C. 785-A

GEOLOGICAL SURVEY CIRCULAR 785-A

U.S. DEPARTMENT OF THE INTERIOR
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Seismic Engineering Program Report, January—April 1978

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

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1978

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 National Strong-Motion Network during the period January 1 through April 30, 1978. A report on the Strong-Motion information Retrieval System 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 U.S. Strong-Motion Program. The data summary presented in table 1 includes those accelerograms recovered (although not necessarily recorded) during the period January through April 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.

R. L. Porcella, Editor
U. S. Geological Survey
345 Middlefield Road MS 78
Menlo Park, California 94025

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Seismic Engineering Program Report

January - April 1978

RECENT STRONG-MOTION RECORDS

by R. L. Porcella

A magnitude 4.5 (m_b) earthquake on March 25, 16:27 local time triggered three accelerographs located at Coyote Dam (18 km from the epicenter), a U.S. Army Corps of Engineers (COE) facility approximately 175 km northeast of San Francisco near the town of Ukiah. The earthquake occurred off the coast of northern California at a depth of about 5 km and was felt in the Ukiah area; no damage was reported. The instrumentation is owned by the COE and operated by the U.S. Geological Survey (USGS) as part of the cooperative National Strong-Motion Network supported by the National Science Foundation.

Coyote Dam is an earthfill embankment approximately 1070 m long and 50 m high; the axis is alined in a nearly north-south direction. Accelerographs are located at the center crest, center toe, and south abutment and are equipped with horizontal starters; thus, the relatively short trigger minus S-wave intervals (approximately 0.5 s) recorded at the crest, toe, and abutment stations* are the result of the accelerographs being triggered by horizontal ground motion perhaps 2 to 3 s after the arrival of the first P-wave (fig. 1). Maximum accelerations recorded at the crest, toe, and south abutment stations are 0.30 g, 0.34 g, and 0.20 g, respectively (see table 1, end of report).

In addition to the magnitude 4.5 earthquake, three smaller aftershocks produced minor records at Coyote Dam (table 1). The maximum acceleration (0.11 g) was recorded on the crest instrument. Additionally, the California Division of Mines and Geology (CDMG) recovered several strong- motion records from CDMG stations located in the Willits-Ukiah area (Toppozada, 1978).

The Imperial Valley earthquake swarm of November 1977 (see Seismic Engineering Program Report, September-December 1977) produced 10 additional records that were collected subsequent to the initial record recovery on November 15. Maximum acceleration (0.21 g) was recorded at El Centro Array Station 6 (table 1).

Additionally, minor records were recovered from unidentified earthquakes at Wahaula and Pahala, Hawaii, and at Carbon Canyon Dam near the city of Brea in southern California.

Event information in table 1 was gathered largely from the National Earthquake Information Service periodical Preliminary Determination of Epicenters, published by the USGS.

Reference: Toppozada, T. R., 1978, Earthquakes in the Willits-Ukiah area: California Div. Mines and Geology, California Geology, June 1978, p. 146-147.

*Notice: The records obtained during the 16:27 earthquake from the crest and toe of Coyote Dam are being withheld at the request of the Army Corps of Engineers, the ASCE committee on Soil Dynamics, the U.S. Committee on Large Dams, and California Division of Dam Safety. These groups are sponsoring a study of current analytical procedures for predicting the response of earth dams to earthquake excitation. For further details about the study, contact:

Frank G. McLean
South Pacific Division of
Army Corps of Engineers
630 Sansome St., Rm 1233
San Francisco, CA 94111
(415) 556-4705

Leslie T. Youd
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
(415) 323-8111 ext. 2657

STRONG-MOTION INFORMATION RETRIEVAL SYSTEM

by A. M. Converse

A major objective of the Strong-Motion Instrumentation Program is to serve the needs of strong-motion data users who are involved in earthquake engineering research concerned with the improvement of structural design practices and the reduction of earthquake hazards. An important task defined for the program is the timely dissemination of information regarding strong-motion data records and the circumstances in which the records were taken. In order to make such information readily available, it is being entered into a computer data-base management system. The system provides ready access to information about strong-motion records, recording sites, and recorded events. It should prove to be of considerable value in the aftermath of a major event by providing immediate information to persons involved in research, design, operations, and regulation.

The information of primary importance is that which describes strong-motion records and the level of processing and analysis that has been performed on them. Information about each event that triggered recorded motion and about the recording stations is also of major importance. Supplementary data sets include instructions and general information about the system, additional information about the stations, recorders, and tranducers, and identification of the organizations that own the instruments, that have additional information about the stations and sites, or that archive the original records. The specific information included in each data set is indicated in table 2.

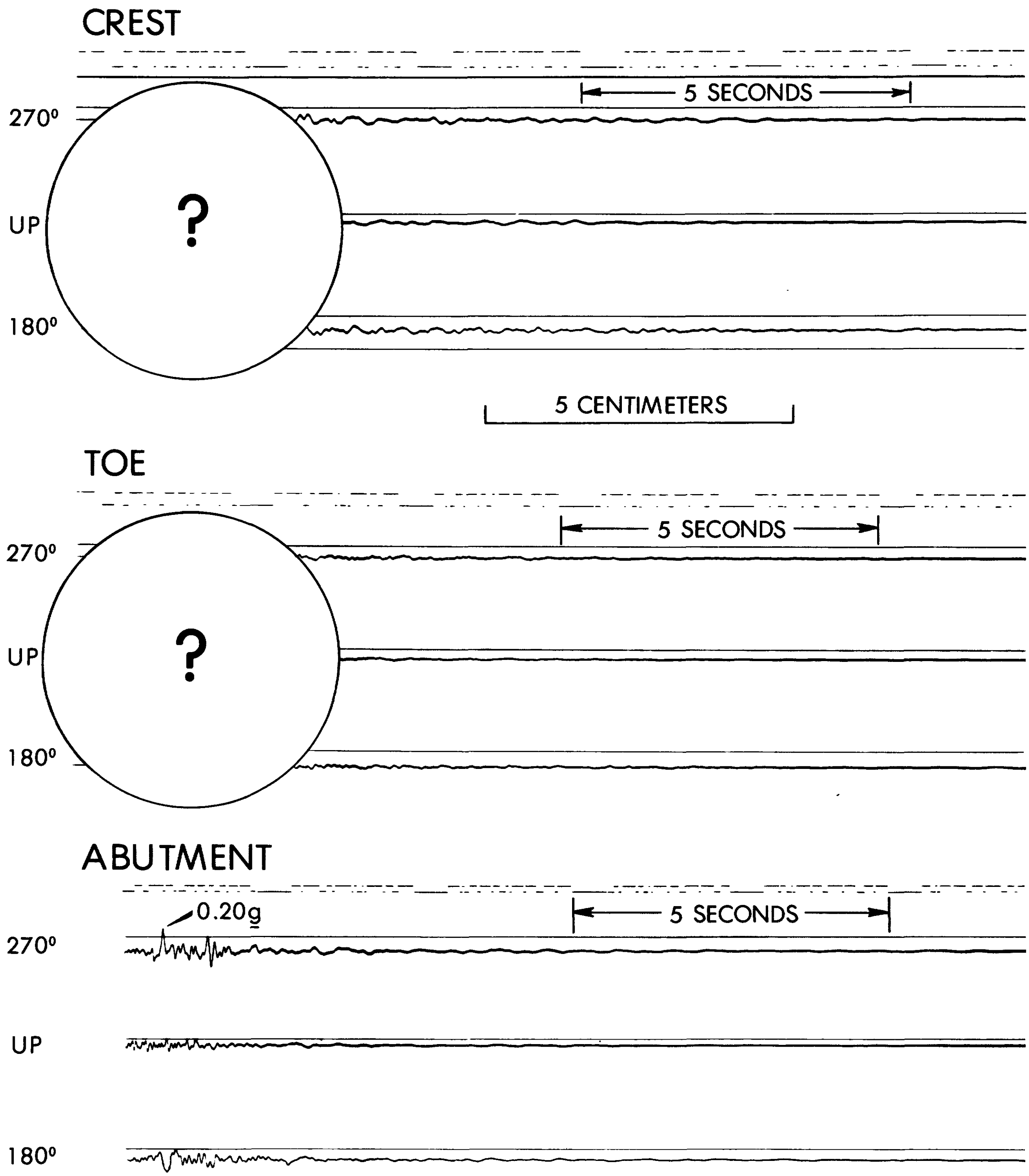

Fig. 1.- Coyote Dam accelerograms from the northern California earthquake of 16:27 local time, March 25, 1978.

Table 2.-- *Data sets*

EVENTS
- event identification (date & suffix)
- time (local or GMT)
- event name
- location: Latitude
  Longitude
- magnitude
- maximum intensity
- references

RECORDS
- event identification
- station number
- substation identification
- transducer level or location
- recorder identification(s)
- s-trigger interval, s
- epicentral distance, km
- intensity at the site
- total length of record
- peak acceleration
- duration >0.1g
- who has the original record
- references

DATA ANALYSES
- who digitized the data
- who has the digitized data
- length of record digitized
- highest stage of analysis
- stage 2 frequency band
- data processing type
- references

STATIONS
- station number
- station name (or street address)
- station location (or city)
- state (or country)
- nearby stations
- references

SUBSTATIONS
- substation identification
- date of installation
- date of removal
- Location: latitude
  Longitude
- geology: Class code
- near-surface shear wave vel.
- structure: Class code
  Size
  Short description
- remarks

ARRAYS
- array name
- list of stations and their substations in the array
- remarks

NEARBY STATIONS
- station number
- list of nearby stations
- remarks

RECORDERS
- recorder identification
- owner agency
- date of installation
- date of removal
- remarks

TRANSDUCERS
- transducer serial number
- date of installation
- date of removal
- location: Code
  Short description
- direction of acceleration
- orientation
- trace location on record
- remarks

TRANSDUCER CALIBRATIONS
- calibration date
- sensitivity
- period
- damping
- remarks

RECORDER TYPES
- recorder type code
- descriptions

AGENCIES
- owner-agency code
- name, address, contact and other remarks

At present, the information included is restricted to that for which the USGS has a primary responsibility. The data sets may be expanded in the future to include information about all strong-motion programs in the U.S. In addition, the computer programs will be available to other organizations that operate strong-motion programs in other parts of the world so that information about strong-motion data can be exchanged in an efficient manner.

The system can be interrogated using an ordinary telephone and an interactive keyboard terminal that operates in full duplex mode and uses ASCII character codes. Once accessed, the system will give the user a general introduction and will tell him how to retrieve and display more specific instructions and guidelines from the data base itself. Access the system in the following manner:

1) Set the switches, keys, or buttons on the terminal that allow a choice of operation modes:
   transmission speed = 30 cps
   half duplex
   on-line
   lower-case ASCII characters

2) Plug in and turn on the terminal; turn on the acoustic coupler if it is a separate device.

3) Telephone the USGS computer at Menlo Park: dial (415) 326-4350 and wait for a high-pitched tone.

4) Quickly place the telephone handset in the cradle on the acoustic coupler. Look for a label or diagram that will show you in which direction the telephone cord should go. Watch for the "carrier detect" light to turn on, indicating that the terminal is properly receiving the signal.

5) 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, and other information.

6) Type: enter < your-name> Sebdb < cr> < lf>
where < cr> is the carriage-return key,
< lf> is the line-feed key, and

< your_name> is your name typed without any embedded blanks.
Note that the "S" in "Sebdb" is upper case.

7) From now on, the system will prompt you whenever it expects you to type something. 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 problems arise, contact April Converse (415-323-8111, ext. 2881 or FTS 467-2881).

NEW INSTRUMENTATION FOR PACOIMA DAM

by C. Rojahn

Pacoima Dam, a 113.5-m-high reinforced concrete arch dam located approximately 32 km north of downtown Los Angeles, was recently instrumented with a 17-channel remote-recording accelerograph system. The system, installed and maintained by the California Division of Mines and Geology under the California Strong-Motion Instrumentation Program, consists of two CRA-1 analog film recorders, three 3-component FBA-3 accelerometer packages, and eight single-axis FBA-1 accelerometers. A water pressure transducer, to be located at the center of the upstream face approximately 47 m below the crest, is planned for installation at a later date. The accelerometer locations were selected on the basis of a forced-vibration test of the dam conducted by Ray Clough of the University of California at Berkeley after the 1971 San Fernando earthquake. The three-component accelerometer packages are located at the base of the dam, left abutment, and right abutment; the single-axis horizontal accelerometers are located on the crest and on the downstream face at 80 percent of the dam height (fig. 2). A triaxial self-contained accelerograph, which is interconnected with the CRA-1 systems on the dam, is located approximately 45 m downstream of the dam at ground level. The entire system is triggered into operation when vertical ground acceleration at the site exceeds 0.01 g.

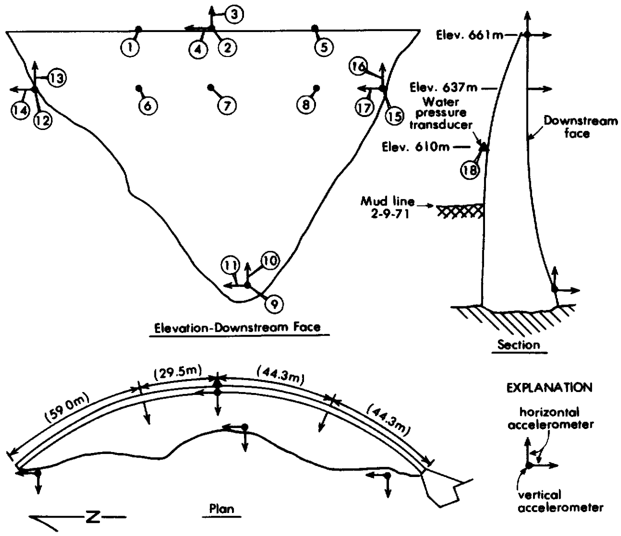

Fig. 2.- Pacoima Dam strong-motion instrumentation scheme. Accelerometers 1, 2, 5, 7, and 8 to be attached to face of dam to sense horizontal motions in radial direction (that is, normal to midsurface line at that elevation). Accelerometers 9, 12, and 15 to be oriented parallel to accelerometer 2. Triaxial self-contained accelerograph at downstream "free-field" site to have same orientation as triaxial package at base of dam (accelerometers 9, 10, and 11).

CHANGES ON STRONG-MOTION RECORD LABELS

by R. P. Maley

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 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

Horizontal directions will henceforth 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 the following:

315°
(Down)
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.

ABSTRACTS OF RECENT REPORTS

USE AND INTERPRETATION OF STRONG-MOTION RECORDS FROM HIGHWAY BRIDGES

by J. D. Raggett and Christopher Rojahn

This report describes how strong-motion records obtained from the earthquake-induced motions of highway bridges may be analyzed for use in the evaluation of bridge design procedures. The report is divided into five principal sections. The first section describes strong-motion instrumentation and strong-motion records. The second describes a mathematical model for the dynamic response of bridges to strong ground shaking. The third section describes how analog records scaled by hand can be analyzed. Force levels throughout bridges and mathematical model parameters are found from hypothetical strong motions for two example bridges. The fourth section describes how digitized records can be analyzed and discusses a linear least-squares fitting procedure in the time domain for identifying mathematical model parameters from recorded strong motions. Hypothetical motions for three example bridges are analyzed using this procedure to yield best-fit mathematical models. The last section consists of appendices; included are a more extensive introduction to dynamics of structures and lists of the programs used to identify the best-fit mathematical models.

Reference: U.S. Geol. Survey Open-File Report 78-707, July 1978, 168 p. (Prepared on behalf of the U.S. Dept. of Transportation.)

NOTES ON STRONG-MOTION INFORMATION SOURCES

PROMPT REPORT ON STRONG-MOTION ACCELEROGRAMS

No. 13 (Izu-Oshima-Kinkai earthquake of January 14, 1978)
No. 14 (Miyagi-Ken-Oki earthquake of February 20, 1978)

This periodical is compiled by the Strong-Motion Earthquake Observation Council and published by the National Research Center for Disaster Prevention, Science and Technology Agency, when there is a strong-motion earthquake producing accelerograms with peak accelerations greater than 80 gal. The reports are intended to disseminate promptly, prior to the annual publication, brief information on accelerograms recovered during the earthquake to the appropriate community of data users. Information in these reports is preliminary and may be corrected in the annual publication (Strong-Motion Earthquake Records in Japan).

Information regarding this periodical may be obtained from the Strong-Motion Earthquake Observation Council, National Research Center for Disaster Prevention, No. 15-1 Ginza 6-chome, Chuoku, Tokyo, Japan.

ANNUAL REPORT ON STRONG-MOTION EARTHQUAKE RECORDS IN JAPANESE PORTS (1976 AND 1977)

Technical note of the Port and Harbour Research Institute ministry of Transport, Japan
No. 287, March 1978

In the major ports of Japan, the strong-motion earthquake and the earthquake response of structures have been observed for 17 years, and as of December 1977, 1211 accelerograms have been accumulated and analyzed by the Earthquake Resistant Structures Laboratory. The observation network consists of 69 strong-motion accelerographs; 52 accelerographs are located on the ground and the rest are on structures. Two types of accelerographs, the SMAC-B2 and the ERS, are being used. This report presents all the records obtained in 1976 and 1977; they are listed in tables that include maximum accelerations. The accelerograms with maximum accelerations exceeding 20 gal are reproduced in the form of computer plots. For ground records with maximum accelerations larger than 50 gal, digitized records, response spectra, and integrated velocities and displacements are included.

Information regarding these publications may be obtained from the Strong-Motion Earthquake Observation Council, National Research Center for Disaster Prevention, No. 15-1 Ginza 6-chome, Chuoku, Tokyo, Japan.

DURATION, SPECTRAL CONTENT, AND PREDOMINANT PERIOD OF STRONG-MOTION EARTHQUAKE RECORDS FROM THE WESTERN UNITED STATES

by Frank K. Chang and Ellis L. Krinitzsky
Soils and Pavement Laboratory
U.S. Army Engineer Waterways Experiment Station
P.O. Box 631, Vicksburg, Miss. 39180

The main purpose of this investigation was to assess the duration and spectral content of strong-motion earthquake accelerograms and, indirectly, to consider their applicability in earthquake design. Correlations of duration with Modified Mercalli intensity for the near and far fields and for Richter magnitude have been obtained. Difference in durations for soil and rock sites was determined. A set of relations between the duration and distance for soil and rock sites was established from records of the San Fernando earthquake of February 9, 1971 (mag. 6.5). Values for other magnitudes were extrapolated. Duration is taken to be the time interval between the first and last peaks of acceleration equal to or greater than 0.05 g.

The spectral content in the range of 0.1-10 Hz for strong-motion records in the western United States (acceleration equal to or greater than 0.05 g) was processed with the modified Nigam and Jennings response spectra computer programs. The corrected accelerograms on the digital magnetic tapes of NIS 130, 131, and 132 provided by the California Institute of Technology were the input data for this study. Critical damping ratios of 5.0, 7.5, and 10.0 percent were assigned to the soil (soft, alluvial), intermediate (firm sediments), and hard-rock sites, respectively. The relative response spectral amplitudes of acceleration, velocity, and displacement were reduced to the ground surface by dividing the relative response spectral amplitude by the dynamic amplification factor of 1/2 h, where h is the critical damping ratio. The frequency-amplitude spectra were then plotted as a function of magnitude, epicentral distance, and site conditions.

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* Inclusion of strong-motion information sources is intended as a service to our readers and does not constitute endorsement of these reports by the U.S. Geological Survey.

DATA REPORTS AND AVAILABILITY OF DIGITIZED DATA

ROMANIAN EARTHQUAKE OF MARCH 4, 1977

The digitization and processing of the Bucharest strong-motion record from the Romanian earthquake of March 4, 1977 have been completed:

A set of punched cards of uncorrected accelerations and corrected acceleration, velocity, and displacement is available from NGSDC/EDS/NOAA, Mail Code D62, Boulder, CO 80302 (approximately 1/2 box; cost $20.00).

A preliminary set of plots of the corrected data and the response and duration spectra are available from the Seismic Engineering Branch, USGS.

GAZLI, U.S.S.R. EARTHQUAKE OF MAY 17, 1976

The accelerogram from the Gazli earthquake of May 17, 1976 was digitized on a Soviet-built semi-automatic digitizer at a constant time interval (ΔT) equal to 0.00657 s. The data are in tabular form, with 75 units equivalent to 1000 cm/s^2. The values listed are relative to a baseline that was drawn through the trace; no baseline correction has been applied. The order of data points is given in columns, from top to bottom, left to right. Further information on the earthquake and strong-motion record is published in two previous issues of the Seismic Engineering Program Report, U.S. Geol. Survey Circ. 736-D and 762-A. Copies of the digitized data and Program Reports are available from Seismic Engineering Branch, USGS.

U. S. STRONG-MOTION NETWORK DATA

The strong-motion records from the February 9, 1971 San Fernando earthquake and most of the significant records prior to that event have been digitized by the California Institute of Technology (CIT). 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.

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). A report containing digitized data and spectra for the significant records collected in 1971 has been released as Open-file Report 76-609. A second report (Open-file Report 77-587) contains the results of the processing of 10 strong-motion records obtained from Lima, Peru during the period 1951 to 1974. These reports are available from the Open-File Services Section, Branch of Distribution, Box 25425, Federal Center, Denver, CO 80225. Tapes containing the numerical data are available from the Environmental Data Service (see below).

Future reports will summarize records recovered during 1972, 1973, 1974, and 1975; table 3 (end of report) lists the records to be contained in each of these data reports.

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) in the forms indicated below. 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.

CIT Volume I data (uncorrected) on cards: EDS
CIT Volume I data on tape: EDS and NISEE
CIT Volume II data (corrected) and Volume III data (response spectra) on tape: NISEE
SEB 1971 data (complete): EDS and NISEE

Inquiries should be addressed to:

1. EDS/NOAA
   National Geophysical and Solar-Terrestrial Data Center
   Mail Code D-62
   Boulder, CO 80302

2. NISEE/Computer Applications
   Davis Hall, UC Berkeley
   Berkeley, CA 94720

3. Seismic Engineering Branch, USGS
   345 Middlefield Rd., Mail Stop 78
   Menlo Park, CA 94025

ERRATA

REFERENCE	ERROR	CORRECTION
CIT; EERL S-M earthquake accelerograms, digitized & plotted data; vol II, III, IV; Part B; Record 037 (1966 Parkfield earthquake)	Temblor, Calif. No. 2 USGS Station No. 1097 35°45'07" N 120°15'52" W	Temblor, Calif. USGS Station No. 1438 35°42'36" N 120°10'12" W
Same as above: vol I, II; Part C Record 041 (1971 San Fernando earthquake; Component direction - Pacoima Dam accelerogram)	L - S74W V - Down T - S16E	L - N76W V - Down T - S14W
USGS S-M Station No. 1250; Gilroy, Gavilan College (Component direction - all S-M records since Oct. 1972	L - S67W V - Down T - S13E	L - S67W V - Down T - S23E
USGS S-M Station No. 2420 New Madrid, Mo. (Component direction - events of 6-13-75 and 3-24-76)	L - S19W V - Down T - S71E	L - West V - Down T - South
USGS S-M Station No. 181; Los Angeles, 1640 Marengo, 1st floor (component direction prior to 7-15-70)	L - N36W V - Down T - S54W	L - S54W V - Down T - S36E
NOTE: Since 7-15-70, the 1st floor (also 4th floor and roof) component directions are:		L - N36W V - Down T - S54W
Geol. Survey Circ. 762-B Seismic Engineering Program Report, May-Aug. 1977	Figures 2, 3, and 4 reduced (strong-motion records)	Enlarge 38%, 22%, and 10%, respectively

Table 1.- *Summary of accelerograms recovered during January - April 1978*

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
7 June 1977- 16 November 1977 S. Hawaii Epicenters and magnitudes unknown	Wahaula, Hawaii Visitor center (USGS)	19.33 N 155.03 W				
	Note: Three unidentifiable records were obtained at Wahaula; maximum acceleration less than 0.05 g.					
9 June 1977- 10 November 1977 S. Hawaii Epicenters and magnitudes unknown	Pahala, Hawaii Kau Hospital (USGS)	19.20 N 155.47 W	-	155°	0.05	-
				Up	.02	-
				065°	.03	-
	Note: One additional record was obtained at Pahala; maximum acceleration less than 0.05 g.					
13 October 1977- 3 March 1978 S. California Epicenter and magnitude unknown	Carbon Canyon Dam Crest (ACOE)	33.91 N 117.84 W	2.9		**	
3 October 1977- 21 March 1978 Imperial Valley Epicenter and magnitude unknown	Niland, Calif. Fire station (CDMG)	33.24 N 115.51 W	1.7	090°	.11	1-peak
				Up	.04	-
				360°	.04	-
4 November 1977- 20 March 1978 Imperial Valley Epicenters and magnitudes unknown	El Centro Array 2 Keystone Rd. (USGS)	32.92 N 115.37 W				
	Note: Two records were obtained at Array 2; maximum acceleration less than 0.05 g.					
14 November 1977- 20 March 1978 Imperial Valley Epicenters and magnitudes unknown	El Centro Array 6 Huston Rd. (CDMG)	32.84 N 115.49 W	2.2	230°	.14	1-peak
				Up	-	-
				140°	.21	0.3
			2.1	230°	.07	-
				Up	-	-
				140°	.17	1-peak
			2.1		**	
			2.0	230°	.04	-
				Up	-	-
				140°	.06	-
15 November 1977 1913 UTC Imperial Valley 32.83N, 115.47W Magnitude 3.4	El Centro Array 7 Imp. Valley College (USGS)	32.83 N 115.50 W	1.1		**	

See footnotes at end of table.

Table 1.- *Summary of accelerograms recovered during January - April 1978* - Continued

Event	Station name (owner)[1]	Station coord.	S-t[2] (s)	Direction[3]	Max accl[4] (g)	Duration[5] (s)
15 November 1977 2200 UTC Imperial Valley Epicenter and magnitude unknown	El Centro Array 7 Imp. Valley College (USGS)	32.83 N 115.50 W	1.6	230° Up 140°	0.05 .03 .06	- - -
15 November 1977- 23 March 1978 Imperial Valley Epicenter and magnitude unknown	El Centro Array 9 Commercial Ave. (USGS)	32.79 N 115.55 W	-		**	
11 December 1977 0557 UTC Imperial Valley 32.57N, 115.32W Magnitude 3.4	Bonds Corner, Calif. Ground level (USGS)	32.693N 115.338W	-		**	
26 March 1978 0027 UTC N. California 39.09N, 123.34W Magnitude 4.5	Coyote Dam, crest Ukiah, Calif. (ACOE)	39.20 N 123.18 W	*	270° Up 180°	.25 .14 .30	1.0 0.3 1.3
	Coyote Dam, toe Ukiah, Calif. (ACOE)	39.20 N 123.18 W	*	270° Up 180°	.34 .09 .22	1.1 - 1.2
	Coyote Dam, abutment Ukiah, Calif. (ACOE)	39.19 N 123.18 W	*	270° Up 180°	.20 .07 .11	0.8 - 1-peak
26 March 1978- 27 March 1978 N. California Epicenters and magnitudes unknown	Coyote Dam, crest Ukiah, Calif. (ACOE)	39.20 N 123.18 W	*	270° Up 180°	.11 .04 .07	1-peak - -

Note: Two additional aftershocks recorded at crest station and three aftershocks each recorded at abutment and toe stations. Maximum acceleration less than 0.05 g.

[1] ACOE - U.S. Army Corps of Engineers
CDMG - California Division of Mines and Geology
USGS - U.S. Geological Survey

[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.

Table 3.- *Records being processed for data reports*

Date of event	Station location	Maximum accl (g)†
	1972	
January 3, 1972	Managua, Nicaragua; Esso Refinery	0.15
January 5, 1972	Managua, Nicaragua; Esso Refinery	.22
	Managua, Nicaragua; National University	.12
March 4, 1972	Bear Valley, Calif.; Melendy Ranch barn	.15
March 22, 1972	Bear Valley, Calif.; Melendy Ranch barn	.16
July 30, 1972	Sitka, Alaska; Magnetic Observatory	.11
August 27, 1972	Beverly Hills, Calif.; 8383 Wilshire*	.15
	Beverly Hills, Calif.; 9100 Wilshire*	.12
	Los Angeles, Calif.; 6300 Wilshire*	.10
	Los Angeles, Calif.; 6420 Wilshire*	.15
September 4, 1972	Bear Valley, Calif.; CDF Fire Station	.18
	Bear Valley, Calif.; Melendy Ranch barn	.48
	Bear Valley, Calif.; Stone Canyon East	.18
December 23, 1972	Managua, Nicaragua; Esso Refinery	.39
Aftershock B	Managua, Nicaragua; Esso Refinery	.17
Aftershock C	Managua, Nicaragua; Esso Refinery	.32
	1973	
February 21, 1973	Port Hueneme, Calif.; U.S. Naval Laboratory	0.13
March 31, 1973	Managua, Nicaragua; National University	.60
April 26, 1973	Kilauea, Hawaii; Namakani Paio Campground	.17
August 8, 1973	Ferndale, Calif.; Old City Hall	.14
September 16, 1973	Berryessa, Calif.; CDF Fire Station	.18
	1974	
January 31, 1974	Gilroy, Calif.; Gavilan College, Bldg. 10	0.16
February 11, 1974	Los Angeles, Calif.; 420 S. Grand*	.10
	Los Angeles, Calif.; 525 S. Flower, No. Tower*	.13
	Los Angeles, Calif.; 700 W. 7th*	.18
	Los Angeles, Calif.; 533 S. Fremont*	.25
August 14, 1974	Pacoima Dam, abutment	.12
	Vasquez Rocks Park, Calif.	.10
November 28, 1974	Hollister, Calif.; City Hall	.17
	San Juan Bautista, Calif.; 24 Polk St.	.12
	Gilroy, Calif.; Gavilan College Bldg. 10	.14
December 6, 1974	Imperial, Calif.; Imperial Valley College Adm. Bldg.	.11
	1975	
January 11, 1975	Petrolia, Calif.; General Store	0.10
	Cape Mendocino, Calif.; Petrolia	.19
January 23, 1975	Imperial, Calif.; Imperial Valley College Adm. Bldg.	.11
March 6, 1975	Bear Valley, Calif.; Melendy Ranch East	.18
May 6, 1975	Shelter Cove, Calif.; Station 2 Power Plant Yard	.18
June 7, 1975	Ferndale, Calif.; Old City Hall	.19
	Cape Mendocino, Calif.; Petrolia	.22
	Petrolia, Calif.; General Store	.19
	Shelter Cove, Calif.; Station 2 Power Plant Yard	.10

See footnotes at end of table.

Table 3.- *Records being processed for data reports* - Continued

Date of event	Station location	Maximum accl ($\underline{g}$)†
June 19, 1975	El Centro Array, Calif.; Station 6, 551 Huston	0.10
June 20, 1975	El Centro Array, Calif.; Station 6, 551 Huston	.13
	Holtville, Calif.	.15
August 1, 1975	Oroville Dam, Calif.; Crest	.13
	Oroville Dam, Calif.; Seismograph station	.11
August 2, 1975	Pleasant Valley Pumping Plant, Calif.	.08
	Pleasant Valley, Calif.; Switchyard	.13
September 13, 1975	Parkfield Grade, Calif.; Jack Varian Ranch	.14
	Vineyard Canyon, Calif.	.18
November 14, 1975	Ferndale, Calif.; Old City Hall	.18
	Cape Mendocino, Calif.; Petrolia	.13
	Petrolia, Calif.; General Store	.10
November 29, 1975 0335 (local time)	Hilo, Hawaii; Univ. Hawaii Cloud Physics Lab.	.15
November 29, 1975 0447 (local time)	Honokaa, Hawaii; Central Service Bldg.	.11

† Maximum acceleration at ground or basement level.
* The records from the upper levels of these buildings are being digitized.

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