vert. E-W	220 90 158	69	112	19.52
Oaxaca City, Oaxaca	17.09	96.72	N-S Vert. E-W	56 45 42	44	...112	20.05
Oaxaca City, Oaxaca	17.09	96.72	N-S Vert. E-W	102 48 100	55	...112	20.50
Patio Bldg. M. Hidalgo Mexico City	19.45	99.14	N-S Vert. E-W	22 x 19	188	468	19.52
Minatitlan, Veracruz (PEMEX)	17.98	94.54	Long. Vert. Trans.	45 26 63	180	288	19.52
Pajaritos, Veracruz (PEMEX)	18.11	94.39	Long. Vert. Trans.	34 x 21	141	309	19.52
Malpaso Dam Crest (CFE)	17.15	93.59	Long. Vert. Trans.	x x x	34	323	19.52
Malpaso Dam Base (CFE)	17.15	93.59	Long. Vert. Trans.	x x x	31	323	19.52
Malpaso Dam R. abut	17.15	93.59	Long Vert. Trans.	x x x	40	323	19.52
University, Mexico City	19.33	99.18	N-S Vert. E-W	x x x	177	490	19.52

-- just slightly above the triggering level of the instrument. The maximum acceleration (0.06g) was recorded at San Gabriel Mixtepec on December 19, 1978 at 2210 UTC (table 3). The USGS aftershock network will be removed in April 1979 unless another large earthquake occurs in this region.

References:

Espinosa, J. M., Alonso, L., Mora, I., Cajiga, J., and Prince, J., 1978, Informe preliminar sobre los sismos del 29 de Noviembre de 1978 en el Estedo de Oaxaca: Instituto de Ingenieria, Ciudad Universitaria, Mexico, D.F., Informe IPS-4, 47 p.

Forell, N., 1978, Quick-look report on the Oaxaca, Mexico earthquake, EERI reconnaissance team: Newsletter, Earthquake Engineering Research Institute, v. 13, n. 1, p. 6-10.

Garza, T. and Lommitz, C., 1978, The Oaxaca gap: A case history: Proceedings of conference VI, methodology for identifying seismic gaps and soon-to-break gaps: U.S. Geological Survey Open-file Report 78-943, p. 173-187.

Table 3. - *Strong-Motion summary of Oaxaca area aftershock records recovered from December 1978 to January 1979*

Event	Recording station	Station coord.	Max accl. (g)
9 December 1978 1103 UTC	Rancho Rosedal	15.90N 96.93W	0.020
12 December 1978 1401 UTC	San Gabriel Mixtepec	16.08N 97.10W	.016
19 December 1978 1810 UTC	San Gabriel Mixtepec	16.08N 97.10W	.060
20 December 1978 0352 UTC	San Gabriel Mixtepec	16.08N 97.10W	.038
28 December 1978 1919 UTC	San Gabriel Mixtepec	16.08N 97.10W	.038
28 December 1978 1949 UTC	Rancho Rosedal	15.90N 96.93W	.030
29 December 1978 1824 UTC	Rancho Rosedal	15.90N 96.93W	less than .005
29 December 1978 1956 UTC	Puerto Escondido	15.85N 97.11W	.006
29 December 1978 2308 UTC	Puerto Escondido	15.85N 97.11W	.008
10 January 1979 0429 UTC	San Gabriel Mixtepec	16.08N 97.10W	.033

Ohtake, M., Matumoto, T., and Latham, G., 1977 Patterns of seismicity preceding earthquakes in Central America, Mexico, and California: Proceedings of conference VI, methodology for identifying seismic gaps and soon-to-break gaps: U.S. Geological Survey Open-file Report 78-943, p. 585-609.

CHANGES ON STRONG-MOTION RECORD LABELS

Effective January 1, 1978 the identification labels attached to strong-motion accelerograph records will contain several revisions of the previous label format. Only two of these changes are significant:

(1) Directions listed for each component are the true directions of acceleration and are shown by an upward trace deflection on the record. Formerly, the directions listed on the label indicated pendulum motion. Because the instruments or accelerometers are located at ground level and within structures, the directions now listed for upward trace deflections on the record are the true acceleration directions of the ground, structure, or structural member where the instrument or accelerometer is located. The footnote on the record label refers to the "case" acceleration, the case being the box containing either the complete accelerograph or individual accelerometer(s). Because the case is attached to the ground (via a concrete slab) or to the structure, case acceleration refers to ground or structural acceleration depending upon the unit's location.

(2) Formerly, horizontal directions were listed on the record label in the quadrant system (pendulum motion for trace up) as follows:

S 45° E
Down
N 45° E

Henceforth, horizontal directions will be listed as degrees of azimuth (acceleration direction for trace up) beginning at north and progressing clockwise for 360°. (A north direction will be listed as 360°, not 000°.) The horizontal directions for the sample above would now be listed as follows:

315°
Up
225°

All records recovered prior to 1978 have labels that indicate horizontal quadrant directions, referring to trace up for pendulum motion. All records recovered henceforth will have labels that indicate horizontal azimuth directions, referring to trace up for acceleration direction.

STRONG-MOTION INFORMATION RETRIEVAL SYSTEM

Descriptions of strong-motion accelerograph records and the circumstances in which the records were recorded are made available to persons involved in earthquake engineering through the Strong-Motion Information Retrieval System. The system is maintained by the U.S. Geological Survey (USGS), and the information is continually updated as new information is gathered. With an ordinary telephone and a teleprinter keyboard terminal, users of the system may review the information from their own offices.

Information about earthquakes that have produced significant strong-motion records, the recording sites, the records recovered, and the extent of the analysis that has been performed on the records is available from the system. Most of this information is related to the network maintained by the USGS, but the system may be expanded in the future to include information about other strong-motion networks as well.

The information is contained in computer files at the USGS computing center in Menlo Park, Calif., and a User's Manual providing instructions for using the computer programs that will display the information is available from the Seismic Engineering Branch (USGS). Instructions are also available from the system itself. A user needs to know only how to dial the computer and what to type in order to access the retrieval system. Once accessed, the user may request a general introduction and how to obtain more detailed instructions.

Access Instructions

The system can be interrogated using an ordinary telephone and an interactive keyboard terminal that operates at 30 cps in half-duplex mode and that uses ASCII character codes. A terminal that supports both upper- and lower-case characters is more suitable than one that uses only upper-case characters. Perform the following steps to gain access to the system:

Dial the USGS computer at Menlo Park (415/326-4350) and wait for a high-pitched tone. (If Menlo Park is a toll call, you may be able to dial a number in the TYMNET telecommunications network. Details are given in the User's Manual.)

Type the line-feed key. The computer will respond with several lines that will tell you which computer system you have accessed, how many other users are connected, etc.

If your terminal will transmit both upper- and lower-case characters, type:

enter "name" SMIRS return linefeed ("name" is your name typed without any embedded blanks.)

Note that the word "enter" is in lower case, "SMIRS" is in upper case, and "name" can be either.

If your terminal has only upper-case characters, type:

MAP return linefeed

ENTER your_name \S\M\I\R\S return linefeed

The "MAP" statement instructs the computer to interpret all the alphabetic characters you will subsequently type as though they were in lower case, excepting those characters that follow a left slant (\).

From now on, the system will prompt you whenever it expects you to type something. All the prompt lines begin and end with two dashes. Answer by typing the question-mark key if you do not know what is expected of you.

If you have a terminal that will not operate in the appropriate modes, or if other access problems arise, contact April Converse (415) 323-8111, ext. 2881 or FTS 467-2881.

ABSTRACTS OF RECENT REPORTS

GEOLOGIC DESCRIPTIONS OF SELECTED STRONG-MOTION ACCELEROGRAPH SITES

by B. L. Silverstein

One of the major tasks of the U.S. Geological Survey (USGS) as regards seismic engineering is the collection and dissemination of strong-motion accelerograph records. In analyzing these records, certain information describing the instrument site is important: local geology; instrument housing (buildings, dams, bridges, instrument shelters); local topography; and proximity of an accelerograph to man-made structures that might influence the record. A series of reports that summarize the site information in the USGS files is being prepared. These reports describe local geologic conditions of selected sites and will cover strong-motion accelerograph sites in the western hemisphere. Station locations described in Parts I and II include 18 in California, 5 in Washington, and 1 each in Arizona, Montana, Nevada, New York, and Utah.

Reference: U.S. Geological Survey Open-file Reports 78-1005 (Part I), 1978, 40 p. and 79-428 (Part II), 1979, 34 p.

STRONG-MOTION INFORMATION, DATA REPORTS, AND AVAILABILITY OF DIGITIZED DATA

U. S. STRONG-MOTION NETWORK DATA

A Strong-Motion Information Retrieval System (SMIRS) has been developed to provide up-to-date information about strong-motion records and the circumstances in which they were recorded to anyone having a computer data terminal (see p.5). The system is operating, but the information within it is incomplete and needs to be verified. A user's manual is available (Converse, 1978).

The strong-motion records from the February 9, 1971 San Fernando, California earthquake and most of the significant records prior to that event have been digitized by the California Institute of Technology (CIT) (Hudson, 1976). Processing and analysis of the data have been presented in a series of reports containing (1) uncorrected digital data, (2) corrected accelerations, velocities, and displacements, (3) response spectra, and (4) Fourier amplitude spectra. All of these data reports are available through the National Technical Information Service (NTIS).

The digitization and analysis of the significant records subsequent to the San Fernando earthquake have been carried out by the U.S. Geological Survey (USGS). Processing and analysis of this data are presented in a series of USGS Open-file Reports. When published, these reports are available from the USGS, Open-File Services Section.

The digitization and analysis of the records collected by the State of California Strong-Motion Instrumentation Program are being handled by the Office of Strong-Motion Studies (OSMS), California Division of Mines and Geology. When completed, reports on these analyses will be available from OSMS (Porter and others, 1979).

The digitized data from the CIT digitization program are available from the Environmental Data Service (EDS) and the National Information Service for Earthquake Engineering at the University of California, Berkeley (NISEE). The magnetic tape digital data from subsequent years will be available from EDS and NISEE at approximately the same time as the data reports are published.

References:

Converse, A., 1978, Strong-motion information retrieval system user's manual: U.S. Geological Survey Open-file Report 79-289, 51 p.

Hudson, D. E., 1976, Strong-motion earthquake accelerograms - index volume: California Institute of Technology, EERI report 76-02, 72 p.

Porter, L. D., Ragsdale, J. T., and McJunkin, R. D., 1979, Processed data from the partial strong-motion records of the Santa Barbara earthquake of 13 August 1978--preliminary results: California Division of Mines and Geology, PR-23, 93 p.

FOREIGN STRONG-MOTION DATA

Because of the long history of close cooperation between the U.S. and the Central and South American strong-motion programs, much of the data from those programs is available from the same sources as the U.S. data (see below). Information about strong-motion data from the western hemisphere will be included in the Strong-Motion Information Retrieval System operated by the USGS.

The USGS does not attempt to obtain first-class copies of records from those foreign organizations that prepare data reports comparable to those prepared by the USGS. Abstracts of the data reports from such organizations are presented in this Seismic Engineering Program Report series, and through informal arrangements, copies of the data and records are made available. The Environmental Data Service of NOAA has attempted to obtain copies of digitized strong-motion data from all organizations worldwide (see the following section).

EDS/NOAA WORLDWIDE STRONG-MOTION DATA

A worldwide collection of strong-motion seismograms for dissemination to the scientific and engineering community is available from World Data Center A for Solid Earth Geophysics and the National Geophysical and Solar-Terrestrial Data Center. Countries contributing to the strong-motion data base include Australia, Italy, Japan, New Zealand, Rumania, U.S.S.R., and Yugoslavia. The U.S. Geological Survey has furnished records from its network of cooperative strong-motion stations, including those in Central and South America.

Copies of strong-motion records are available on 35-mm film, on 70-mm film chips, as paper copies, and as digitized data on punched cards or magnetic tape. A listing of most records can be obtained from the World Data Center A publication "Catalog of Seismograms and Strong-Motion Records, Report SE-6." This catalog can be ordered from NGSDC for $2.00.

The most significant strong-motion records recorded in the United States and Latin America between 1931 and 1971 have been copied on eight reels of 35-mm film (12x reduction) and 70-mm film chips (approximately 8x reduction). The film chips are available for $.50 per chip. Longer records are continued on additional chips. The 35-mm film copies can be purchased for $20 per reel, the complete set of eight reels for $130.

Full-size paper copies (12" x 36") are available for many of the events in the United States and Latin America at a cost of $1.50 per record. Other records are available as paper copies, but at a reduced scale.

Japan and Australia have supplied magnetic tapes of digitized data from stations located in the western Pacific Ocean (the Japanese Islands, New Guinea, and New Britain). A series of 400 U.S. strong-motion records (1933-1971) were digitized by the California Institute of Technology and are now available on six magnetic tapes. The U.S. Geological Survey is digitizing post-1971 records from its network. They have generated five tapes of strong-motion records recorded from 1967 to 1975 in the United States and Latin America (Chile, Nicaragua, San Salvador, and Mexico).

Other digitized data recently received are punched cards containing strong-motion records from the March 4, 1977 earthquake in Rumania (recorded in Bucharest); the Gazli earthquake of May 17, 1976, in Uzbek, USSR; and three earthquakes in the New Madrid seismic zone (located in midcontinental United States) in 1975 and 1976.

Recent acquisitions include a magnetic tape of strong-motion records triggered by a swarm of earthquakes that rocked northern Italy near the town of Friuli in 1976; these were compiled by the National Commission for Nuclear Energy (CNEN) and have been given to the Center for distribution.

A table listing all digitized strong-motion records available on magnetic tape may be obtained free of charge from EDS/NOAA. Digitized strong-motion records may be purchased either in punched card format at $20 per record (including all three instrument components) or in tape format at $60 per tape.

Checks or money orders should be made payable to "Commerce/NOAA/NGSDC"; inquiries should be addressed to EDS/NOAA (see address below). Phone: (303) 499-1000, ext. 6744; FTS phone: 323-6477.

For reports or data regarding strong-motion records and data, address inquiries to the appropriate agency listed below:

1. EDS/NOAA
   National Geophysical and Solar-Terrestrial Data Center (D62)
   Boulder, CO 80302
2. NISEE/Computer Applications
   Davis Hall, UC Berkeley
   Berkeley, CA 94720
3. Open-file Services Section
   Branch of Distribution
   U.S. Geological Survey
   Box 25425, Federal Center
   Denver, CO 80225

4. California Division of Mines
   and Geology
   Office of Strong-Motion Studies
   2811 "O" Street
   Sacramento, CA 95816

5. National Technical Information Service
   U.S. Dept. of Commerce
   Springfield, VA 22151

Table 1. - *Summary of accelerograms recovered during September - December 1978*

Event	Station name (owner)	Station coord.	S-t (s)	Accl direction	Max Accl (g)	Duration (s)
11 November 1977- 25 August 1978 Palm Springs, Calif. Epicenter and magnitude unknown	Palm Springs north Post Office (USGS)	33.92 N 116.54 W	1.3	300° Up 210°	0.12 .03 .07	1-peak - -
28 March 1978 27 August 1978 S. Hawaii Epicenters and magnitudes unknown	Pahala, Hawaii Kau Hospital (USGS)	19.20 N 155.47 W	-		**	
	Honokaa, Hawaii Fire station (USGS)	20.081 N 155.465 W	-		**	
	Wahaula, Hawaii Visiter center (USGS)	19.33 N 155.03 W	1.4		**	
	Note: Three additional records were obtained at Visitor center; maximum acceleration less than 0.05 g.					
23 June 1978 0404 UTC S. California Epicenter and magnitude unknown	Salton Sea Nat'l Wildlife Refuge (USGS)	33.18 N 115.62 W	0.9	315° Up 225°	.08 .03 .02	
15 August 1978- 11 December 1978 Santa Barbara, Calif. Epicenter and magnitude unknown	Santa Barbara Courthouse basement (USGS)	34.434 N 119.712 W	1.7		**	

See footnotes at end of table.

Table 1. - *Summary of accelerograms recovered during September - December 1978* - Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Accl direction[3]	Max accl[4] (g)	Duration[5] (s)
4 October 1978 1642 UTC Bishop, Calif. 37.53N, 118.66W Magnitude 5.7	Pine Flat Dam (ACOE) †	36.83 N 119.33 W	-		**	
	Note: One event recorded at stations located at the toe, downstream, and outlet tower levels 2 and 5; maximum acceleration less than 0.05 g.					
	Buchanan Dam (ACOE) †	37.22 N 119.98 W	-		**	
	Note: One event recorded at stations located at the crest, abutment, and outlet tower upper and lower levels; maximum acceleration less than 0.05 g.					

[1] ACOE - U.S. Army Corps of Engineers
USGS - U.S. Geological Survey
† WWVB time code is incomplete or nonexistent; correlation of accelerogram with event is questionable.

[2] S-wave minus trigger time.
* Accelerograph equipped with horizontal starter; S-t time is not significant.

[3] Azimuthal direction of case acceleration for upward trace deflection on accelerogram (opposite direction to pendulum motion).

[4] Unless otherwise noted, maximum acceleration recorded at ground or basement level.
** Denotes maximum acceleration is less than 0.05 g at ground stations or less than 0.10 g at upper floors of buildings.

[5] Duration for which peaks of acceleration exceed 0.10 g.

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