DEPARTMENT OF THE INTERIOR

U.S. Geological Survey

STRONG-MOTION RECORDS FROM EARTHQUAKES OF JUNE 13, 1988, NOVEMBER 10, 1988, AND APRIL 3, 1989, ON THE CALAVERAS FAULT, CENTRAL CALIFORNIA

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STRONG-MOTION RECORDINGS FROM THE CALAVERAS FAULT EARTHQUAKES OF JUNE 13, 1988, NOVEMBER 10, 1988, AND APRIL 3, 1989

INTRODUCTION

The U.S. Geological Survey (USGS) has installed an array of strong-motion accelerographs along the Calaveras fault from Cherry Flat Dam east of San Jose, California north to Pleasant Hill. The USGS operates other strong-motion ground stations in the Santa Clara Valley, at the Livermore Veterans Administration hospital, and at structural arrays on the Interstate 280 US 101 overpass in San Jose and at Anderson Dam. One of the objectives of this program are to record strong ground motions and the response of representative engineered structures during strong, local earthquakes and to disseminate the resultant information and analyzed data to engineers and scientists.

This report presents the strong-motion data recorded during three moderate-size earthquakes which occurred along the Calaveras fault zone approximately 10 km northeast of San Jose between June 13, 1988 and April 3, 1989. Details of these events, provided by the National Earthquake Information Center (NEIC), are as follows:

Time: June 13, 1988 0145:36.8 GMT
Location: 37.385°N and 121.772°W
Magnitude: M_L = 5.4
Depth: 7 km

Time: November 10, 1988 0508:03.0 GMT
Location: 37.373°N and 121.757°W
Magnitude: M_L = 4.8
Depth: 7 km

Time: April 3, 1989 1746:34.4 GMT
Location: 37.422°N and 121.795°W
Magnitude: M_L = 4.7
Depth: 9 km

STRONG MOTION DATA

The M_L 5.4 earthquake of June 13, 1988 triggered strong-motion accelerographs at seven stations in the range of 8 to 28 km (Table 1, Figure 1). A peak acceleration of 0.11 g was recorded at an epicentral distance of 22 km at the Fremont station (Figure 2). The earthquake caused slight damage (MM=VI) at Milpitas and San Jose and was felt strongly throughout the San Francisco Bay area as far north as Santa Rosa, south to Salinas and east to Modesto (NEIC).

The M_L 4.8 earthquake of November 10, 1988 triggered strong-motion accelerographs at seven stations in the range of 9 to 25 km (Table 2, Figure 1). A peak acceleration of 0.17 g was recorded at the abutment of the Interstate 280/US 101 overpass in San Jose (Figure 3). The earthquake knocked items from store shelves at San Jose and was felt north to Eureka, south to Monterey and east as far as Modesto (NEIC).

The M_L 4.7 earthquake of April 3, 1989 triggered strong-motion accelerographs at five stations in the range of 4 to 33 km (Figure 1). A peak acceleration of 0.16 g was recorded at Cherry Flat Reservoir (see Table 3, Figure 4). The earthquake caused slight damage (MM=VI) at San Jose and was felt from Monterey to Santa Rosa (NEIC).

STRUCTURAL STATION INFORMATION

The following is a brief description of the instrumented structures included in this report; Anderson Dam, the San Jose I-280/Highway 101 overpass and Livermore VA hospital.

Anderson Dam. Anderson Dam, four miles east of Morgan Hill, is an earth and rockfill structure 64 m high with a 422 m crest length and a clay core cutoff

wall. Its maximum capacity is 91,000 acre feet. Acceleration sensors are located at the center and right sections of the crest and mid-level of the dam, and at the toe. Free-field accelerographs are located on the left abutment and downstream. (Maley and others, 1989).

San Jose, Interstate 280/Highway 101 Overpass. The San Jose Instrumentation is installed in the bridge carrying Interstate 280 over U.S. Highway 101. The bridge is a three-span continuous post-tensioned box girder bridge 1.45 m deep by 20.73 m wide. Bents are supported by two columns each.

Acceleration sensors are mounted on a central column near the footing, in a bridge cell at the top of the same column, in a cell midway between the west abutment and the central column and at the west abutment. Freefield sensors are located approximately 15 m south of the bridge.

Livermore VA Hospital. The Livermore Veterans Administration hospital is located on the southern edge of the city of Livermore approximately 6.5 km east of the Calaveras fault. The building is six stories high plus a basement; its dimensions are 87 m long, 15 m wide, and 28 m high. The structure has a reinforced concrete frame with spread footings supporting square concrete columns at 7 m bays. Interior structural walls at two-bay and three-bay intervals are 30 cm thick reinforced concrete. Two accelerographs in this structure, interconnected for common triggering and time, are located in the basement and on the 7th floor.

ACKNOWLEDGEMENTS

The acceleration data presented in this report were recorded in part by instrumentation operated as a component of cooperative programs with the Department of Veterans Affairs and California Department of Transportation. The U.S. Geological Survey appreciates the assistance of all organizations that have allowed the use of their facilities for the operation of strong-motion instrumentation.

REFERENCE

Maley, R., A. Acosta, F. Ellis, E. Etheredge, L. Foote, D. Johnson, R. Porcella, M. Salsman, and J. Switzer, 1989, U.S. Geological Survey strong-motion records from the northern California (Loma Prieta) earthquake of October 17, 1989: U.S. Geological Survey Open-File Report 89-568, 85 p.

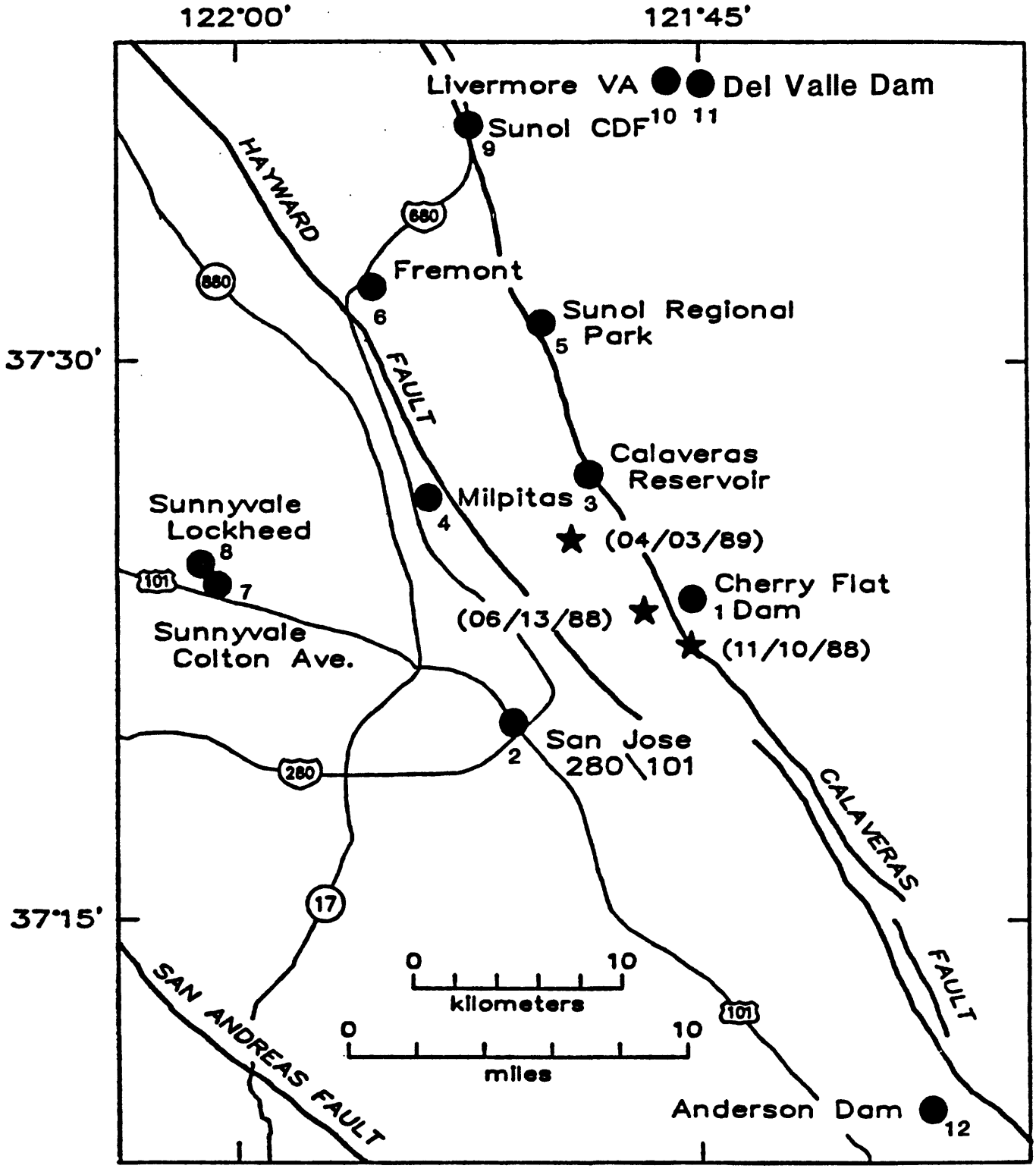


Figure 1. Strong-motion stations operated by the USGS during the June 13, 1988; November 10, 1988 and April 3, 1989 Calaveras Fault earthquakes.

Table 1. Peak Accelerations from the Calaveras fault earthquake of June 13, 1988

Station Identification				Epicentral Distance (km)	Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)		Direction (degrees)	Maximum (g)
3.	1687	Calaveras Array Calaveras Reservoir So. (USGS)	37.452 121.807	8	180 Up 090	.08 .05 .09
4.	1677	Milpitas Rivera St. (USGS)	37.437 121.879	13	360 Up 270	.09 .02 .07
5.	1684	Calaveras Array Sunol Wilderness Regional Park (USGS)	37.515 121.830	15	360 Up 270	.05 .03 .05
6.	1686	Fremont Emerson Court (USGS)	37.535 121.929	22	180 Up 090	.07 .06 .11
9	1688	Calaveras Array Sunol CDF Fire Station (USGS)	37.597 121.880	25	180 Up 090	.08 .03 .06
10.	1226	Livermore VA Hospital (VA) Bldg 62	37.625 121.762	27		
		Basement			125 Up 035	.01 .02 .02
		Roof (7th)			125 Up 035	.03 .01 .06
12.	1652	Anderson Dam (USGS)	37.165 121.631	28		
		Downstream			340 Up 250	.02 .01 .01

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1687 37.452N, 121.807W	180°	Sens. = 1.81 cm/g Freq. = 25.7 Hz	0.08g
Calaveras Array - Calaveras Reservoir South		Damp. = 0.60 crit	
SMA-1 No. 2257 (USGS)	Up	Sens. = 1.76 cm/g Freq. = 26.3 Hz	0.05g
EARTHQUAKE OF		Damp. = 0.56 crit	
13 June 1988 - 0145 G.m.t.	090°	Sens. = 1.71 cm/g Freq. = 26.2 Hz Damp. = 0.58 crit	0.09g

Film speed = 1 cm/sec

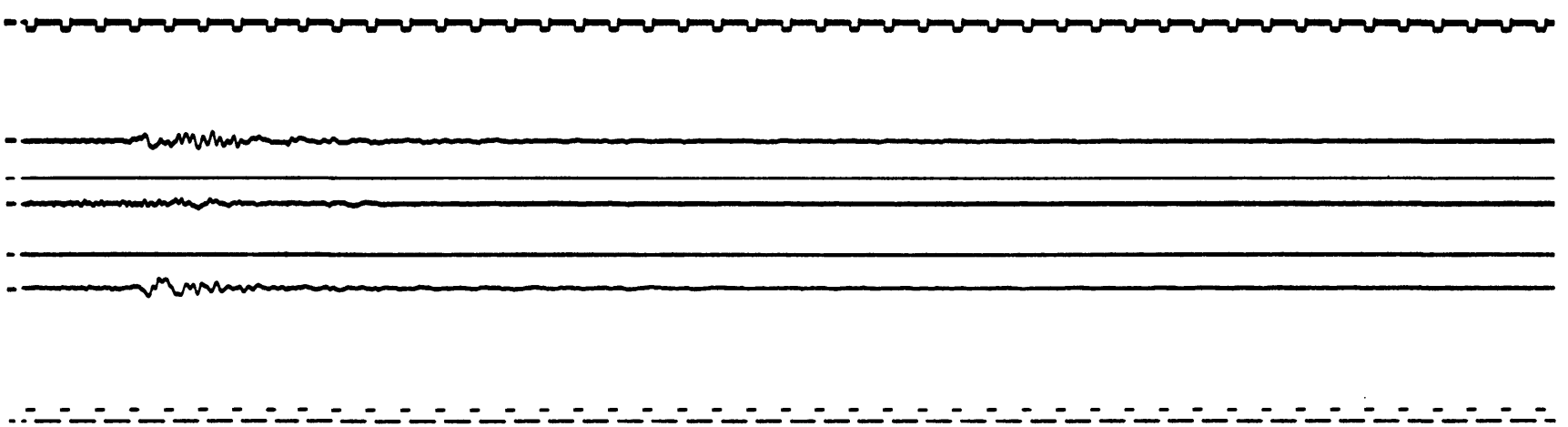


Figure 2. Copies of accelerograms from the Calaveras fault earthquake of June 13, 1988.

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1677 37.437N, 121.879W	360°	Sens. = 1.85 cm/g Freq. = 26.4 Hz	0.09g
Milpitas, CA - Rivera Street		Damp. = 0.6 crit	
SMA-1 No. 394 (USGS)	Up	Sens. = 1.75 cm/g Freq. = 26.6 Hz	0.02g
EARTHQUAKE OF		Damp. = 0.6 crit	
13 June 1988 0145 G.m.t.	270°	Sens. = 1.95 cm/g Freq. = 25.2 Hz	0.07g
		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

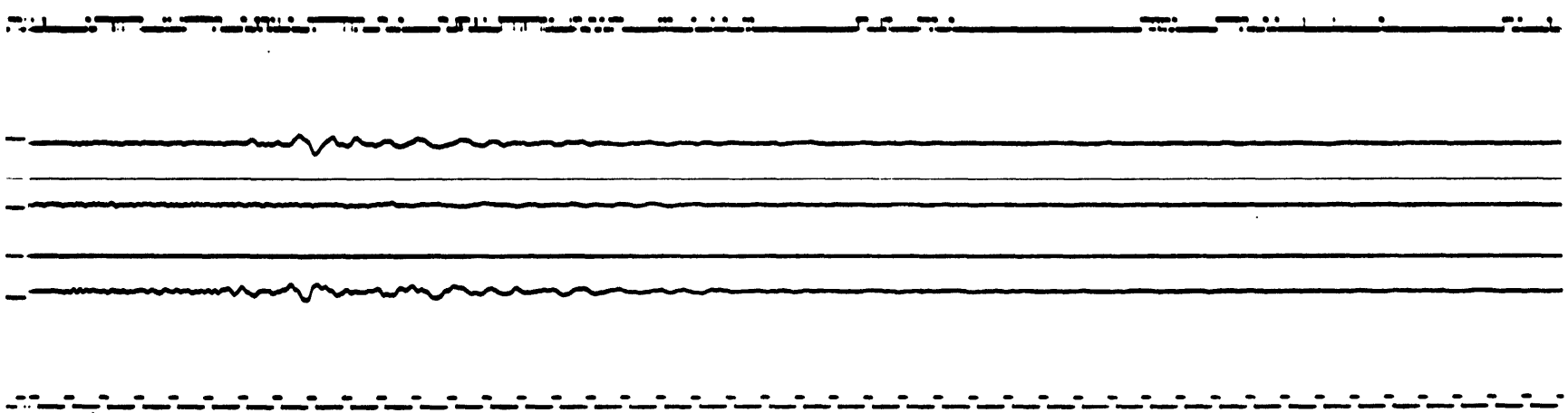


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1684 37.515N, 121.830W	360°	Sens. = 1.92 cm/g Freq. = 25.6 Hz Damp. = 0.61 crit	0.05g
Calaveras Array Sunol Wilderness Regional Park			
SMA 1 No. 2258 (USGS)	Up	Sens. = 1.78 cm/g Freq. = 27.0 Hz Damp. = 0.59 crit	0.03g
EARTHQUAKE OF			
13 June 1988 - 0145 G.m.t.	270°	Sens. = 1.71 cm/g Freq. = 26.3 Hz Damp. = 0.57 crit	0.05g
		Film speed = 1 cm/sec	

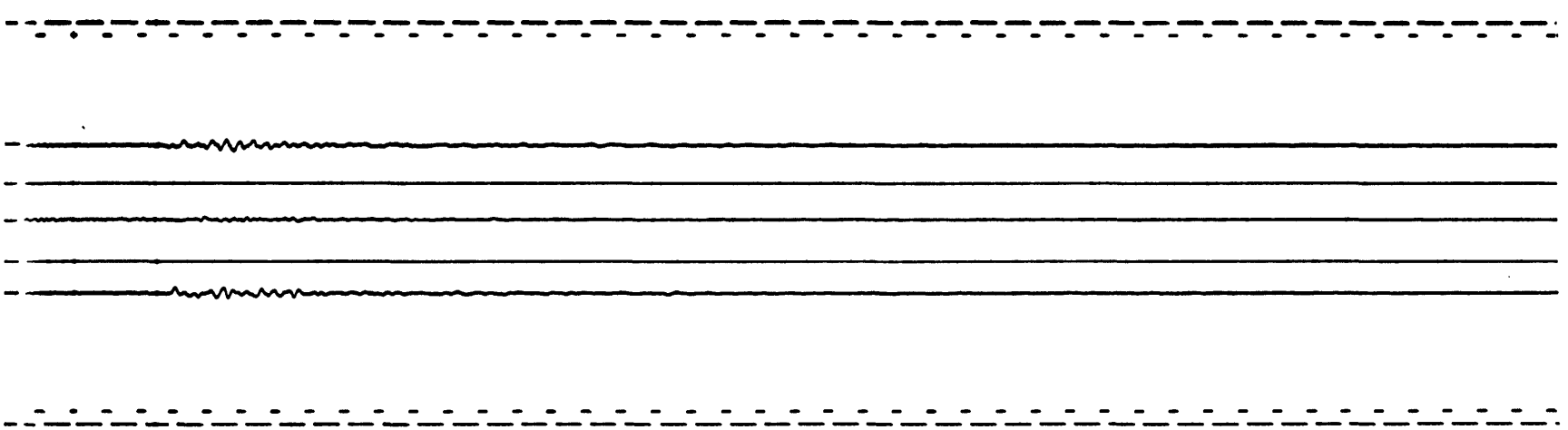


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1686 37.535N, 121.929W	180°	Sens. = 1.85 cm/g Freq. = 25.2 Hz	0.07g
Fremont, Emerson Ct.		Damp. = 0.61 crit	
SMA-1 No. 2261 (USGS) Ground	Up	Sens. = 1.75 cm/g Freq. = 26.1 Hz	0.06g
EARTHQUAKE OF		Damp. = 0.59 crit	
13 June 1988 - 0145 G.m.t.	090°	Sens. = 1.87 cm/g Freq. = 25.4 Hz Damp. = 0.6 crit	0.11g

Film speed = 1 cm/sec

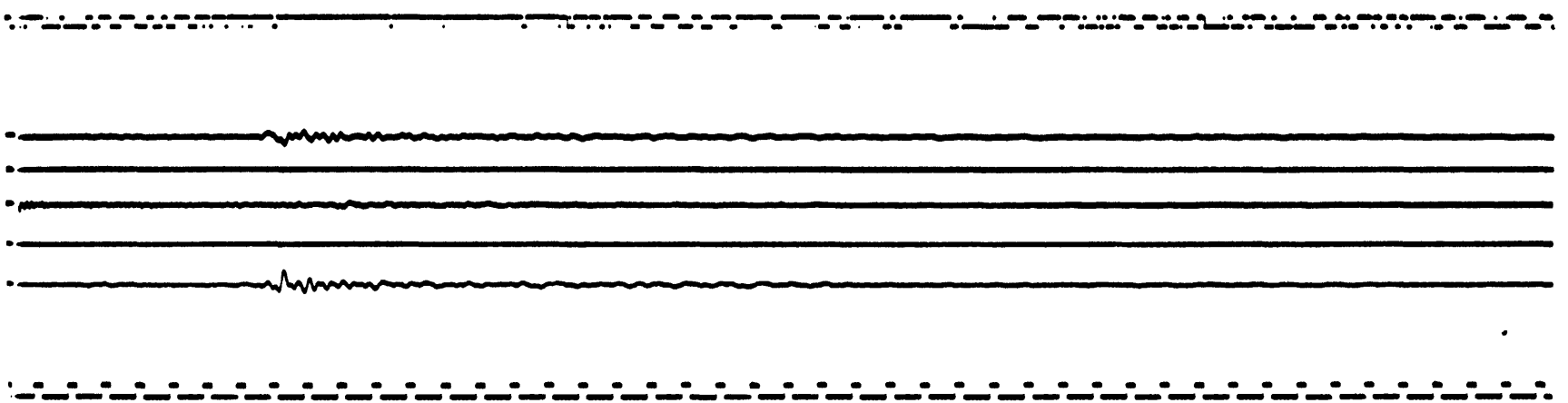


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1688 37.597N, 121.880W	180°	Sens. = 1.91 cm/g Freq. = 25.3 Hz	0.08g
Calaveras Array - Sunol CDF Fire Station		Damp. = 0.6 crit	
SMA-1 No. 4703 (USGS) Ground	Up	Sens. = 1.91 cm/g Freq. = 24.9 Hz	0.03g
EARTHQUAKE OF		Damp. = 0.6 crit	
13 June 1988 - 0145 G.m.t.	090°	Sens. = 1.89 cm/g Freq. = 25.5 Hz Damp. = 0.6 crit	0.06g

Film speed = 1 cm/sec

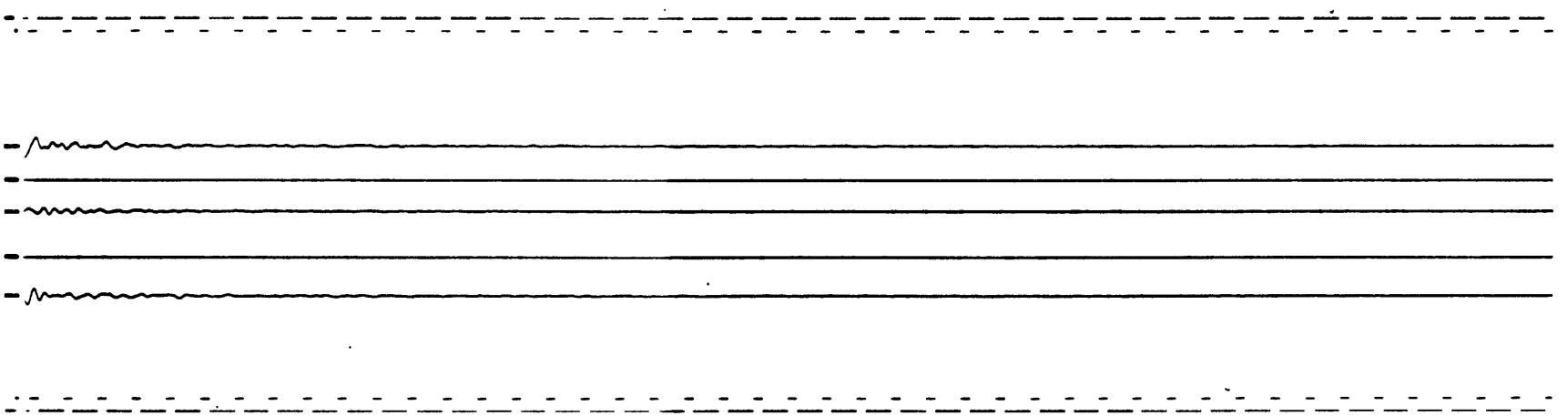


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1226 37.625N, 121.762W	125°	Sens. = 1.86 cm/g Freq. = 25.4 Hz	0.01g
Livermore VA Hospital - Bldg. 62		Damp. = 0.6 crit	
SMA-1 No. 602 (VA) Basement	Up	Sens. = 1.79 cm/g Freq. = 25.8 Hz	0.02g
EARTHQUAKE OF		Damp. = 0.6 crit	
13 June 1988 - 0145 G.m.t.	035°	Sens. = 1.95 cm/g Freq. = 25.8 Hz Damp. = 0.6 crit	0.02g
		Film speed = 1 cm/sec	

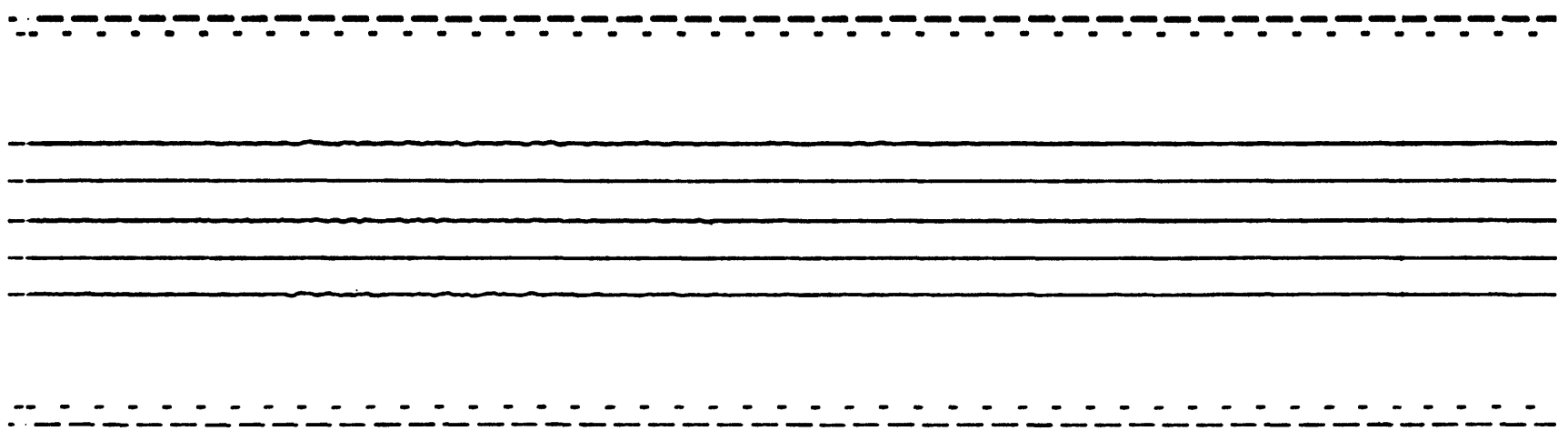


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1226 37.625N, 121.762W	125°	Sens. = 1.80 cm/g Freq. = 25.8 Hz	0.03g
Livermore VA Hospital - Bldg. 62		Damp. = 0.6 crit	
SMA-1 No. 854 (VA) Roof (7th)	Up	Sens. = 1.80 cm/g Freq. = 25.8 Hz	0.01g
EARTHQUAKE OF		Damp. = 0.6 crit	
13 June 1988 - 0145 G.m.t.	035°	Sens. = 1.90 cm/g Freq. = 25.3 Hz Damp. = 0.6 crit	0.06g

Film speed = 1 cm/sec

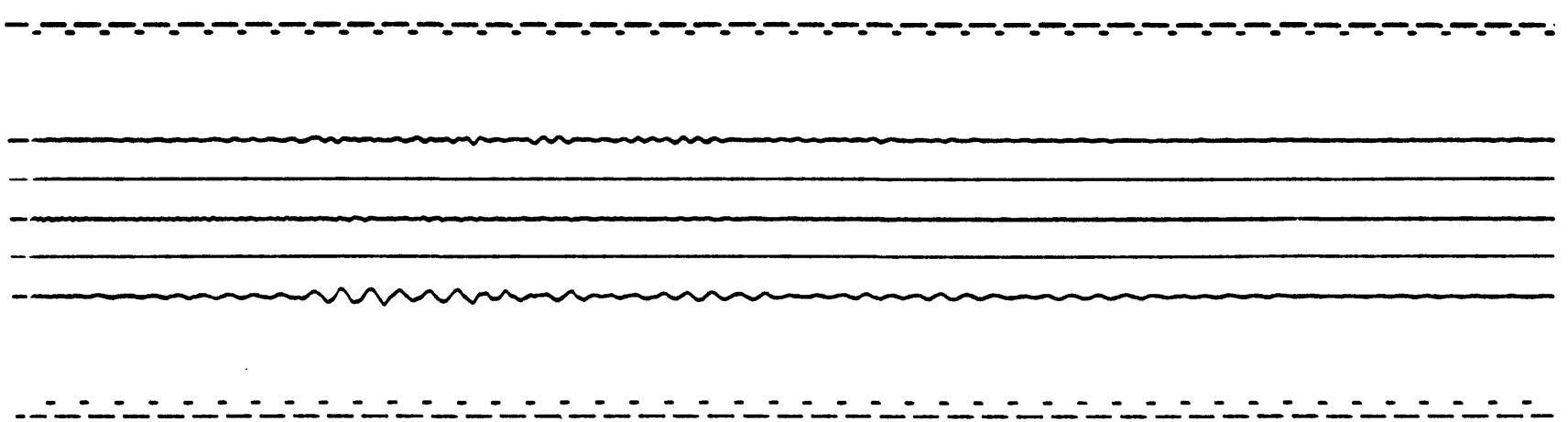


Figure 2. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELEROGRAM
Station No. 1652 37.165N, 121.631W	340°	Sens. = 1.73 cm/g Freq. = 27.0 Hz	0.02g
Anderson Dam - Downstream		Damp. = 0.6 crit	
SMA-1 No. 2803 (USGS)	Up	Sens. = 1.69 cm/g Freq. = 27.0 Hz	0.01g
EARTHQUAKE OF		Damp. = 0.6 crit	
13 June 1988 - 0145:43.5 G.m.t.	250°	Sens. = 1.71 cm/g Freq. = 27.0 Hz	0.01g
(WWVB trigger)		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

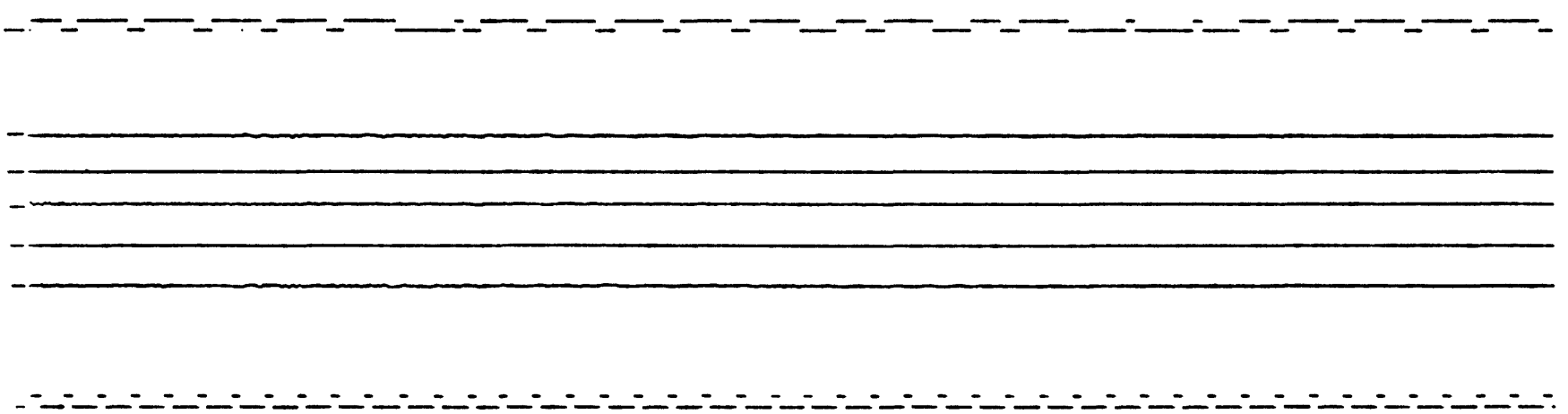
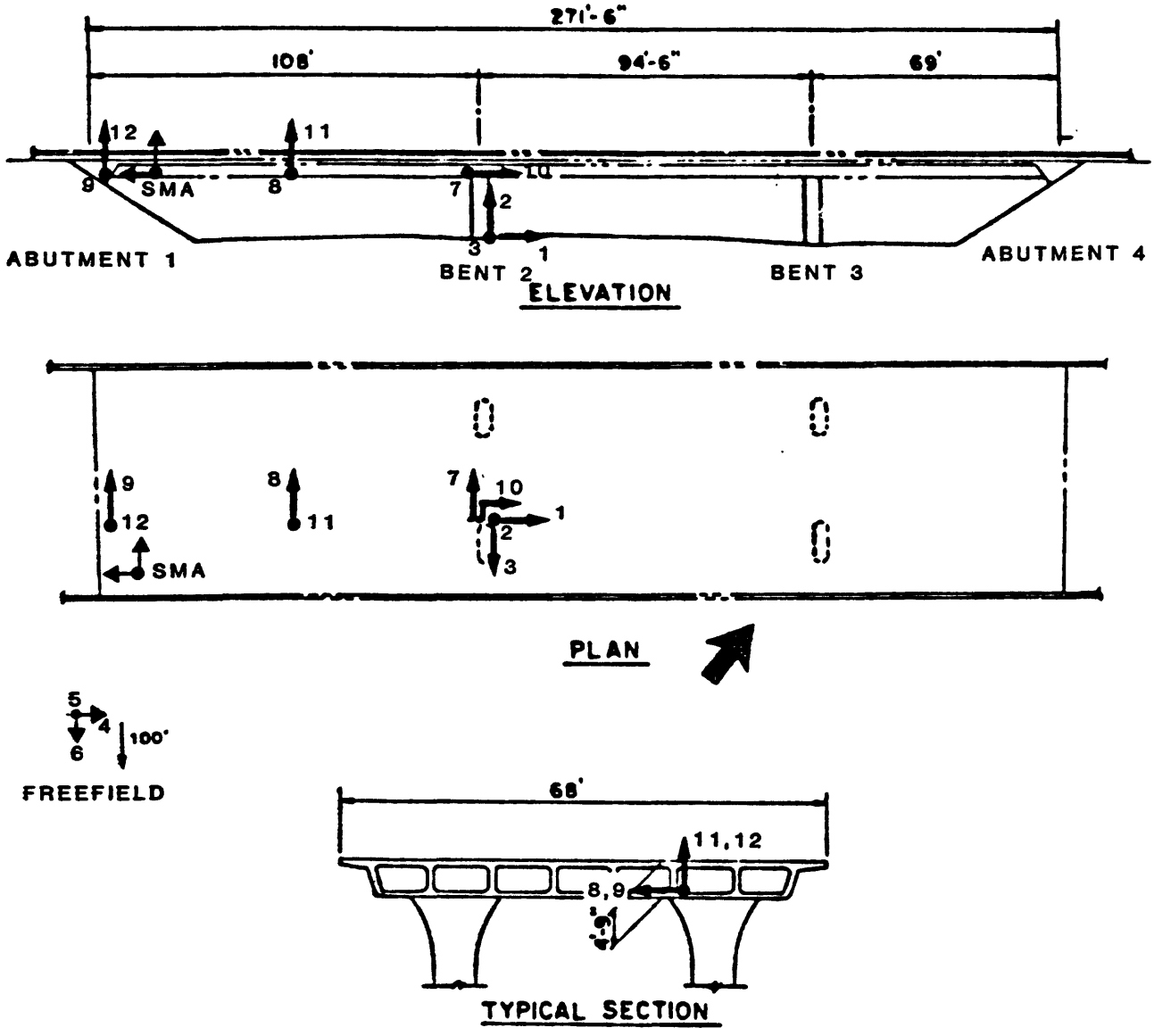


Figure 2. Continued

Table 2. Peak Accelerations from the Calaveras fault earthquake of November 10, 1988

Station Identification				Epicentral Distance (km)	Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)		Direction (degrees)	Maximum (g)
2.	1571	San Jose Interchange, 101/280 (USGS/CDOT)	37.340 121.851	9		
		Abutment			322	.17
					Up	.02
					232	.09
		Structure Array:				
		Ch. 1- Column base bent 2			052	.04
		Ch. 2- Column base bent 2			Up	.02
		Ch. 3- Column base bent 2			142	.12
		Ch. 4- Freefield			052	.08
		Ch. 5- Freefield			Up	.02
		Ch. 6- Freefield			142	Failed
		Ch. 7- Column top bent 2			322	.15
		Ch. 8- Midspan			322	.16
		Ch. 9- West abutment			322	.16
		Ch. 10- Column top bent 2			052	.08
		Ch. 11- Midspan			Up	.06
		Ch. 12- West abutment			Up	.02
3.	1687	Calaveras Array Calaveras Reservoir So. (USGS)	37.452 121.807	10	180	.06
					Up	.03
					090	.07
4.	1677	Milpitas Rivera St. (USGS)	37.437 121.879	15	360	.05
					Up	.02
					270	.04
5.	1684	Calaveras Array Sunol Wilderness Regional Park (USGS)	37.515 121.830	17	360	.02
					Up	.02
					270	.02
6.	1686	Fremont Emerson Court (USGS)	37.535 121.929	23	180	.02
					Up	.02
					090	.02
7.	1695	Sunnyvale Colton Avenue (USGS)	37.402 122.024	24	360	.07
					Up	.03
					270	.03
8	1693	Sunnyvale Lockheed Way (USGS)	37.418 122.031	25	090	.03
					Up	.02
					360	.03



SAN JOSE INTERCHANGE 101/280

Figure 3. Selected structure drawings and copies of accelerograms.

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1571 37.340N, 121.851W	322°	Sens. = 1.63 cm/g Freq. = 26.3 Hz Damp. = 0.6 crit	0.17g
San Jose 101/280 Fwy Interchange			
SMA-1 No. 288 USGS/CDOT (Bridge) Abutment	Up	Sens. = 1.84 cm/g Freq. = 26.3 Hz Damp. = 0.6 crit	0.02g
EARTHQUAKE BETWEEN			
15 June 1988 and 10 November 1988	232°	Sens. = 1.81 cm/g Freq. = 25.6 Hz Damp. = 0.6 crit	0.09g
		Film speed = 1 cm/sec	

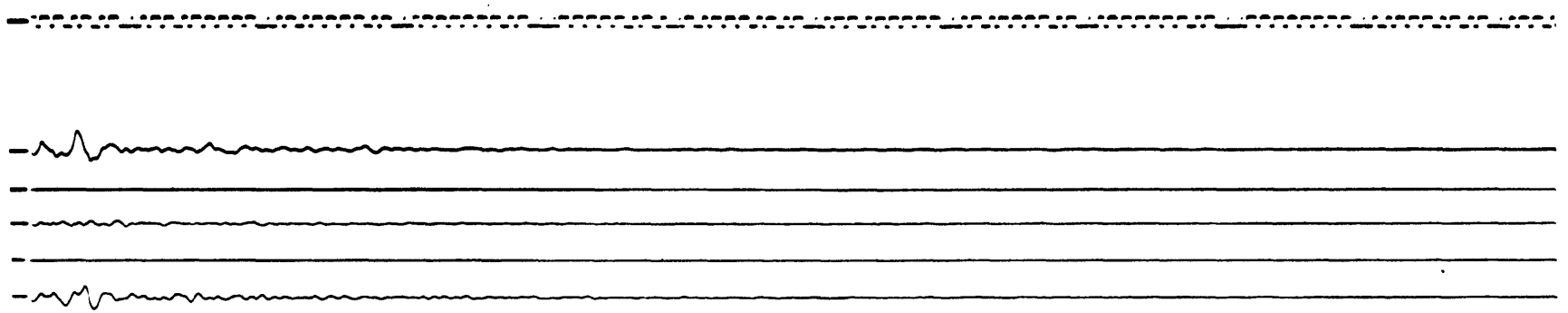
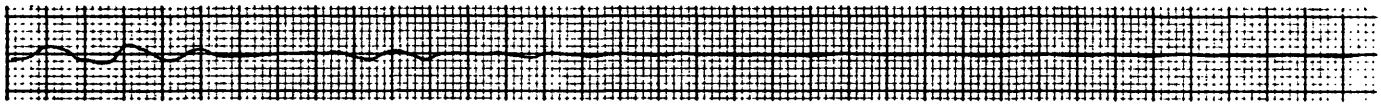


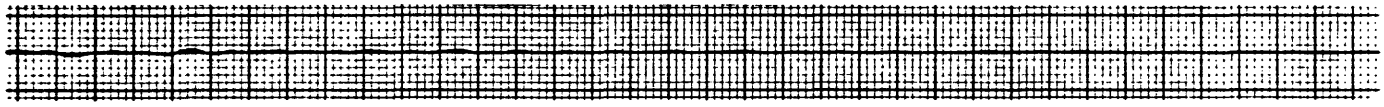
Figure 3. Continued

SAN JOSE INTERCHANGE 101/280

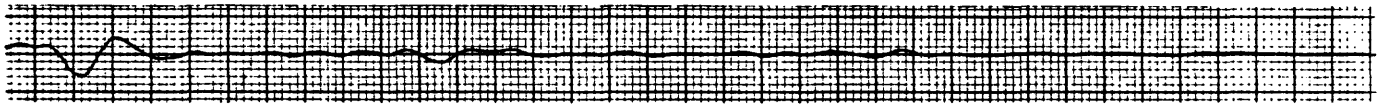
1. COLUMN BASE BENT 2 052 0.04g



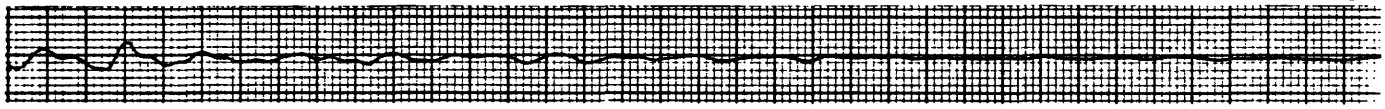
2. COLUMN BASE BENT 2 UP 0.02g



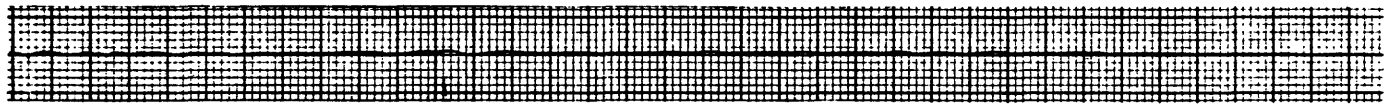
3. COLUMN BASE BENT 2 142 0.12g



4. FREEFIELD 052 0.08g



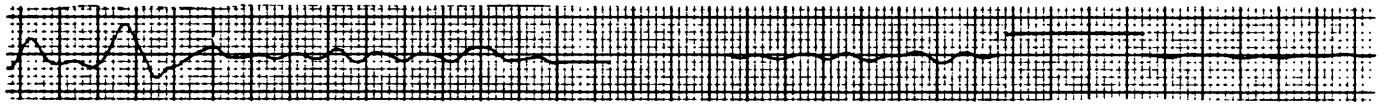
5. FREEFIELD UP 0.02g



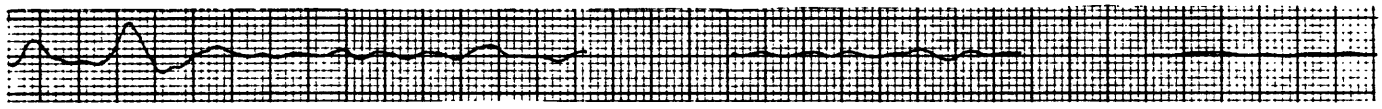
FILM SPEED 2.5 CM/SEC

Figure 3. Continued

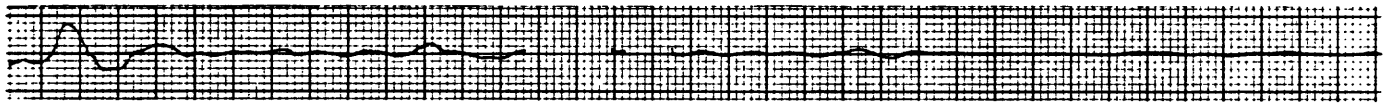
7. COLUMN TOP BENT 2 322 0.15g



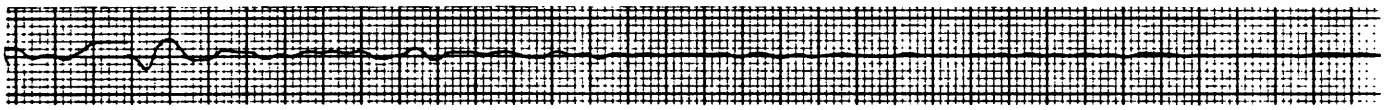
8. MIDSPAN 322 0.16g



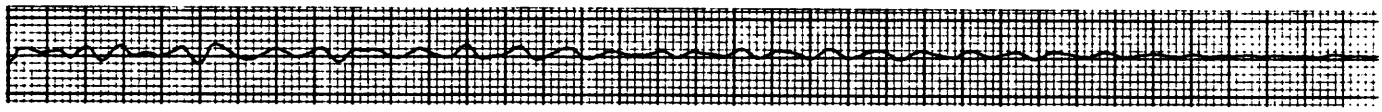
9. WEST ABUTMENT 322 0.16g



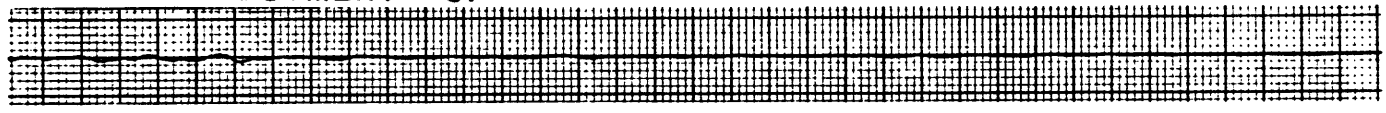
10. COLUMN TOP BENT 2 052 0.08g



11. MIDSPAN UP 0.06g



12. WEST ABUTMENT UP 0.02g



FILM SPEED 2.5 CM/SEC

Figure 3. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1687 37.452N, 121.807W	180°	Sens. = 1.81 cm/g Freq. = 25.7 Hz Damp. = 0.60 crit	0.06g
Calaveras Array - Calaveras Reservoir South SMA-1 No. 2257 (USGS)	Up	Sens. = 1.76 cm/g Freq. = 26.3 Hz Damp. = 0.56 crit	0.03g
EARTHQUAKE OF 10 November 1988 - 0508 G.m.t.	090°	Sens. = 1.71 cm/g Freq. = 26.2 Hz Damp. = 0.58 crit	0.07g
		Film speed = 1 cm/sec	

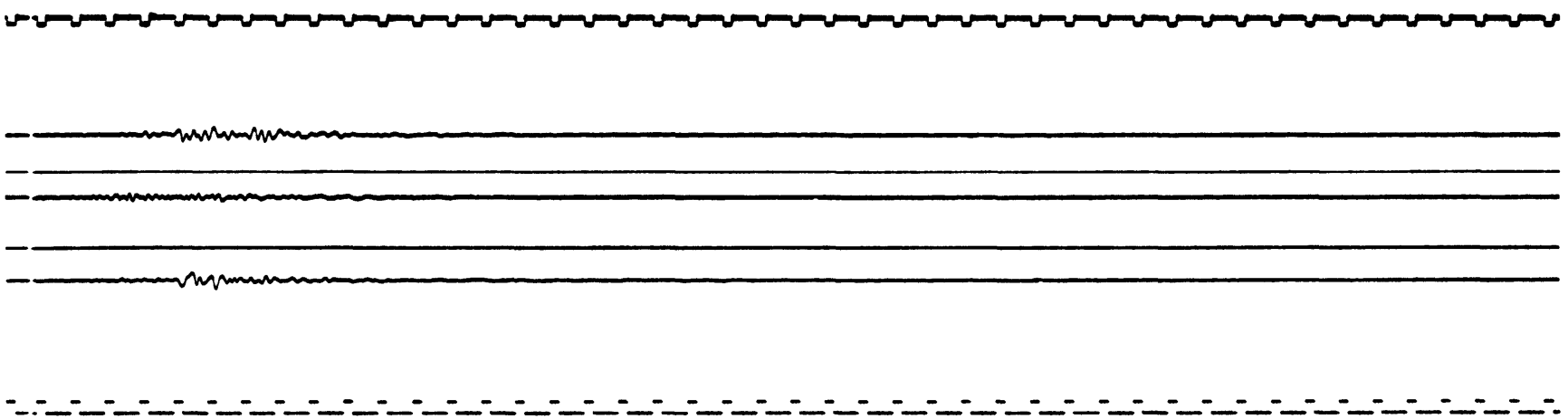


Figure 3. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1677 37.437N, 121.879W	360°	Sens. = 1.85 cm/g Freq. = 26.4 Hz	0.05g
Milpitas, CA - Rivera Street		Damp. = 0.6 crit	
SMA-1 No. 394 (USGS)	Up	Sens. = 1.75 cm/g Freq. = 26.6 Hz	0.02g
EARTHQUAKE BETWEEN		Damp. = 0.6 crit	
15 June 1988 and 10 November 1988	270°	Sens. = 1.95 cm/g Freq. = 25.2 Hz	0.04g
(Possible earthquake of 10 November 1988 0508 G.m.t.)		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

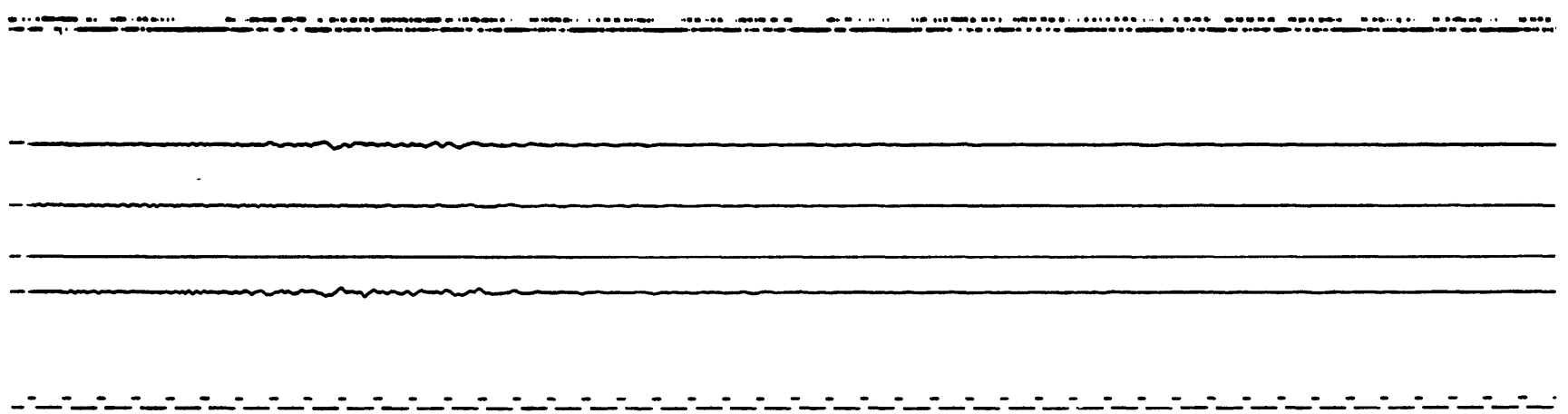


Figure 3. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1684 37.515N, 121.830W	360°	Sens. = 1.92 cm/g Freq. = 25.6 Hz Damp. = 0.61 crit	0.02g
Calaveras Array Sunol Wilderness Regional Park			
	Up	Sens. = 1.78 cm/g Freq. = 27.0 Hz Damp. = 0.59 crit	0.02g
SMA 1 No. 2258 (USGS)			
EARTHQUAKE OF			
	270°	Sens. = 1.71 cm/g Freq. = 26.3 Hz Damp. = 0.57 crit	0.02g
10 November 1988 - 0508 G.m.t.			
		Film speed = 1 cm/sec	

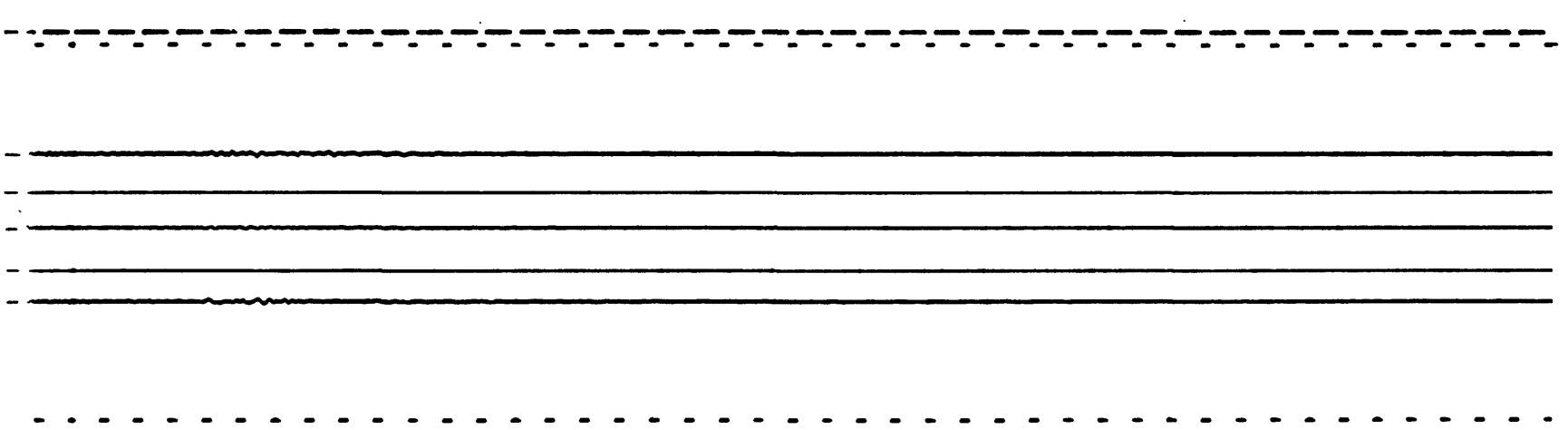


Figure 3. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1686 37.535N, 121.929W	180°	Sens. = 1.85 cm/g Freq. = 25.2 Hz	0.02g
Fremont, Emerson Ct.		Damp. = 0.61 crit	
SMA-1 No. 2261 (USGS) Ground	Up	Sens. = 1.75 cm/g Freq. = 26.1 Hz	0.02g
EARTHQUAKE OF		Damp. = 0.59 crit	
10 November 1988 - 0508 G.m.t.	090°	Sens. = 1.87 cm/g Freq. = 25.4 Hz Damp. = 0.6 crit	0.02g

Film speed = 1 cm/sec

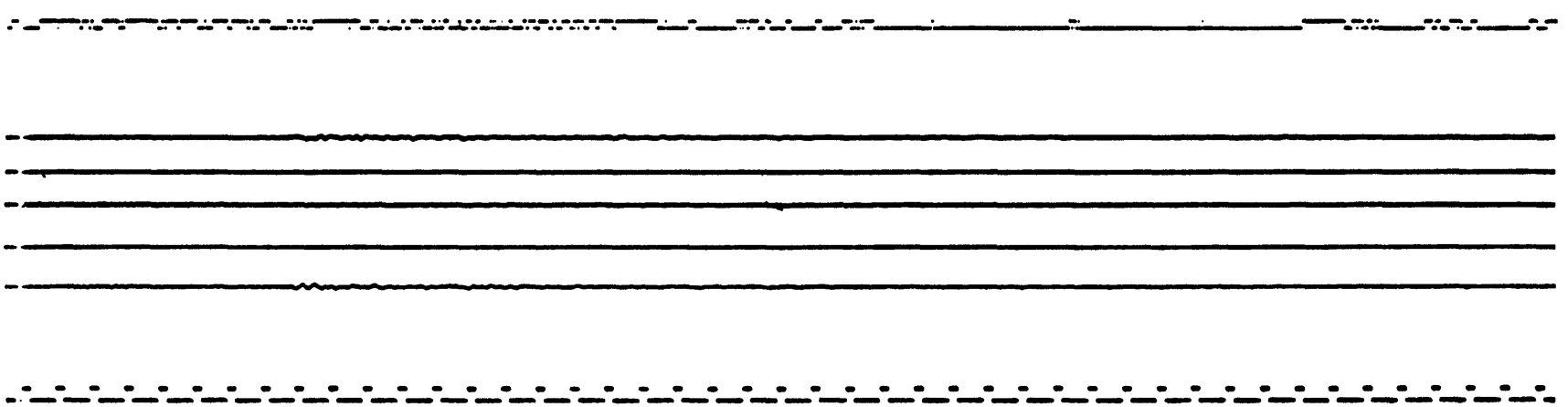


Figure 3. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1695 37.402N, 122.024W	360°	Sens. = 1.88 cm/g Freq. = 25.5 Hz	0.07g
Sunnyvale - Colton Avenue		Damp. = 0.6 crit	
SMA-1 No. 4053 (USGS)	Up	Sens. = 1.95 cm/g Freq. = 24.9 Hz	0.03g
EARTHQUAKE OF		Damp. = 0.6 crit	
10 November 1988 - 0509:08.2 G.m.t.	270°	Sens. = 1.71 cm/g Freq. = 26.1 Hz	0.03g
(WWVB trigger time)		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

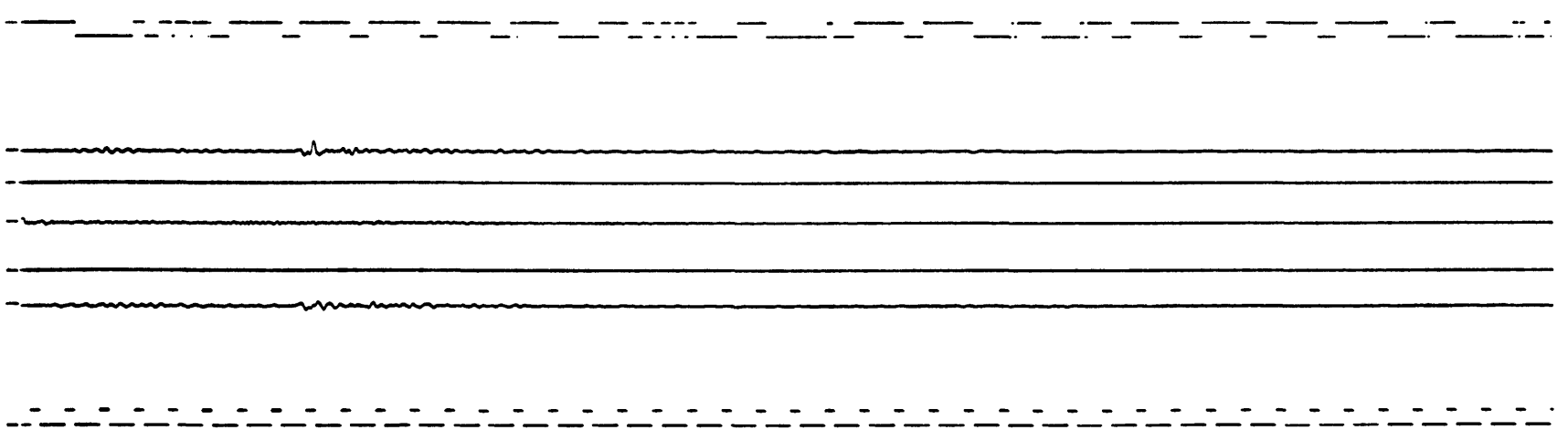


Figure 3. Continued

U.S. STRONG-MOTION NETWORK		DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1693	37.418N, 122.031W	090°	Sens. = 1.86 cm/g Freq. = 26.0 Hz	0.03g
Sunnyvale - 1111 Lockheed Way			Damp. = 0.6 crit	
SMA No. 1518	(USGS)	Up	Sens. = 1.85 cm/g Freq. = 26.0 Hz	0.02g
EARTHQUAKE OF			Damp. = 0.6 crit	
10 November 1988 - 0508 G.m.t.		360°	Sens. = 1.97 cm/g Freq. = 24.9 Hz	0.03g
			Damp. = 0.6 crit	
			Film speed = 1 cm/sec	

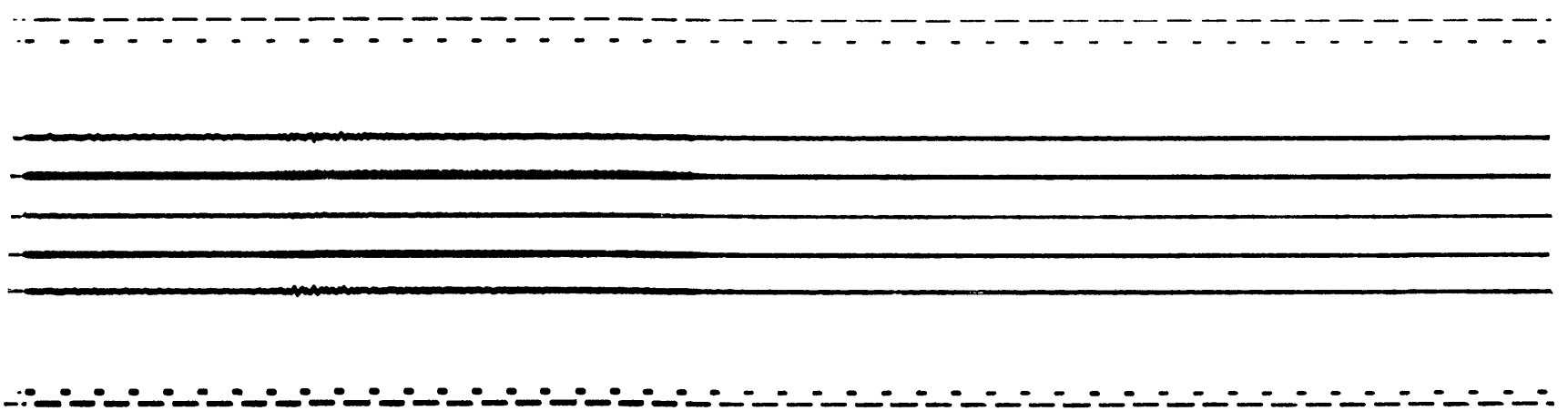


Figure 3. Continued

Table 3. Peak Accelerations from the Calaveras fault earthquake of April 3, 1989

Station Identification				Epicentral	Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Distance (km)	Direction (degrees)	Maximum (g)
1.	1696	Calaveras Array Cherry Flat Reservoir (USGS)	37.396 121.756	5	360 Up 270	.09 .07 .16
2.	1571	San Jose Interchange, 101/280/680 (USGS)	37.340 121.851	11		
		Abutment			322 Up 232	.09 .04 .06
		Structure Array:				
		Ch. 1- Column base bent 2			052	.04
		Ch. 2- Column base bent 2			Up	.03
		Ch. 3- Column base bent 2			142	.06
		Ch. 4- Freefield			052	.04
		Ch. 5- Freefield			Up	.04
		Ch. 6- Freefield			142	.06
		Ch. 7- Column top bent 2			322	.11
		Ch. 8- Midspan			322	.11
		Ch. 9- West abutment			322	.08
		Ch. 10- Column top bent 2			052	.06
		Ch. 11- Midspan			Up	.08
		Ch. 12- West abutment			Up	.03
3.	1687	Calaveras Array Calaveras Reservoir So. (USGS)	37.452 121.807	4	180 Up 090	.07 .02 .08
7.	1695	Sunnyvale Colton Avenue (USGS)	37.402 122.024	21	360 Up 270	.03 .04 .03
12.	1652	Anderson Dam	37.166 121.628	33		
		Crest			340 Up 250	.02 .01 .02
		Structure Array:				
		Ch. 1- Mid-dam Center			153	.01
		Ch. 2- Mid-dam Center			243	.01
		Ch. 3- Mid-dam Right			063	.01
		Ch. 4- Toe			333	.01
		Ch. 5- Toe			Up	.01
		Ch. 6- Toe			063	.01
		Ch. 7- Right Crest			333	.03
		Ch. 8- Righr Crest			Up	.02
		Ch. 9- Right Crest			063	.02
		Ch. 10- Center Crest			333	.02
		Ch. 11- Center Crest			Up	.02
		Ch. 12- Center Crest			063	.02

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1696 37.396N, 121.756W	360°	Sens. = 2.00 cm/g Freq. = 24.7 Hz	0.09G
Calaveras Array - Cherry Flat Reservoir		Damp. = 0.62 crit	
SMA-1 No. 600 (USGS) L. abutment	Up	Sens. = 1.70 cm/g Freq. = 25.8 Hz	0.07g
EARTHQUAKE OF		Damp. = 0.59 crit	
3 April 1989 - 1746:36.8 G.m.t.	270°	Sens. = 1.75 cm/g Freq. = 25.0 Hz	0.16g
(WWVB trigger time)		Damp. = 0.59 crit	
		Film speed = 1 cm/sec	

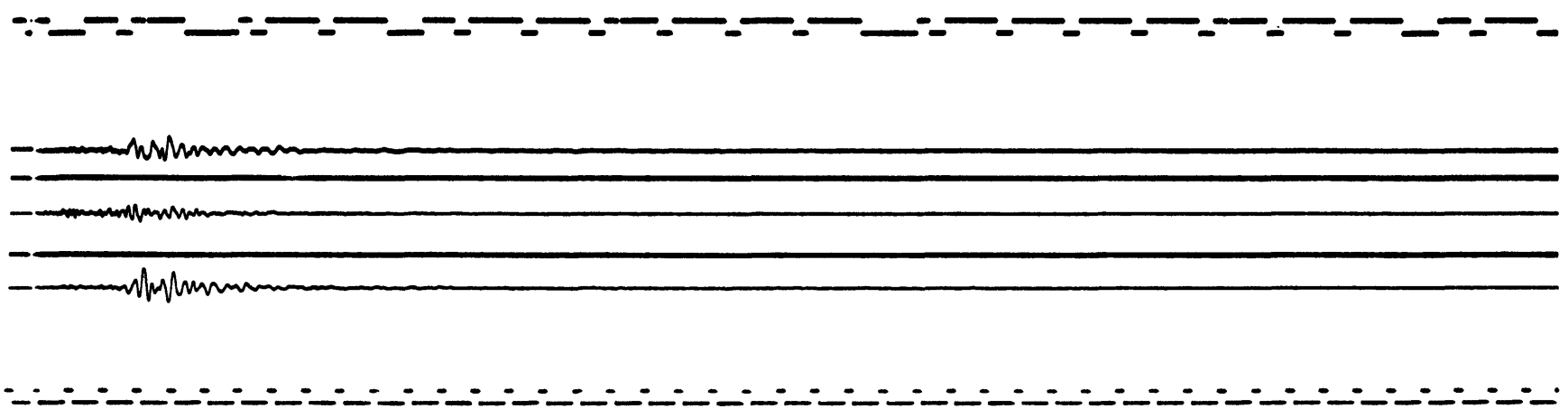


Figure 4. Copies of accelerograms and selected structure drawings.

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1571 37.340N, 121.851W	322°	Sens. = 1.63 cm/g Freq. = 26.3 Hz	0.09g
San Jose 101/280 Fwy Interchange		Damp. = 0.6 crit	
SMA-1 No. 288 USGS/CDOT (Bridge) Abutment	Up	Sens. = 1.84 cm/g Freq. = 26.3 Hz	0.04g
EARTHQUAKE OF		Damp. = 0.6 crit	
3 April 1989 - 1746:43.1 G.m.t.	232°	Sens. = 1.81 cm/g Freq. = 25.6 Hz	0.06g
		Damp. = 0.6 crit	
(Uncorrected TCG trigger time)		Film speed = 1 cm/sec	

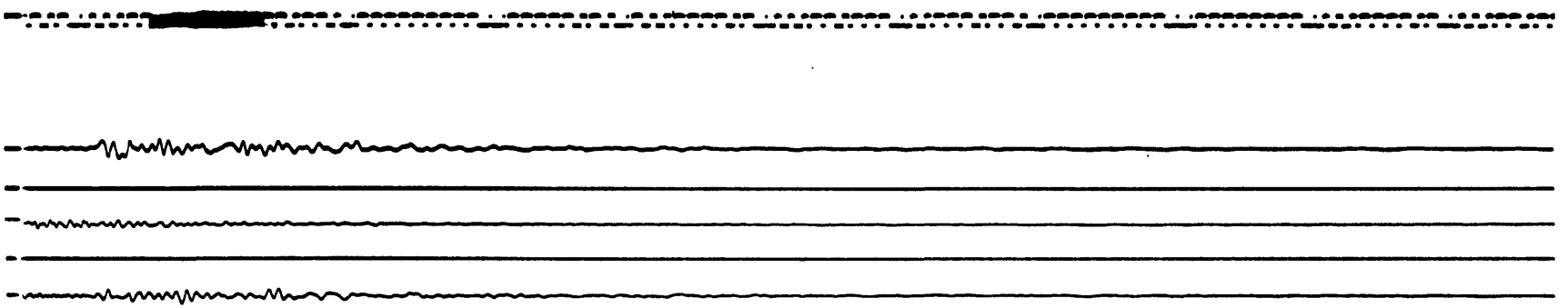
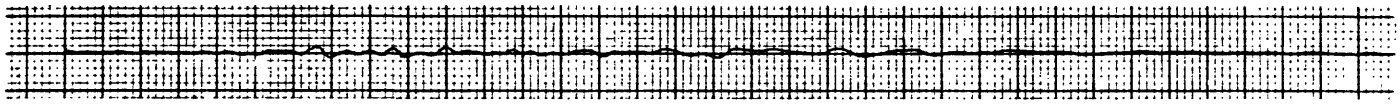


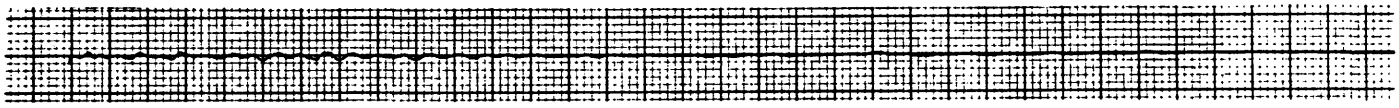
Figure 4. Continued

SAN JOSE INTERCHANGE 101/280

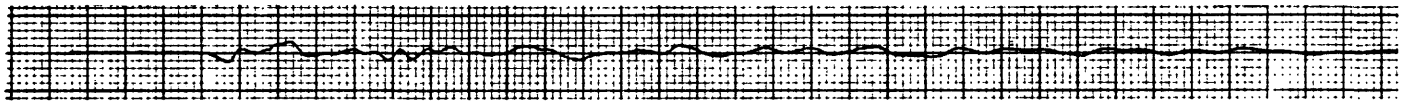
1. COLUMN BASE BENT 2 052 0.04g



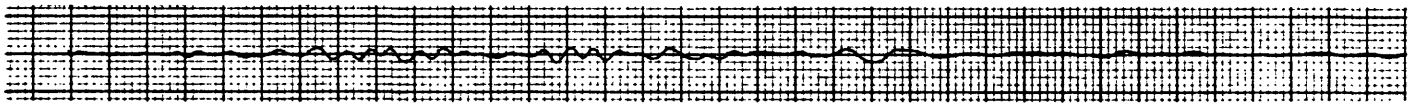
2. COLUMN BASE BENT 2 UP 0.03g



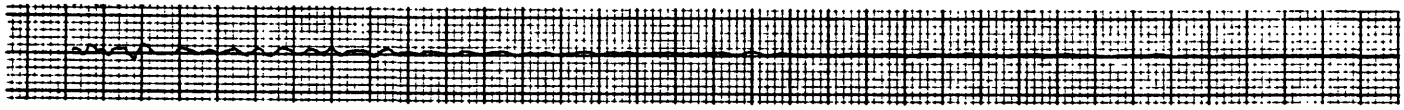
3. COLUMN BASE BENT 2 142 0.06g



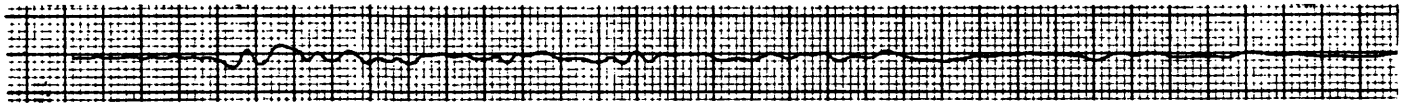
4. FREEFIELD 052 0.04g



5. FREEFIELD UP 0.04g



6. FREEFIELD 142 0.06g

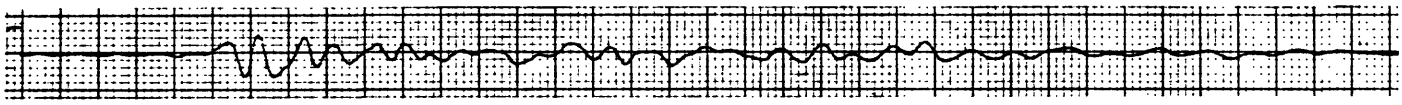


FILM SPEED 2.5 CM/SEC

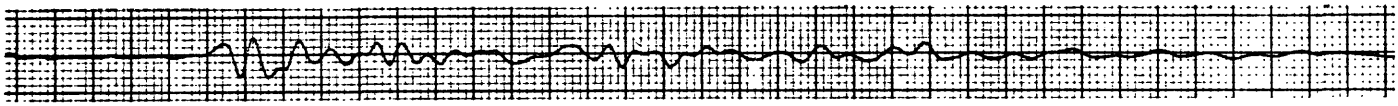
Figure 4. Continued

SAN JOSE INTERCHANGE 101/280

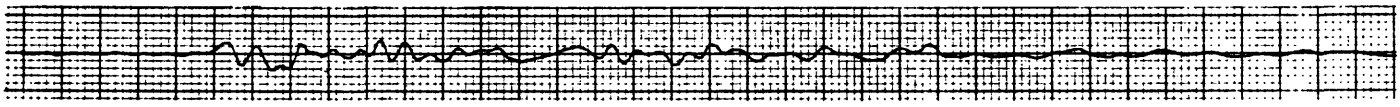
7. COLUMN TOP BENT 2 322 0.11g



8. MIDSPAN 322 0.11g



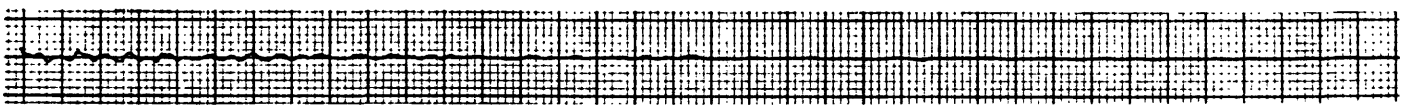
9. WEST ABUTMENT 322 0.08g



10. COLUMN TOP BENT 2 052 0.06g

11. MIDSPAN UP 0.08g

12. WEST ABUTMENT UP 0.03g



FILM SPEED 2.5 CM/SEC

Figure 4. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1687 37.452N, 121.807W	180°	Sens. = 1.81 cm/g Freq. = 25.7 Hz Damp. = 0.60 crit	0.07g
Calaveras Array - Calaveras Reservoir South SMA-1 No. 2257 (USGS) Ground	Up	Sens. = 1.76 cm/g Freq. = 26.3 Hz Damp. = 0.56 crit	0.02g
EARTHQUAKE OF 3 April 1989 - 1746 G.m.t.	090°	Sens. = 1.71 cm/g Freq. = 26.2 Hz Damp. = 0.58 crit	0.08g

Film speed = 1 cm/sec

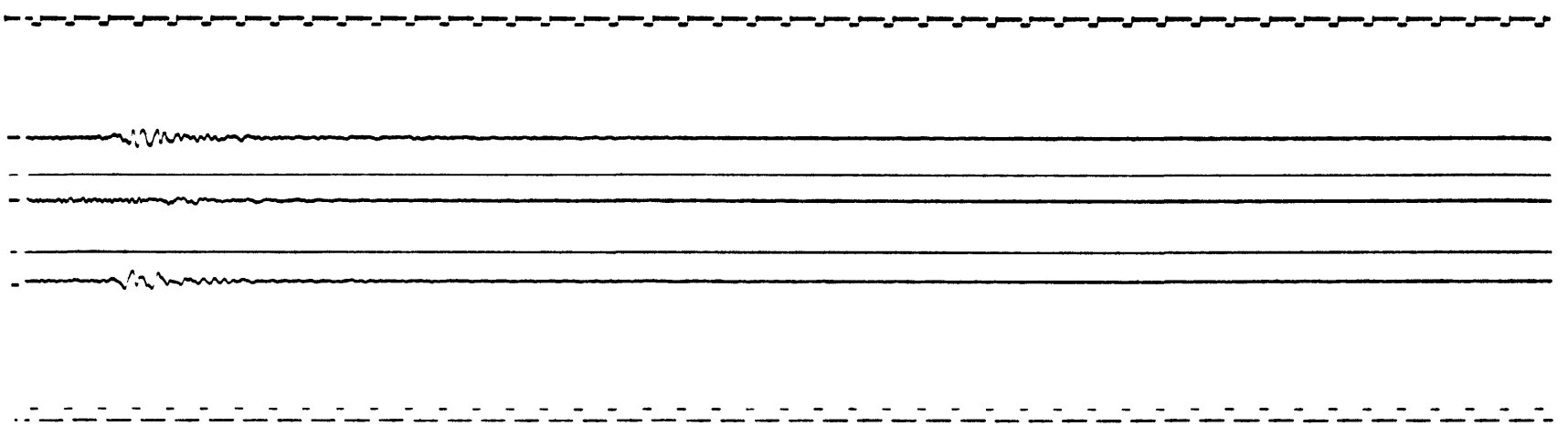


Figure 4. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1695 37.402N, 122.024W	360°	Sens. = 1.88 cm/g Freq. = 25.5 Hz	0.03g
Sunnyvale - Colton Avenue		Damp. = 0.6 crit	
SMA-1 No. 4053 (USGS)	Up	Sens. = 1.95 cm/g Freq. = 24.9 Hz	0.04g
EARTHQUAKE OF		Damp. = 0.6 crit	
3 April 1989 - 1746:39.3 G.m.t.	270°	Sens. = 1.71 cm/g Freq. = 26.1 Hz	0.03g
(WWVB trigger time)		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

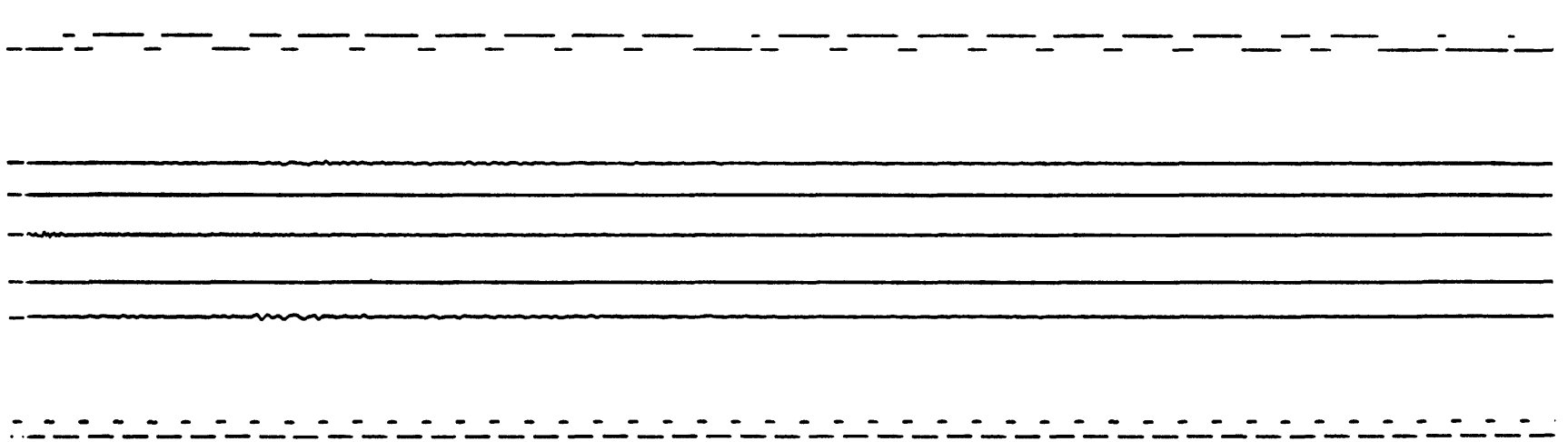
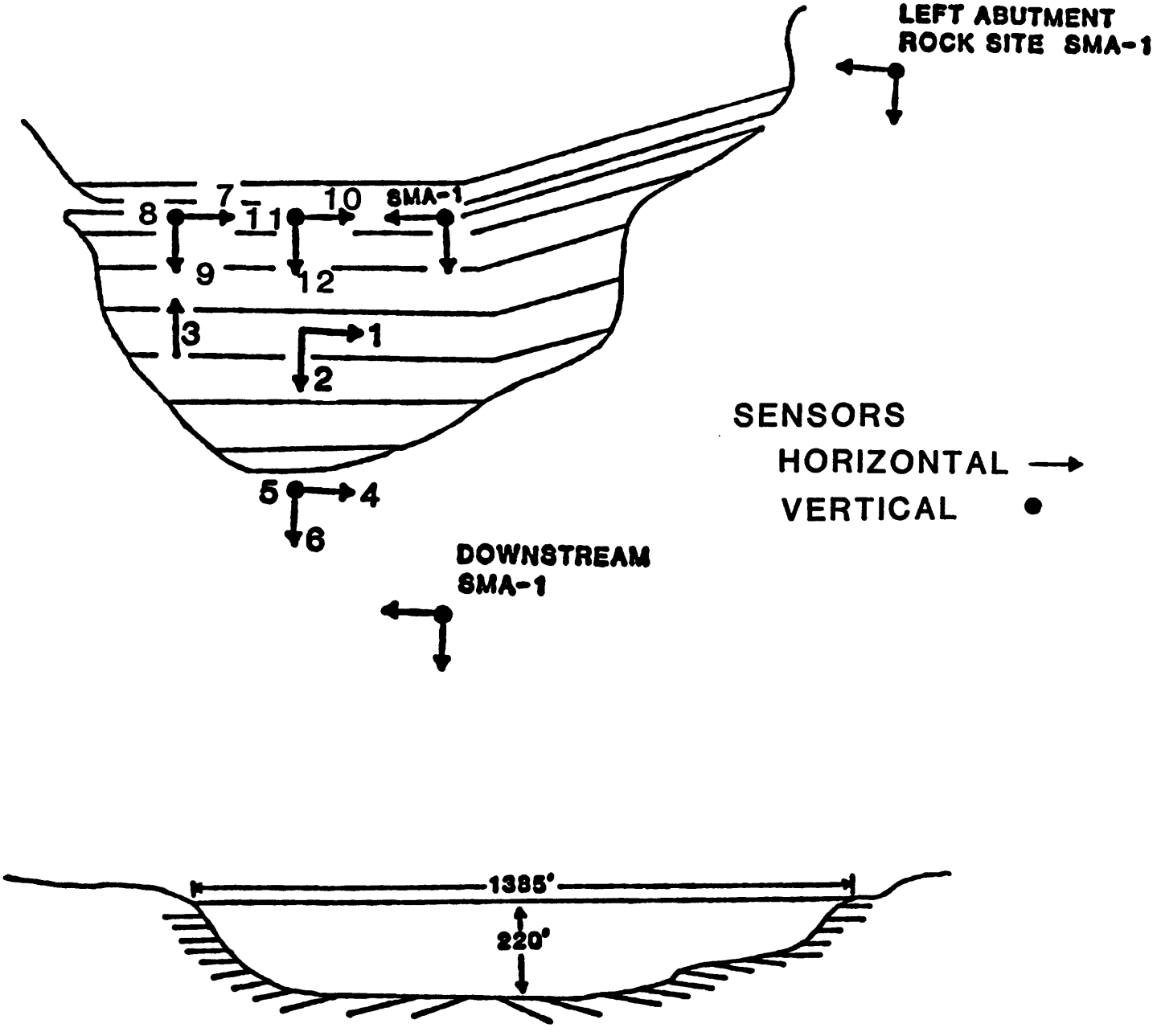


Figure 4. Continued

ANDERSON DAM STRUCTURE ARRAY



DAM TYPE
ROLLED EARTH AND ROCKFILL STRUCTURE WITH CLAY CORE

Figure 4. Continued

U.S. STRONG-MOTION NETWORK	DIRECTION	CONSTANTS	MAX. ACCELERATION
Station No. 1652 37.166N, 121.628W	340°	Sens. = 2.02 cm/g Freq. = 25.0 Hz	0.02g
Anderson Dam - Crest		Damp. = 0.6 crit	
SMA-1 No. 4324 (USGS)	Up	Sens. = 1.73 cm/g Freq. = 26.3 Hz	0.01g
EARTHQUAKE OF		Damp. = 0.6 crit	
3 April 1989 - 1746:46.2 G.m.t.	250°	Sens. = 1.75 cm/g Freq. = 26.3 Hz	0.02g
(WWVB trigger time)		Damp. = 0.6 crit	
		Film speed = 1 cm/sec	

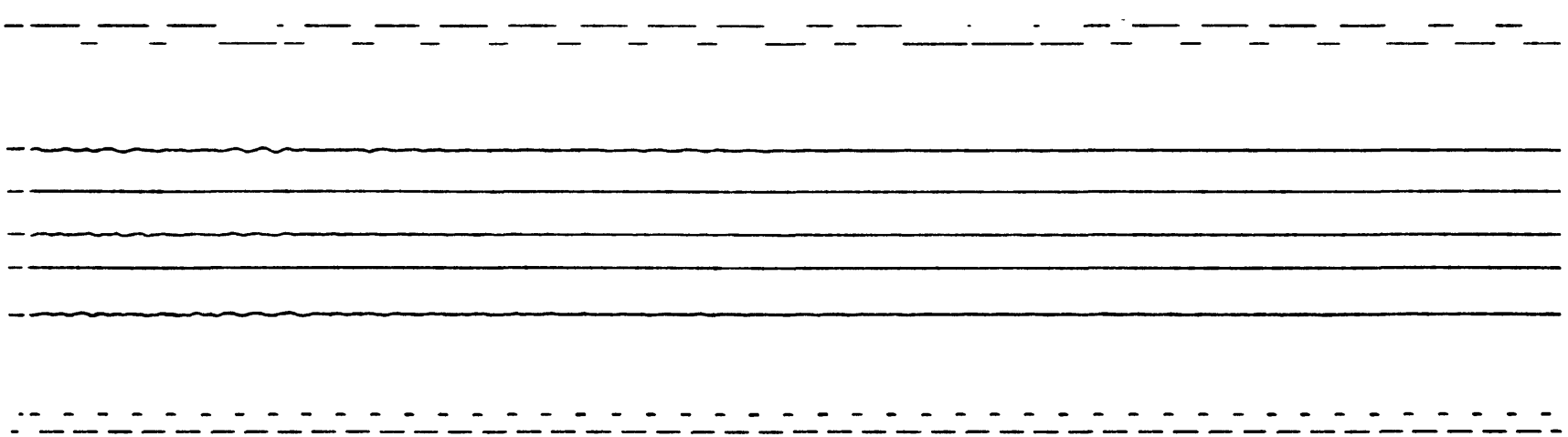


Figure 4. Continued

U.S. STRONG-MOTION NETWORK

Station No. 1652 37.166N, 121.628W

Anderson Dam

CRA-1 No. 252

EARTHQUAKE OF

3 April 1989 - 1746:46.2 G.m.t.

(WWVB trigger time)

Film speed = 1 cm/sec

CHANNEL	DIRECTION	LOCATION	SENSITIVITY	MAX. ACCELERATION
1	153°	Mid-dam, Center	1.75 cm/g	0.01g
2	243°	Mid-dam, Center	1.85 cm/g	0.01g
3	063°	Mid-dam, Right	1.78 cm/g	0.01g
4	333°	Toe	1.91 cm/g	0.01g
5	Up	Toe	1.84 cm/g	0.01g
6	063°	Toe	1.84 cm/g	0.01g
7	333°	Right Crest	1.81 cm/g	0.03g
8	Up	Right Crest	1.77 cm/g	0.02g
9	063°	Right Crest	1.87 cm/g	0.02g
10	333°	Center Crest	1.78 cm/g	0.02g
11	Up	Center Crest	1.54 cm/g	0.02g
12	063°	Center Crest	1.75 cm/g	0.02g

(See Accelerogram on next page)

Figure 4 - Continued

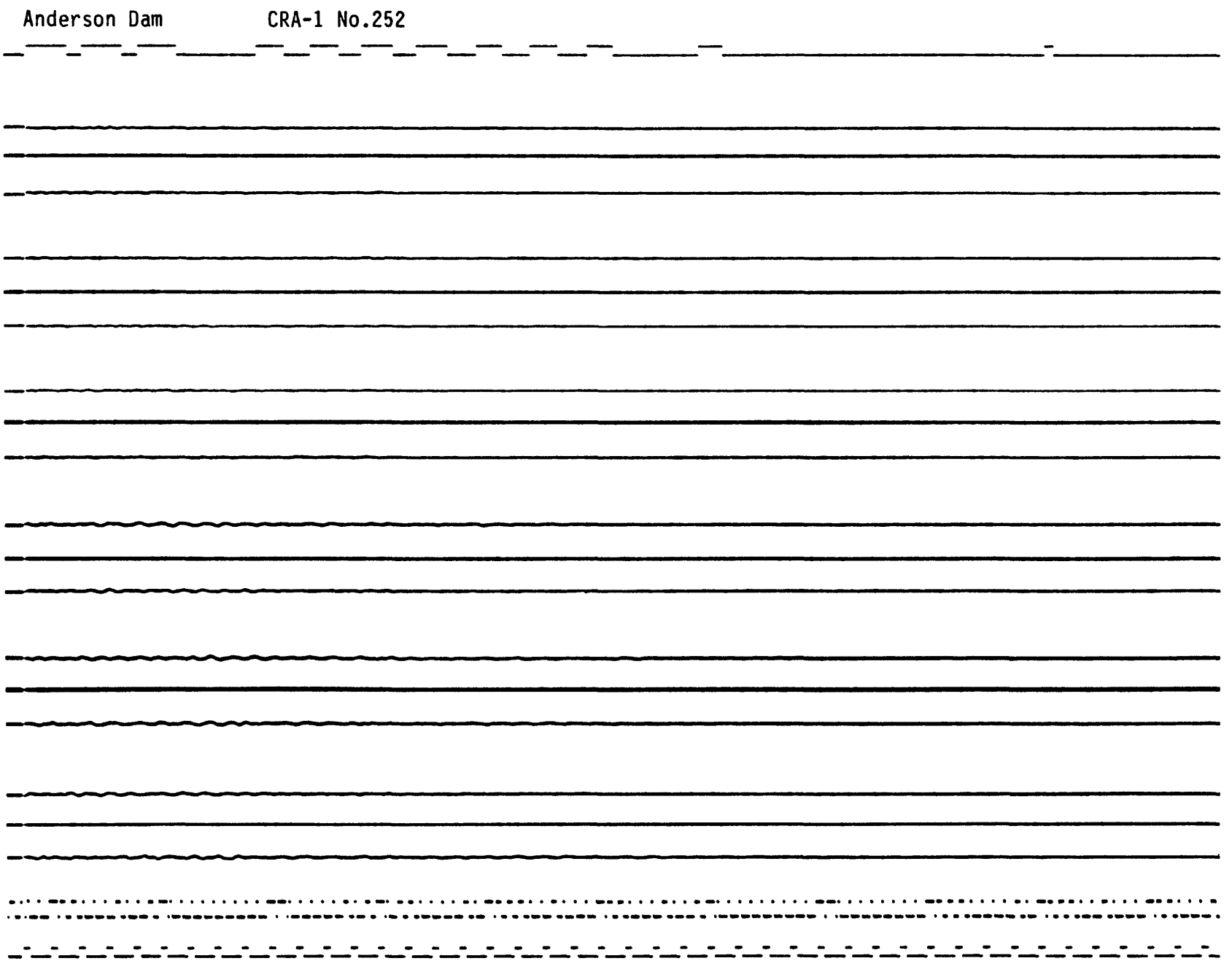


Figure 4 - Continued