GEOLOGICAL SURVEY CIRCULAR 713

Seismic Engineering Program Report, October-December 1974

Prepared on behalf of the National Science Foundation

Seismic Engineering Program Report, October-December 1974

GEOLOGICAL SURVEY CIRCULAR 713

Prepared on behalf of the National Science Foundation

1974

United States Department of the Interior

ROGERS C. B. MORTON, *Secretary*

Geological Survey

V. E. McKelvey, *Director*

First printing 1974

Second printing 1975

Free on application to the U.S. Geological Survey, National Center, Reston, Va. 22092

PREFACE

The Seismic Engineering Branch (SEB) of the U.S. Geological Survey (formerly the Seismological Field Survey of the National Oceanic and Atmospheric Administration) is pleased to issue this "Seismic Engineering Program Report," an informal document designed to keep the ever-growing community of strong-motion data users appraised of the activities and findings of this office. The report is similar in style and content (though not in title) to the "Quarterly Engineering Seismology Bulletin," a limited distribution publication issued by the Seismological Field Survey from 1949 to 1965.

This particular report lists the strong-motion accelerograph data generated in 1972 and 1973 and describes the status of the strong-motion program in general.

Christopher Rojahn
Data Management,
Seismic Engineering Branch

CONTENTS

ILLUSTRATION

TABLES

Requests for data or information should be submitted to:

Seismic Engineering Branch
U.S. Geological Survey
Attention: Data Management
390 Main Street, Room 7067
San Francisco, California 94105
(415) 556-7768

Seismic Engineering Program Report, October-December 1974

CURRENT STATUS OF THE SEISMIC ENGINEERING PROGRAM

INTRODUCTION

By an interagency agreement among the U.S. Geological Survey of the Department of the Interior, the National Science Foundation (NSF), and the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, the responsibility for the strong-motion engineering seismology program conducted by NOAA's Seismological Field Survey (SFS) was transferred to NSF effective May 27, 1973. In assuming responsibility for the SFS program, NSF agreed to provide program policy, management, and funding. The USGS was selected by NSF to be the operating agency for the SFS, which has subsequently been renamed the Seismic Engineering Branch (SEB), a unit of the Office of Earthquake Studies in the Geologic Division of the USGS.

NSF has indicated that the functions of the program are to develop a national network of strong-motion instrumentation, to maintain this network, and to process, manage, and disseminate the strong-motion data. The program defined by this general charge is primarily one of an operational nature (to serve the needs of research studies in strong-motion seismology and earthquake engineering).

Thus, the primary objective of SEB's strong-motion program is to obtain and disseminate the strong-motion data that are of importance in research studies and applications in earthquake engineering and earthquake hazard reduction. This current emphasis involves corollary functions of network operations and data management. At the present time, of the 18 members of the SEB staff, 11 are working in network operations and 5 in data management.

NETWORK OPERATIONS

In 1932 the United States Coast & Geodetic Survey (C&GS) inaugurated a program of strong-motion seismological work designed to furnish the engineer and interested others with data considered essential to the design of earthquake resistant structures. The responsibility for organizing an instrumentation network to achieve this objective was assigned to SEB's predecessor, the Seismological Field Survey. The program was initiated with the installation of nine low-sensitivity short-period seismographs (accelerographs) in structures selected for special studies by local engineers. Less than 8 months later, instruments installed at Los Angeles, Vernon, and Long Beach, Calif., recorded the disastrous 1933 Long Beach earthquake. These first useful records of damaging earthquake motions showed amplitudes as large as 0.25 g, thus justifying the program and furnishing the impetus for additional efforts. Consequently, the network was rapidly expanded to 50 instruments located primarily in the San Francisco and Los Angeles areas but extending to other seismic regions of the Western United States as well. The principal instrument used in this network was the strong-motion accelerograph designed by the C&GS in cooperation with the U.S. Bureau of Standards.

During the succeeding 30 years, there was gradual improvement in the quality of instrumentation and a slow increase in the total number of strong-motion seismographs in the network. By 1962 the network consisted of 70 accelerographs and more than 100 seismoscopes,

a low-cost instrument developed to supplement the existing accelerograph.

In 1963 the first commercially designed accelerograph featuring numerous engineering and electronic improvements was marketed in California. This instrument overcame many of the inadequacies of the earlier accelerograph and consequently ushered in an era of substantial expansion in the strong-motion network. Further encouraged by several newer and less expensive instruments that have been manufactured in recent years, the network has continued to enlarge at an accelerating pace. Between 1963 and the present time the number of accelerographs has increased from 70 to approximately 1,200, including a large number of instruments installed east of the Rocky Mountains and in Alaska, Hawaii, and Puerto Rico (fig. 1).

From its inception, the program has received the cooperation of many outside organizations and individuals. In the early years, housing and facilities were provided by private and public organizations, and in recent years, a large number of accelerographs purchased by other organizations have been incorporated into the network. In fact, more than 900 of the accelerographs installed since 1963 are the result of major contributions by two Federal agencies (the U.S. Army Corps of Engineers and the Veterans Administration), two California State agencies (the Division of Mines and Geology and the Department of Water Resources), and the numerous building departments whose codes require instrumentation at various levels of high-rise buildings. Approximately one-half of the total number of accelerographs in the network at the present time are those operating in high-rise buildings. Thirty-one other organizations have also provided instrumentation that is now incorporated in the strong-motion network.

Since 1964, three field offices have been established to conduct operations in various geographic areas. In 1965 a Los Angeles office was opened and is now staffed with four men to operate the instrumentation in southern California and western Arizona. In 1973 one-man offices were opened in Las Vegas, Nev., and Columbia, S.C., to operate the network respectively in the Rocky Mountain states and in the central and eastern regions of the country.

DATA MANAGEMENT

When the number of instruments and records were small, little was required in the way of data management. Annual listings and reports served the needs of the relatively small but actively interested research and engineering community. As the number of records collected each year and the number of instruments have increased, the community of users has also greatly expanded. Thus, it has become necessary to create an efficient data management program.

As presently conceived, SEB's data management program consists of three subactivities: (1) an archival system to catalog and provide secure storage for the original earthquake records, (2) a data processing system for reproducing analog copies and for digitizing the records and producing routine spectra, and (3) an information dissemination system for collecting information about the strong-motion program and disseminating this information to the user community.

Archiving System

Archiving of the 3,100 existing strong-motion accelerograms and displacement records obtained from the national network has already commenced at SEB's San Francisco facility. It is anticipated that the process will be completed sometime within the next few months.

Data Processing System

In conjunction with the California Institute of Technology (CIT) and the Environmental Data Service (EDS) of NOAA, SEB is now in the process of establishing a data service for providing on request the following products to the user community:

1. Blue-line copies of analog records (not digitizable).
2. Digitized strong-motion data (available on lists, card decks, or magnetic tape).

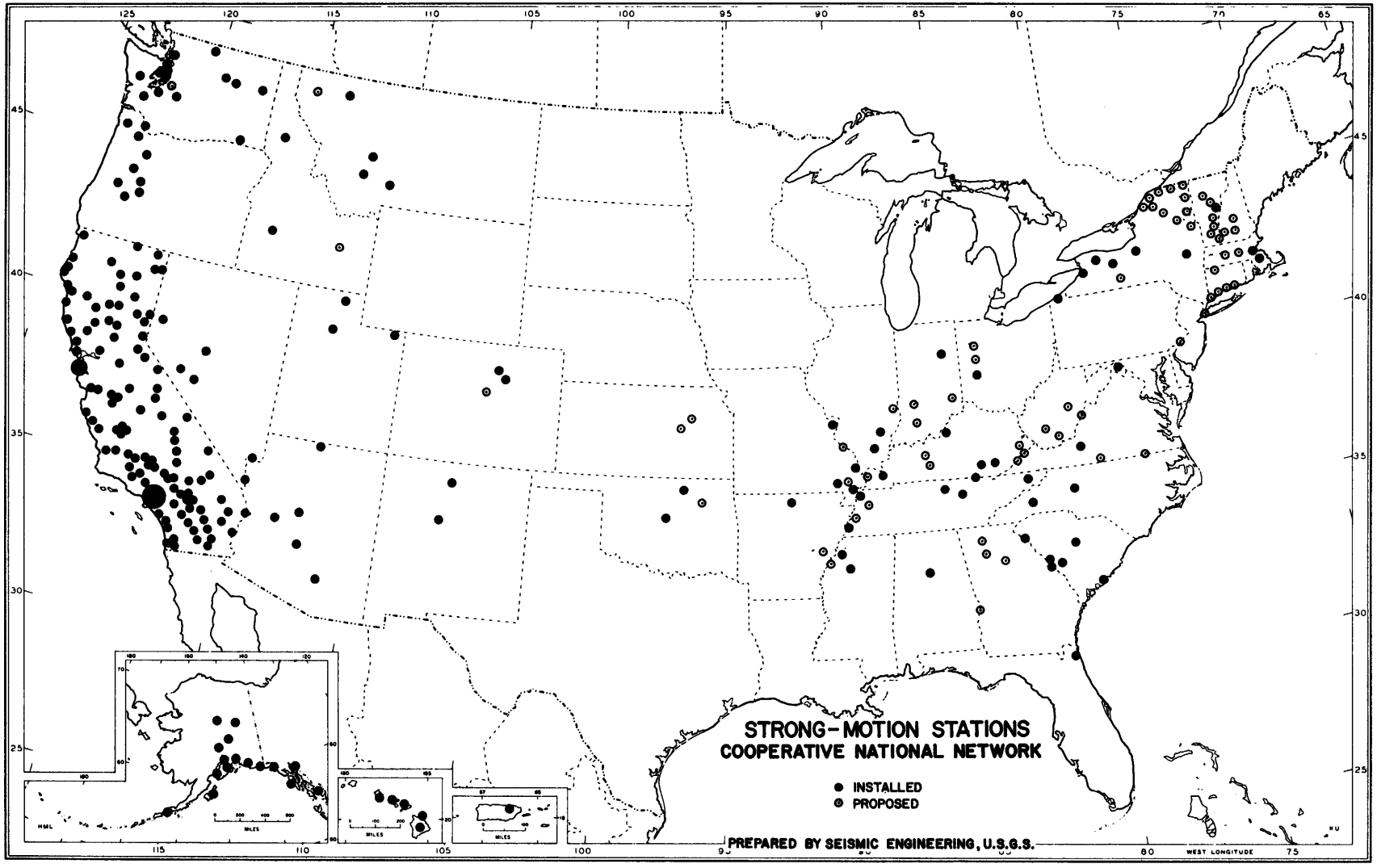

FIGURE 1.—Strong-motion stations in the cooperative national network.

3. Response and Fourier Spectra for all significant records (available as plots, on lists, card decks, or magnetic tape).

The digitization and routine analysis capabilities will be patterned after the CIT 1971 San Fernando Earthquake strong-motion record digitization and analysis program. The data will be made available either through this office or through EDS, Boulder, Colorado.

Information Dissemination Service

SEB intends to distribute information describing the national network of strong-motion instruments and the records derived therefrom through the following specialized reports:

1. "Strong-Motion Accelerograph Station Locations"—Lists all accelerograph stations in the national network; contains the following for each station: station number, station location, coordinates, structure type/size, instrument location(s), and source(s) for data.
2. "Strong-Motion Accelerograph Station Descriptions"—Lists station descriptions; contains for each station, in addition to the information provided in the "Strong-Motion Accelerograph Station Locations," short, succinct paragraphs describing the geology and soil conditions at the site and the structure in which the instrumentation is housed.
3. "Catalog of Strong-Motion Records"—Gives historical listing of strong-motion records generated in the national network of strong-motion instruments. Records will be listed by station.

In addition, SEB is also compiling individual station descriptions that are more complete than those listed in "Strong-Motion Accelerograph Station Descriptions." Such descriptions will be filed at SEB's main facility and will be available as open-file reports.

Eventually, SEB hopes to create a computerized strong-motion data storage and retrieval system that can be queried by any interested user via remote terminal.

ACCELEROGRAPH RECORDS IN 1972 AND 1973

More than 450 accelerograph records were obtained during 1972 and 1973 from the National Strong-Motion Instrumentation Network operated by the U.S. Geological Survey. The following paragraphs summarize the results of the more important United States earthquakes recorded:

Sitka, Alaska, 30 July 1972

A magnitude 6.5 (NOAA) earthquake occurred approximately 35 km east of Sitka on July 30, triggering accelerographs located at that city as well as at Juneau and Yakutat. Maximum horizontal ground accelerations of 0.09 g and 0.11 g were recorded at the Sitka station. Records were insignificant at the other two sites with the ground motion barely surpassing the instrument's triggering threshold.

The earthquake was felt over 130,000 km^2 and had a maximum intensity of VII.

Beverly Hills, Calif., 27 August 1972

A magnitude 3.2 (PAS) earthquake occurred in the center of a cluster of instrumented high-rise buildings in Beverly Hills on August 27. Consequently, 95 accelerograph records were obtained from 32 structures located between 1 and 11 km of the epicenter, 25 of these within 5 km. Maximum ground accelerations exceeding 0.05 g were recorded at 12 buildings; accelerations exceeding 0.10 g were also recorded in the upper levels of three other buildings. Duration of the relatively high amplitude motions was short, averaging one-half second or less.

The earthquake was felt over 350 km^2 and had a maximum intensity of V.

Bear Valley, Calif., 4 September 1972

A series of moderate earthquakes, generally less than magnitude 5, began occurring along the San Andreas fault in the Bear Valley area of central California in late 1971. Spurred by this activity, SEB began installation of accelerographs adjacent to the active fault trace early in 1972. On 4 September 1972 a magnitude 4.7 (BRK) earthquake occurred less than 10 km from three recording stations. The strong-motion record obtained at the Melendy Ranch barn at 9 km showed high frequency acceleration pulses of 0.48 g and 0.69 g on the two horizontal components.

The earthquake was felt over 14,300 km^2 and had a maximum intensity of VI.

Point Mugu, Calif., 21 February 1973

A magnitude 5.9 (PAS) earthquake near Point Mugu, Calif., triggered 320 strong-motion accelerographs in central and southern California, the majority installed in high-rise buildings in the Los Angeles area. A peak acceleration of 0.13 g was recorded in a north-south direction by the nearest instrument located at Port Hueneme, 18 km from the epicenter. Eight ground records obtained in Los Angeles showed horizontal accelerations of 0.05 g to 0.09 g, all at distances greater than 50 km. The maximum building accelerations recorded were 0.22 g on the 11th floor (top) of a building located near Marina del Ray.

The earthquake was felt over 60,000 km^2 and had a maximum intensity of VII.

Honomu, Hawaii, 26 April 1973

A magnitude 6.0 (NOAA) earthquake near Honomu, Hawaii, was recorded by an accelerograph recently installed at Namakani Paio campground at Kilauea, thus providing the first strong-motion recording of a Hawaiian earthquake. The event, located 50 km northeast of the campground (hypocenter at 50 km), produced maximum recorded horizontal accelerations of 0.11 g and 0.17 g. A second instrument installed at Honolulu, 325 km epicentral distance, showed minor ground amplitudes of 0.03 g and less. After the earthquake, the Hawaiian network was enlarged with the installation of three additional accelerographs on Hawaii and one each on Molokai and Maui.

The April 26 earthquake had a maximum intensity of VII and was felt as far as Kauai at 595 km.

Records for 1972 and 1973

Tables 1 and 2 provide a complete listing of the 1972 and 1973 earthquake records[1] and the maximum accelerations scaled from those considered more significant. Future Seismic Engineering Program reports will include summaries of records for the previous quarter in as timely a manner as possible. The earthquakes are listed in chronological order and include locality, geographic coordinates, magnitude, and maximum intensity when available. This information has been gathered from "Preliminary Determination of Epicenters" and "Abstracts of Earthquake Reports for the United States", both published by the U.S. Geological Survey. The recording stations are listed in alphabetical order with a brief description of the building in which the instrument is housed. Epicentral distances were calculated to show the relative proximity of the individual recording stations. Maximum accelerations are listed for those events where ground accelerations were more than 0.05 g or amplitudes recorded in structures (other than at the basement or ground level) were more than 0.1 g. These criteria were arbitrarily adopted to reduce the amount of insignificant data reported. Although the maximum recorded acceleration poorly defines the nature of motion at a site, it is the most easily and quickly obtained quantity. It should be pointed out that these measurements have *no* relationship to frequency or duration of shaking, and in fact, in many instances, the amplitudes recorded as maximum acceleration were observed as only one or two prominent peaks.

[1] Data that are not available in "U.S. Earthquakes," the annual NOAA/USGS publication.

TABLE 1.–*Summary of accelerograph records obtained from earthquakes in 1972*

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 3 January 1972	Managua, Nicaragua	12.14N	19 (12)	South	.10
Managua, Nicaragua:	Esso Refinery	86.32W		Down	.06
12.31N, 86.30W - Magnitude 4.1	(1-story bldg.)			East	.15
	Note: Six small shocks also recorded at this station. Four small shocks also recorded at Banco Central.				
Earthquake of 5 January 1972	Managua, Nicaragua	12.14N	19 (12)	South	.09
Managua, Nicaragua:	Esso Refinery	86.32W		Down	.08
12.29N, 86.24W - Magnitude 4.2	(1-story bldg.)			East	.22
	Note: One small shock also recorded at this station.				
	Managua, Nicaragua	12.11N	20 (12)	East	.12
	National University	86.24W		Up	.06
	(Small, 1-story bldg.)			South	.11
	Note: Two small shocks also recorded at this station.				
Earthquake of 24 February 1972	Hollister, Calif.	36.85N	-	-	*
Bear Valley, California:	City Hall	121.40W			
36.59N, 121.20W - Magnitude 5.1	(1-story bldg.)				
Maximum Intensity VI					
Earthquake of 27 February 1972	Bear Valley, Calif.	36.64N	-	-	*
1153 PST	Stone Canyon East	121.24W			
Bear Valley, California:	(Small, 1-story bldg.)				
36.64N, 121.25W - Magnitude 3.4					
Earthqauke of 27 February 1972	Hollister, Calif.	36.85N	-	-	*
1413 PST	City Hall	121.40W			
Bear Valley, California:	(1-story bldg.)				
36.55N, 121.09W - Magnitude 4.7					
Maximum Intensity V	Bear Valley, Calif.	36.64N	-	-	*
	Stone Canyon East	121.24W			
	(Small, 1-story bldg.)				

* Maximum acceleration less than .05g.

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 1 March 1972 Off North Coast of California: 40.67N, 125.25W - Magnitude 5.2 Maximum Intensity V	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*
Earthquake of 4 March 1972 Bear Valley, California: 36.5N, 121.1W - Magnitude 3.5	Bear Valley, Calif. Melendy Ranch Barn (1-story bldg.)	36.59N 121.19W	>1 (.6)	N61E Down N29W	.15 .04 .07
Earthquake of 22 March 1972 Bear Valley, California: 36.35N, 121.13W - Magnitude 3.5	Bear Valley, Calif. Melendy Ranch Barn (1-story bldg.)	36.59N 121.19W	7 (4)	N61E Down N29W	.16 .03 .08
Earthquake of 7 April 1972 Bear Valley, California: 36.33N, 121.11W - Magnitude 3.4	Bear Valley, Calif. Melendy Ranch Barn (1-story bldg.)	36.59N 121.19W	7 (4)	N61E Down N29W	.06 .01 .03
Earthquake of 5 July 1972 San Fernando, California: 34.41N, 118.38W - Magnitude 3.4	Pacoima Dam, Calif. Abutment (Instrument shelter)	34.34N 118.40W	-	-	*
Earthquake of 30 July 1972 Sitka, Alaska: 56.8N, 135.7W - Magnitude 6.5 Maximum Intensity VII	Sitka, Alaska Magnetic Observatory (Concrete vault)	57.06N 135.32W	35 (22)	North Down West	.09 .05 .11
	Juneau, Alaska Auke Bay Fisheries Lab (1-story bldg.)	58.38N 134.64W	-	-	*
	Yakutat, Alaska Airport Pump House (Small, 1-story bldg.)	59.51N 139.67W	-	-	*

* Maximum acceleration less than .05g.

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
Earthquake of 3 August 1972 Near Andreanof Islands, Alaska: 51.5N, 178.5W - Magnitude 5.0 Maximum Intensity II	Adak, Alaska U. S. Naval Base (Concrete vault)	51.88N 176.58W	-	-	*		
Earthquake of 15 August 1972 Fairbanks, Alaska: 65.1N, 148.7W - Magnitude 4.3 Maximum Intensity IV	Fairbanks, Alaska College Observatory (Concrete vault)	64.86N 147.83W	-	-	*		
					Bsmt	5th flr	Roof
Earthquake of 27 August 1972 Beverly Hills, California: 34.06N, 118.39W - Magnitude 3.2	Beverly Hills, Calif. 8383 Wilshire (10-story bldg.)	34.06N 118.38W	1 (.6)	East Down North	.15 .04 .12	.07 .02 .06	.06 .08 .07
					Grnd	7th flr	Roof
	Beverly Hills, Calif. 8601 Wilshire (11-story bldg.)	34.07N 118.38W	2 (1.2)	S75E Down N15E	.09 .02 .07	.06 .02 .07	.05 .02 .05
					Bsmt	5th flr	Roof
	Beverly Hills, Calif. 9100 Wilshire (10-story bldg.)	34.07N 118.39W	2 (1.2)	South East Up	.09 .12 .02	.04 .05 .03	.04 .05 .04
					Grnd	3rd flr	
	Los Angeles, Calif. 1177 Beverly (7-story bldg.)	34.06N 118.40W	1 (.6)	N31W N59E Up	.06 .03 .04	.10 .17 .07	
					Bsmt	5th flr	Roof
	Los Angeles, Calif. 1800 Century Park E. (15-story bldg.)	34.06N 118.41W	2 (1.2)	S36E Down N54E	.06 .04 .02	.05 .05 .04	.09 .09 .04

* Maximum acceleration less than .05g.

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
					Bsmt	7th flr	
Earthquake of 27 August 1972 (Continued)	Los Angeles, Calif. 1880 Century Park E. (16-story bldg.)	34.06N 118.41W	2 (1.2)	N54E	.06	.02	
				Down	.04	.01	
				N36W	.08	.05	
					Bsmt	14th flr	
	Los Angeles, Calif. 1888 Century Park E. (21-story bldg.)	34.06N 118.41W	2 (1.2)	S36E	.05	.01	
				Down	.01	.06	
				N54E	.05	-	
					Bsmt	5th lvl	9th lvl
	Los Angeles, Calif. 1888 Century Park E. (9-level parking garage)	34.06N 118.41W	2 (1.2)	S36E	.05	.05	.16
				Down	.03	.05	.06
				N54E	.06	.08	.07
					Bsmt	6th flr	Roof
	Los Angeles, Calif. 7060 Hollywood (12-story bldg.)	34.10N 118.34W	6 (3.6)	North	.01	.01	.02
				Down	-	.02	.04
				West	.06	.06	.04
					4th flr	9th flr	
	Los Angeles, Calif. 120 Robertson (9-story bldg.)	34.06N 118.38W	11 (7)	S02W	.13	.13	
				Down	.03	.06	
				S88E	.12	.10	
					Bsmt	3rd flr	6th flr
	Los Angeles, Calif. 4680 Wilshire (6-story bldg.)	34.06N 118.33W	10 (6)	N18E	.06	.10	.06
				Down	.03	.03	.03
				N72W	.05	.10	.06
					Bsmt	16th flr	Roof
	Los Angeles, Calif. 5900 Wilshire (31-story bldg.)	34.06N 118.36W	2 (1.2)	S07W	.05	.05	.02
				N83W	.03	.03	.05
				Down	.02	.04	.02

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
					Grnd	10th flr	17th flr
Earthquake of 27 August 1972 (Continued)	Los Angeles, Calif. 6200 Wilshire (17-story bldg.)	34.06N 118.36W	2 (1.2)	N82W	.05	.14	.09
				N08E	.01	.06	.08
				Down	.03	.03	.04
					Bsmt	11th flr	
	Los Angeles, Calif. 6300 Wilshire (21-story bldg.)	34.06N 118.37W	1 (.6)	S82E	.08	.04	
				Down	.04	.04	
				N08E	.10	.05	
					Bsmt	11th flr	Roof
	Los Angeles, Calif. 6420 Wilshire (19-story bldg.)	34.06N 118.37W	1 (.6)	N08E	.15	.06	.03
				S82E	.02	.05	.05
				Down	.06	.05	.04
	Note: Smaller amplitude records* also generated at the following stations: Beverly Hills- 430 Camden, 450 Roxbury, 9401 Wilshire, 9450 Wilshire, 9500 Wilshire, 9665 Wilshire. Culver City- 5990 Green Valley Circle. Los Angeles- 1900 Ave. of Stars, 1901 Ave. of Stars, 2080 Century Park E., 1801 Century Park W., 750 Garland, 930 Hilgard, 1760 Orchid, 1025 Highland (Hollywood Storage), 10100 Santa Monica, 6464 Sunset, 10850 Wilshire.						
Earthquake of 4 September 1972 Bear Valley, California: 36.64N, 121.29W - Magnitude 4.7 Maximum Intensity VI	Bear Valley, Calif. CDF Fire Station (1-story bldg.)	36.57N 121.18W	33 (20)	S81E	.11		
				Down	.09		
				N09E	.18		
	Bear Valley, Calif. Melendy Ranch Barn (1-story bldg.)	36.59N 121.19W	17 (11)	N61E	.48		
				Down	.21		
				N29W	.69		

* Maximum acceleration recorded at ground or basement level less than .05g (upper stories less than 0.1g).

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 4 September 1972 (Continued)	Bear Valley, Calif. Stone Canyon East (Small, 1-story bldg.)	36.64N 121.24W	20 (12)	S03E Down N87E	.17 .10 .18
	Note: Smaller amplitude records* also generated at the following stations: Hollister- Almaden Winery and City Hall.				
Earthquake of 23 September 1972 0256 PST San Juan Bautista, California: 36.80N, 121.55W - Magnitude 4.1 Maximum Intensity V	Hollister, Calif. Almaden Winery (1-story bldg.)	36.75N 121.18W	-	-	*
	Hollister, Calif. City Hall (1-story bldg.)	36.85N 121.40W	-	-	*
Earthquake of 23 September 1972 0708 PST San Juan Bautista, California: 36.80N, 121.54W - Magnitude 4.2 Maximum Intensity V	Hollister, Calif. Almaden Winery (1-story bldg.)	36.75N 121.18W	-	-	*
	Hollister, Calif. City Hall (1-story bldg.)	36.85N 121.40W	-	-	*
Earthquake of 2 October 1972 San Juan Bautista, California: 36.80N, 121.54W - Magnitude 4.8 Maximum Intensity VI	Hollister, Calif. Almaden Winery (1-story bldg.)	36.75N 121.18W	-	-	*
	Hollister, Calif. City Hall (1-story bldg.)	36.85N 121.40W	-	-	*
	Hollister, Calif. SAGO Central (Concrete vault)	36.78N 121.45W	-	-	*

* Maximum acceleration less than .05g.

TABLE 1.--*Summary of accelerograph records obtained from earthquakes in 1972*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 13 November 1972 Off North Coast of California: 40.3N, 124.7W - Magnitude 4.9	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*
Earthquake of 23 December 1972 Managua, Nicaragua: 12.4N, 86.1W - Magnitude 5.6 Maximum Intensity XII	Managua, Nicaragua Esso Refinery (1-story bldg.)	12.14N 86.32W	37 (23)	South Down East	.39 .33 .33

Note: At least 16 aftershocks also recorded at this station including those with the following maximum accelerations:

	Event A	Event B	Event C
South	.09	.17	.32
Down	.04	.08	.20
East	.09	.13	.28

NOTES:

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

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
Earthquake of 15 January 1973 Hollister, California: 36.7N, 121.3W - Magnitude 4.0 Maximum Intensity V	Hollister, Calif. City Hall (1-story bldg.)	36.85N 121.40W	-	-	*		
Earthquake of 30 January 1973 Managua, Nicaragua: Epicenter Unknown Magnitude Unknown	Managua, Nicaragua National University (Small, 1-story bldg.)	12.11N 86.24W	-	East Up South	.09 .05 .07		
	Managua, Nicaragua Esso Refinery (1-story bldg.)	12.14N 86.32W	-	-	*		
					Grnd	4th flr	8th flr
Earthquake of 21 February 1973 Point Mugu, California: 34.06N, 119.03W - Magnitude 5.9 Maximum Intensity VII	Culver City, Calif. 5990 Green Valley Cir. (8-story bldg.)	33.98N 118.38W	61 (38)	S45W Down S45E	.04 .03 .05	.05 .04 .08	- .05 .14
					Bsmt	5th flr	9th flr
	Los Angeles, Calif. 9750 Airport (9-story bldg.)	33.95N 118.38W	62 (39)	North Down West	.04 .02 .03	.08 .02 .06	.11 .02 .10
					Bsmt	7th flr	14th flr
	Los Angeles, Calif. 9841 Airport (14-story bldg.)	33.95N 118.39W	61 (38)	North West Up	.05 .05 .02	.06 .06 .04	.05 .04 .04
					Grnd	6th flr	12th flr
	Los Angeles, Calif. 4827 Central (12-story bldg.)	34.00N 118.26W	72 (45)	North Down West	.05 .02 .06	.06 .02 .06	.14 .03 .14

* Maximum acceleration less than .05g.

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
					Grnd	5th flr	
Earthquake of 21 February 1973 (Continued)	Los Angeles, Calif. 5249 Century (10-story bldg.)	33.94N 118.37W	63 (39)	East	.04	.06	
				Down	.02	.05	
				South	.05	.07	
					Grnd	4th flr	Roof
	Los Angeles, Calif. 5260 Century (7-story bldg.)	33.95N 118.37W	63 (39)	East	.05	.02	.03
				North	.05	.03	.04
				Up	.01	.02	.09
					Grnd	6th flr	12th flr
	Los Angeles, Calif. 4411 Eleventh (12-story bldg.)	34.00N 118.33W	66 (41)	West	.05	.06	.11
				Down	.04	.05	.05
				South	.06	.13	.14
					Grnd	7th flr	Roof
	Los Angeles, Calif. 16633 Ventura (14-story bldg.)	34.16N 118.50W	50 (31)	S77E	.06	.05	.06
				Down	.01	.02	.03
				N13E	.03	.06	.04
					Grnd	6th flr	11th flr
	Los Angeles, Calif. 415 Washington (11-story bldg.)	33.98N 118.45W	54 (33)	S53W	.09	.12	.22
				Down	.02	.04	.06
				S37E	.07	.09	.22
	Port Hueneme, Calif. Naval Laboratory (1-story warehouse)	34.15N 119.20W	18 (11)	Up		.04	
				South		.13	
				West		.08	

Note: Smaller amplitude records* also generated at the following stations;
Alhambra- 900 S. Fremont.

* Maximum acceleration recorded at ground or basement level less than 0.05g (upper stories less than 0.1g).

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 21 February 1973 (Continued)	Note: Beverly Hills- 450 Roxbury, 8383 Wilshire, 8601 Wilshire, 9100 Wilshire, 9401 Wilshire, 9450 Wilshire, 9595 Wilshire, 9665 Wilshire. Bakersfield- Bakersfield High School. Costa Mesa- 666 W. 19th. El Segundo- 101 Continental, 909 Sepulveda. Glendale- 633 E. Broadway. Lake Hughes- Station No. 1, Station No. 4. Loma Linda- Loma Linda University Hospital. Long Beach- State University, Terminal Island, Utilities Building. Los Angeles- 1900 Ave. of Stars, 1901 Ave. of Stars, 1177 Beverly, Century City Ground, 1800 Century Park E., 1801 Century Park E., 1880 Century Park E., 1888 Century Park E., 414 Commercial, 222 Figueroa, 234 Figueroa, 445 Figueroa, 250 E. First, 800 W. First, 525 Flower, 533 Fremont, 750 Garland, 420 Grand, 930 Hilgard, 1150 Hill, 7060 Hollywood, 7080 Hollywood, 3663 Hoover, 111 Hope, Jensen Filter Plant, 3838 Lankershim, 3010 Leeward, 1640 Marcugo, 616 Normandie, 646 Olive, 808 Olive, 1625 Olympic, 2555 E. Olympic, 1760 Orchid, 8244 Orion, 120 Robertson, 10100 Santa Monica, 11661 San Vicente, Sepulveda VA, 14500 Sherman Circle, 611 Sixth, 3407 Sixth, 210 Spring, 4867 Sunset, 6255 Sunset, 6464 Sunset, 945 Tiverton, UCLA, 3440 University, Van Norman Dam, 15107 Van Owen, 14724 Ventura, 15250 Ventura, 15433 Ventura, 15910 Ventura, 16055 Ventura, 16255 Ventura, 16661 Ventura, 18321 Ventura, 930 Westwood, 637 Wilshire, 800 Wilshire, 3250 Wilshire, 3255 Wilshire, 3345 Wilshire, 3470 Wilshire, 3550 Wilshire, 3710 Wilshire, 4680 Wilshire, 6300 Wilshire, 6420 Wilshire, 10740 Wilshire, 10747 Wilshire, 10850 Wilshire, 10960 Wilshire, 2011 Zonal. Maricopa- Station Nos. 1, 2, 3, and 4. Orange- One City Boulevard. Pacoima Dam- Abutment Palmdale- Fire Staion. Pasadena- Milikan Library, JPL, Seismic Lab.				

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 21 February 1973 (Continued)	Note: Puddingstone Dam- Abutment. Pyramid Dam- Toe. San Antonio Dam- Crest. Santa Ana- Orange County Engineering Building, 1600 N. Broadway. Santa Anita Dam- Abutment. Santa Barbara- Court House Santa Felicia Dam- Crest. Santa Monica- 201 Ocean. Taft- Lincoln School. Vernon- CMD Terminal. Whittier Narrows Dam- Spillway.				
Earthquake of 12 March 1973 Off Coast of Northern California: 40.3N, 124.2W - Magnitude 4.3 Maximum Intensity V	Eureka, Calif. Federal Building (3-story bldg.)	40.80N 124.16W	-	-	*
	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*
Earthquake of 31 March 1973 Managua, Nicaragua: Epicenter Unknown Magnitude Unknown	Managua, Nicaragua National University (Small, 1-story bldg.)	12.11N 86.24W	-	East Up South	.60 .53 .26
Earthquake of 26 April 1973 Honomu, Hawaii: 19.93N, 155.10W - Magnitude 6.0 Maximum Intensity VIII	Kilauea, Hawaii Namakani Paio Campground Small, 1-story bldg.)	19.43N 155.30W	50 (31)	S30W Down S60E	.17 .07 .11
	Honolulu, Hawaii Maluhia Service Club (Small, 1-story bldg.)	21.29N 157.86W	-	-	*

* Maximum acceleration less than .05g.

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 20 May 1973 Off North Coast of California: 40.3N, 124.5W - Magnitude 4.0 Maximum Intensity IV	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*
Earthquake of 14 July 1973 SW San Bernardino Co., Calif: 34.4N, 116.8W - Magnitude 4.8 Maximum Intensity V	Cedar Springs Dam, Ca. Crest/Toe (Concrete vault/Box	34.30N 117.31W	-	-	*
Earthquake of 24 July 1973 Ukiah, California: 39.1N, 123.2W - Magnitude 3.7 Maximum Intensity V	Coyote Dam, Calif. Crest/Toe/Abutment (Concrete vaults)	39.20N 123.18W	-	-	*
Earthquake of 6 August 1973 Off Coast of Southern California: 34.0N, 119.5W - Magnitude 4.7 Maximum Intensity V	Los Angeles, Calif. 415 Washington (11-story bldg.)	34.98N 118.45W	-	-	*
	Port Hueneme, Calif. Naval Laboratory (1-story warehouse)	34.15N 119.20W	-	-	*
Earthquake of 8 August 1973. Off North Coast of California: 40.3N, 124.2W - Magnitude 5.1	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	25 (15)	Up S44W N46W	.03 .10 .14
	Butler Valley, Calif. Station No. 2 (Instrument shelter)	40.79N 123.88W	-	-	*
	Eureka, Calif. Federal Building (3-story bldg.)	40.80N 124.16W	-	-	*

* Maximum acceleration less than .05g.

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g
Earthquake of 16 September 1973 Berryessa, California: 38.60N, 122.15W - Magnitude 4.2 Maximum Intensity V	Berryessa, Calif. CDF Fire Station (1-story bldg.)	38.54N 122.23W	10 (6)	S78W Down N12W	.18 .04 .08
Earthquake of 29 September 1973 Off North Coast of California: 40.28N, 124.16W - Magnitude 4.1 Maximum Intensity IV	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*
Earthquake of 3 October 1973 Near Santa Clara, California: 37.2N, 121.6W - Magnitude 4.7 Maximum Intensity V	Santa Clara, Calif. 890 Main (11-story bldg.)	37.38N 121.56W	-	-	*
Earthquake of 5 October 1973 Near Santiago, Chile:	Santiago, Chile University of Chile (3-story bldg.)	-33.47N 70.67W	-	-	*
Earthquake of 9 October 1973 Honomu, Hawaii: 19.32N, 155.26W - Magnitude 4.6	Honomu, Hawaii** C. Tanimote Res. (1-story house)	19.87N 155.12W	-	-	*
Earthquake of 11 November 1973 Near Ukiah, California: 39.3N, 123.4W - Magnitude 4.0 Maximum Intensity V	Coyote Dam, Calif. Crest/Toe/Abutment (Concrete vaults)	39.20N 123.18W	-	-	*
Earthquake of 12 November 1973 Near Corralitos, California: 37.2N, 122.0W - Magnitude 4.5 Maximum Intensity V	Corralitos, Calif. Koinonia Conf. Crounds (Small, 1-story bldg.)	37.05N 121.80W	-	-	*

* Maximum acceleration less than .05g.
** Temporary station.

TABLE 2.--*Summary of accelerograph records obtained from earthquakes in 1973*--Continued

EVENT	STATION LOCATION	STATION COORDINATES	EPICENTRAL DIST: km(mi)	COMPONENT	MAX. ACCELERATION[a]: g		
Earthquake of 12 November 1973 (Continued)	Oakland, Calif. 2730 Adeline (2-story bldg.)	37.63N 122.12W	-	-	*		
	Santa Clara, Calif. 890 Main (11-story bldg.)	37.38N 121.56W	-	-	*		
					Grnd	5th flr	
Earthquake of 30 November 1973 Near Los Angeles Airport: 34.0N, 118.4W - Magnitude 3.2 Maximum Intensity IV	Los Angeles, Calif. 5249 Century (10-story bldg.)	33.94N 118.37W	-	East	.04	.01	
				Down	.01	.01	
				South	.09	.03	
					Bsmt	7th flr	12th flr
	Los Angeles, Calif. 9901 La Cienega (12-story bldg.)	33.95N 118.37W	-	North	.07	.04	.04
				Down	.01	.02	.02
				East	.02	.01	.01
	Note: Smaller amplitude records** also generated at the following station: Los Angeles- 5855 Century.						
Earthquake of 21 December 1973 Off North Coast of California: 40.6N, 124.6W - Magnitude 4.6 Maximum Intensity V	Butler Valley, Calif. Station No. 2 (Small prefab bldg.)	40.79N 123.88W	-	-	*		
	Eureka, Calif. Federal Building (3-story bldg.)	40.80N 124.16W	-	-	*		
	Ferndale, Calif. City Hall (2-story bldg.)	40.58N 124.26W	-	-	*		
	Petrolia, Calif. (Instrument shelter)	40.35N 124.35W	-	-	*		

* Maximum acceleration less than .05g.
** Maximum acceleration recorded at ground or basement level less than .05g (upper stories less than 0.1g).

NOTES:
a. Unless otherwise noted, maximum acceleration recorded at ground or basement level.

*U.S. GOVERNMENT PRINTING OFFICE: 1975 O—585-473/87