Catalogue of U.S. Geological Survey Strong-Motion Records, 1993

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PREFACE

The first seismic engineering program in the United States was administered by the Seismological Field Survey (SFS) of the U. S. Coast and Geodetic Survey. This program was begun in 1931 and essentially remained the responsibility of the SFS until 1973, when the U.S. Geological Survey (USGS) assimilated the program into its Earthquake Hazards Reduction Program. Currently, the National Strong-Motion Program (NSMP) operates a cooperative network containing nearly 1000 accelerographs in 39 states and Puerto Rico. This network is administered by the USGS in cooperation with both private industry and numerous Federal, State, and local agencies and organizations. Major contributors include the Army Corps of Engineers, the Department of Veterans Affairs, and the Metropolitan Water District of Southern California. Primary objectives of the program are to record strong ground motions and the response of representative engineered structures during moderate to large earthquakes, and to disseminate the resultant data and information about the records, sites, and structures to the earthquake engineering research and design community.

This catalogue continues in a revised format the yearly publication "Strong-Motion Program Report, January-December [year]"; it is a continuation of the table 1 summary of accelerograms recovered at NSMP stations that had been published in that format since 1974. This report includes all strong-motion recordings recovered during 1993. Unless otherwise referenced, earthquake data and information are taken from the "Preliminary Determination of Epicenters," published weekly by the U.S. Geological Survey.

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Strong-Motion Records, 1993

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INTRODUCTION

During the period January-December, 1993, only 83 accelerograph records were recovered from permanent National Strong-Motion Program (NSMP) stations operated by the U. S. Geological Survey: this compares with an annual average of more than 300 recordings for the period 1974 through 1992. Accelerograms were recovered from NSMP instrumentation triggered by 12 California earthquakes in the magnitude 3 to 6.2 range; 4 Hawaii earthquakes, including magnitude 4.8 and 4.9 events on January 26 and June 8, respectively; magnitude 5.7 and 5.9 earthquakes in northern Oregon on March 5 and southern Oregon on September 21, respectively; and by a 5.2 earthquake in southern Alaska on May 18. Also included are recordings from 14 stations in the greater Anchorage region (see table 1.)

Peak ground acceleration exceeded 0.10 *g* at NSMP sites only twice during 1993: 0.11 *g* during an unidentified southern California event near San Bernardino, and 0.28 *g* at Kau Hospital in Pahala, Hawaii during the M_D=4.8 earthquake on January 26.

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Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

[Station owners: ACOE, U.S. Army Corps of Engineers; MANC, Municipality of Anchorage; USGS, U.S. Geological Survey; VA, U.S. Veterans Administration. Instrument trigger time in seconds after the minute or the following minute listed in earthquake column. *S*-minus trigger denotes *S*-wave-arrival-minus-trigger-time (*S*-*t*) or *S*-wave-minus-*P*-wave-arrival time (*S*-*P*, in brackets) interval. Direction is of case acceleration for upward trace deflection on accelerogram; horizontal components are listed as azimuth, and vertical components as "up" or "down." Maximum amplitude is peak acceleration recorded at ground level on one vertical and two orthogonal horizontal components unless otherwise noted. Numbers in parentheses refer to footnotes at end of table.]

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
16 January 1993	Anderson Dam	37.166	(*3*)	(*2*)		
0629:34.9 G.m.t.	(USGS)	121.628				
Central Calif.						
37.025N, 121.458W	Crest				340	.05
Magnitude 5.3 ML					Up	.03
					250	.09
	Downstream				340	.05
					Up	.02
					250	.05
	Structure Array:					
	Channel 1- Mid-dam, Center				153	.04
	Channel 2- Mid-dam, Center				243	.05
	Channel 3- Mid-dam, Right				063	.06
	Channel 4- Toe				333	.03
	Channel 5- Toe				Up	.02
	Channel 6- Toe				063	.03
	Channel 7- Right Crest				333	.05
	Channel 8- Right Crest				Up	.06
	Channel 9- Right Crest				063	.05
	Channel 10- Center Crest				333	.04
	Channel 11- Center Crest				Up	.06
	Channel 12- Center Crest				063	.09
24 January 1993	Isabella Main Dam	36.645	(*4*)			
2109:26.2 G.m.t.	(ACOE)	118.480				
Central Calif.						
35.636N, 118.455W	Mid-dam			1.2	285	.04
					Up	.02
					195	.06
	Right Crest			(*2*)		(*1*)
25 January 1993	Hawaii National Park	19.423	(*4*)	1.1	360	.08
0814:53.7 G.m.t.	Volcano Observatory	155.291			Up	.05
Hawaii	(USGS)				270	.10
19.417N, 155.320W						
Magnitude 4.4 MD						

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
25 January 1993 0853 G.m.t. Hawaii Epicenter and magnitude unknown	Hawaii National Park Volcano Observatory (USGS)	19.423 155.291	(*4*)	(*2*)		(*1*)
26 January 1993 1524:08.8 G.m.t. Hawaii 19.219N, 155.482W Magnitude 4.8 MD	Honokaa, Hawaii Police Station (USGS)	20.080 155.465	(*4*)	(*2*)		(*1*)
	Honomalino, Hawaii (USGS)	19.169 155.868	(*4*)	1.2	360 Up 270	.08 .03 .06
	Kealakekua, Hawaii (USGS)	19.523 155.879	(*4*)	(*2*)		(*1*)
	Pahala, Hawaii Kau Hospital (USGS)	19.20 155.47	(*4*)	1.0	360 Up 270	.11 .12 .28
	Waiohinu, Hawaii Kau Baseyard (USGS)	19.070 155.615	(*4*)	(*2*)		(*1*)
1 February 1993 2043 G.m.t. Central Calif. Epicenter and magnitude unknown	McGee Creek Mammoth Lakes (USGS) (Multi-channel)	37.550 118.811	(*4*)			
	166 m Downhole			(*2*)		(*1*)
	35 m Downhole			(*2*)		(*1*)
	1 m Downhole			(*2*)		(*1*)
	Surface			(*2*)		(*1*)
25 March 1993 1334:35.4 G.m.t. Northern Oregon 45.035N, 122.607W Magnitude 5.7 ML	Detroit Dam, Oregon (ACOE)	44.72 122.25	(*3*)			
	Downstream			2.3	198° Up 108°	.06 .05 .06
	Gallery Level #7			4.8	198° Up 108°	.15 .07 .18
	Gallery Level #1			4.6		(*1*)

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
	Portland State U., Oregon Cramer Hall, Basement (USGS)	45.513 122.683	(3)	(2)		(1)
	Vancouver, Washington VA Hospital (VA)	45.64 122.66	(*3*)	7.2		(*1*)
	Green Peter Dam, Oregon (ACOE)	44.48 122.53	(*4*)	0.9		
	Upper Gallery				042 Up 312	.11 .03 .08
	Lower Gallery					(*1*)
	Blue River Dam, Oregon (ACOE)	44.17 122.33	(*3*)	(*2*)		
	Toe					(*1*)
	Cougar Dam, Oregon (ACOE)	44.13 122.24	(*3*)	(*2*)		
	Center Crest					(*1*)
3 November 1992- 6 April 1993 Central Calif. Epicenter and magnitude unknown	Parkfield Liquefaction Array (USGS)	35.797 120.337	(*3*)	(*2*)		
	Array 1:					
	1. AC-1, 38'				315	(*1*)
	2. AC-1, 38'				Up	(*1*)
	3. AC-1, 38'				045	(*1*)
	4. AC-4, 9'				315	(*1*)
	5. AC-4, 9'				Up	(*1*)
	6. AC-4, 9'				045	(*1*)
	7. Pressure Transducer, A-1, 16.7'					*
	8. Pressure Transducer, A-3, 16.9'					*
	9. Pressure Transducer, A-4, 13.1'					*
	10. Pressure Transducer, B-2, 17'					*
	11. Pressure Transducer, B-4, 31.1'					*
	12. Pressure Transducer, C-3, 20.7'					*

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
	Parkfield Liquerfaction Array-continued					
	Array 2:					
	1. AC-3, 96'				315	(*1*)
	2. AC-3, 96'				Up	(*1*)
	3. AC-3, 96'				045	(*1*)
	4. AC-2, 13'				315	(*1*)
	5. AC-2, 13'				Up	(*1*)
	6. AC-2, 13'				045	(*1*)
	7. Surface				315	Inoperative
	8. Surface				Up	Inoperative
	9. Surface				045	Inoperative
	10. Pressure Transducer, D-1, 30.6'					*
	11. Pressure Transducer, D-3, 41.2'					*
	12. Pressure Transducer, C-1, 20'					*
	* Piezometer trace.					
17 May 1993 2320:49.2 G.m.t. Central Calif. 37.171N, 117.775W Magnitude 6.2 ML	Lake Success Dam (ACOE)	36.061 118.920				
	Left Crest			(*2*)		(*1*)
	Right Crest			(*2*)		(*1*)
	Terminus Auxiliary Dam (ACOE)	36.405 110.001				
	Center Crest			(*2*)		(*1*)
	White Mountain Array Deep Springs College (USGS)	37.291 117.979	20:55.8	3.1	360 Up 270	.08 .05 .06
18 May 1993 0804:18.9 G.m.t. Southern Alaska 61.031N, 149.953W Magnitude 5.2 ML	Anchorage, Alaska Fire Station #4 (MANC)	61.182 149.848	(*3*)	6.1		(*1*)
	Anchorage, Alaska Old Federal Bldg (USGS)	61.219 149.892	(*3*)	7.1		(*1*)
	Anchorage, Alaska Anchorage Lutheran Church (USGS) Ground	61.21 149.89	(*4*)	7.0		(*1*)
	Anchorage, Alaska Fire Station #7 (MANC)	61.146 149.50	(*3*)	6.4		(*1*)

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
	Anchorage, Alaska Fire Station #8 (MANC)	61.124 149.766	(*3*)	4.9		(*1*)
	Anchorage, Alaska Municipal Light and Power (MANC)	61.214 149.864	(*3*)	6.8		(*1*)
	Anchorage, Alaska Alaska Pacific University (USGS)	61.189 149.801	(*3*)	6.0		(*1*)
	Anchorage, Alaska Fire Dept Vehicle Maint Fac (MANC)	61.214 149.824	(*3*)	6.4		(*1*)
	Anchorage, Alaska Anchorage Records Center (MANC)	61.216 149.885	(*3*)	6.6		(*1*)
	Anchorage, Alaska International Airport (USGS)	61.174 149.973	(*3*)	6.2		(*1*)
	Anchorage, Alaska Humana Hospital (USGS)	61.121 149.982	(*3*)	6.0		
	Ground level					(*1*)
	4th floor				225 Up 135	.03 .04 .06
	7th floor				225 Up 135	.05 .05 .07
	Anchorage, Alaska Hilton Hotel (USGS)	61.220 149.892	(*3*)	6.4		
	Basement					(*1*)
	6th floor					(*1*)
	14th floor					(*1*)

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
	Anchorage Hilton Hotel-continued					
	20th floor				315	.02
					Up	.06
					225	.04
	22nd level				315	.04
	(Penthouse)				Up	.07
					225	.04
	Anchorage, Alaska	61.19	(*3*)	6.2		
	BP Building	149.86				
	(USGS)					
	Basement				360	.05
	(Incorrectly listed as 7th				Up	.02
	floor in published catalog)				270	.03
	Structure Array					
	Channel 1 - 14th floor northeast corner				270	(*1*)
	Channel 2 - 14th floor southwest corner				270	(*1*)
	Channel 3 - 8th level northeast corner				270	(*1*)
	Channel 4 - 8th level southwest corner				270	(*1*)
	Channel 5 - 14th floor center				360	(*1*)
	Channel 6 - 8th level center				Up	(*1*)
	Channel 7 - Basement northwest corner				Up	(*1*)
	Channel 8 - Basement southeast corner				Up	(*1*)
	Channel 9 - Basement southeast corner				270	(*1*)
	Channel 10 - Freefield, 2 ft downhole				090	.06
	Channel 11 - Freefield, 2 ft downhole				360	.06
	Channel 12 - Freefield, 2 ft downhole				Up	(*1*)
	Eagle River, Alaska	61.350	(*3*)	(*2*)		(*1*)
	Alaska Geological Survey	149.540				
	(USGS) Basement					
18 May 1993	White Mountain Array	37.291	(*3*)	(*2*)		(*1*)
2348:53.9 G.m.t.	Deep Springs College	117.979				
Central Calif.	(USGS)					
37.064N, 117,777W						
Magnitude 5.2 ML						
31 May 1993	Forest Falls	34.088	55:34.1	(*2*)		(*1*)
0855:29.9 G.m.t.	Post Office	116.919				
Southern Calif.	(USGS)					
34.120N, 116.995W						
Magnitude 3.9 ML						

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Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
8 June 1993 1257:49.4 G.m.t. Hawaii 19.328N, 155.217W Magnitude 4.9 MD	Pahala, Hawaii Kau Hospital (USGS)	19.20 155.47	(*4*)	(*2*)	360 Up 270	.04 .03 .06
	Kealakekua, Hawaii Kona Hospital (USGS)	19.523 155.879	(*4*)	(*2*)		(*1*)
	Hilo, Hawaii U.S.D.A. Laboratory (USGS)	19.731 155.100	(*4*)	(*2*)	360 Up 270	.08 .02 .08
	Hawaii National Park Volcano Observatory (USGS)	19.423 155.291	(*4*)	(*2*)		(*1*)
	Hawaii Volcano Observatory Warehouse (USGS)	19.434 155.264	(*4*)	(*2*)		(*1*)
	Mauna Kea, Hawaii State Park (USGS)	19.752 155.530	(*4*)	7.4	360 Up 270	.06 .03 .02
	Mauna Kea Summit, Hawaii U.K. Observatory (USGS)	19.826 155.473	(*4*)	(*2*)		(*1*)
	Hilo, Hawaii Hilo Hospital (USGS)	19.72 155.12	(*3*)	6.1	352 Up 262	1.0 Inoperative .04
	Mauna Loa, Hawaii Observatory (USGS)	19.539 155.580	(*3*)	5.8		(*1*)
16 December 1992- 20 July 1993 Southern Calif. Epicenter and magnitude unknown	Fun Valley Reservoir 361	33.925 116.389	(*3*)	(*2*)		(*1*)
17 December 1992- 21 July 1993 Southern Calif. Epicenter and magnitude unknown	San Bernardino Array Mill Creek Ranger Station (USGS)	34.080 117.114	(*3*)	1.4	360 Up 270	.09 .05 .11

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
29 June 1992- 26 July 1993 Southern Calif. Epicenter and magnitude unknown	Wrightwood Post Office (USGS)	34.360 117.629	(*3*)	2.5		(*1*)
	Leona Valley Fire Station (USGS)	34.62 118.29	(*3*)	(*2*)		(*1*)
18 December 1992- 27 July 1993 Southern Calif. Epicenter and magnitude unknown	Loma Linda VA Hospital (VA)	34.049 117.250	(*3*)	1.6		
	South Ground Site					(*1*)
11 August 1993 2233:04.0 G.m.t. Central Calif. 37.313N, 121.675W Magnitude 4.8 ML	Anderson Dam (USGS)	37.166 121.628	(*4*)	(*2*)		
	Crest					(*1*)
	Downstream					(*1*)
	Structure Array Ch. 1-12					(*1*)
12 August 1993 1028:48.6 G.m.t. Hawaii 20.091N, 156.041W Magnitude 3.7 MD	Waimea, Hawaii Fire Station (USGS)	20.026 155.664	(*4*)	(*2*)		(*1*)
	Honokaa, Hawaii Police Station (USGS)	20.080 155.465	(*4*)	(*2*)		(*1*)
21 September 1993 0328:55.4 G.m.t. Oregon 42.314N, 122.012W Magnitude 5.9ML	Applegate Dam, Oregon (ACOE)	42.008 123.119	(*3*)	(*2*)		
	Right Abutment					(*1*)
	Crest					(*1*)
	Upper Tower					(*1*)
	Lower Tower					(*1*)

Note: One each additional record[1] recovered at Applegate Dam crest, upper and lower towers.

Table 1. U. S. Geological Survey Accelerograph Records Recovered During 1993

Earthquake	Station Name (Owner)	Coordinates (Lat. °N Long. °W)	Trigger time (Gmt)	S-minus trigger (s)	Direction (az)	Maximum amplitude (g)
	Lost Creek Dam, Oregon (ACOE)	42.671 122.672	(*3*)	(*2*)		
	Upper Tower					(*1*)
	Left Crest					(*1*)
	Note: One additional record[1] recovered at Lost Creek Dam left crest.					

[1] Less than 0.05 *g* at ground-level or less than 0.10 *g* at non-ground-level stations.

[2] Questionable or indeterminable.

[3] WWVB time code illegible, or instrument not equipped with a radio receiver; correlation of accelerogram with event may be questionable or identity of event unknown.

[4] Contains internal clock for event correlation only; accuracy is widely variable.