



Chapter 7 – Ground motion used in this study

In this study, we used 22 earthquake subsets having a range in magnitude M_w between 5.6 and 7.6. the minimum fault distance was $C/D=0.1$ km.

All the near field records are affected by forward directivity effect. Reviewing the earthquakes that account site characteristics and the corresponding displacement of a single degree of freedom (SOF) system provides an expected displacement of a building under referred ground shaking. The details of each earthquake that is recorded location, faulting mechanisms, type of directivity and closest distance are tabulated in table 7-1.

No	LOCATION	DATE	M_w	F/M	STATION	S/C	DIR/TY	C/D	COMP.	SDmax
1	Imperial Valley CA, USA	19/05/1940	6.6	SS	El Centro	SL	B	8.0	180 - 270	26.07 – 36.40
2	Parkfield,CA,USA	27/6/1966	6.0	SS	Cholame Shandon Array 2 (CO2)	SL	F	0.1	65	38.65
					Cholame Shandon Array 5 (CO5)	SL	F	5.2	85 - 355	20.01 - 11.78
					Cholame Shandon Array 8 (CO8)	SL	F	9.2	50 - 320	16.21 - 14.34
					Temblor Station 2 (TMB)	-	F	6.5	205 - 295	10.95 - 7.55
3	San Fernando,CA,US A	9/2/1971	6.7	SS	Pacoima Dam (PCD)	H R	F	3.0	254 - 164	23.38 - 88.53
4	Gazli,USSR	17/5/1976	6.7	RV	Karakyr Point (KAR)	S R	N	3.0	0 - 90	82.29 - 68.15
5	Tabas,Iran	16/9/1978	7.1	RV	Tabas (TAB)	SL	N	1.2	74 - 344	243.73 - 131.32
6	Coyote Lake ,CA,USA	8/6/1979	5.6	SS	Gilroy Array 1 (GA1)	H	F	9.0	230 - 320	1.47 - 2.74
					Gilroy Array 2 (GA2)	R	F	7.2	50 - 140	4.91 - 11.39
					Gilroy Array 3 (GA3)	SL	F	5.1	50 - 140	11.49 - 9.55
					Gilroy Array 4 (GA4)	SL	F	3.5	270 - 360	8.18 - 10.15
					Gilroy Array 6 (GA6)	SL	F	1.2	230 - 320	58.51 - 33.95
					San Martin Coyote Creek (SMCC)	S R -	B	0.2	160 - 250	3.37 - 4.81
7	Imperial Valley, CA,USA	15/10/1979	6.4	SS	Aeropurto Mexicall (AEP)	SL	F	0.4	45 – 315	31.14 – 8.73
					Agrarias (AGR)	SL	N	0.6	33 – 273	21.89 – 27.79
					El Centro Array 3, Pine Union Schl (E03)	SL	F	11.7	140 – 230	54.26 - 55.52
					El Centro Array 4, Anderson Rd (E04)	SL	F	6.0	140 – 230	68.96 - 123.84
					El Centro Array 4, Anderson Rd (E04)	SL	F	2.7	140 – 230	112.33 - 127.06
					El Centro Array 5, James Rd (E05)	SL	F	0.3	140 – 230	66.62 - 155.55
					El Centro Array 6, Huston Rd (E06)	SL	F	1.8	140 – 230	65.21 - 117.6
					El Centro Array 7, Imperial Val. Cl (E07)	SL	F	5.0	140 – 230	79.31 - 85.67
					El Centro Array 7, Imperial Val. Cl (E07)	SL	F	9.6	320 – 50	51.48 - 92.28
El Centro Array 8, Cruickshank Rd	SL	F	2.0	230 – 140	33.94 - 28.93					



					(E08) El Centro Array 10, Hospital (E10) Bonds Corner (BCR) Calexico Fire Station (CXO) Mexicali Casa Flores (MXC) Compuertas (CMP) Meloland Route Overpass (EMO) Brawley Airport (BRA) Differential Array-Dogwood Rd (EDA) Post Office,Hotville (HVP)	SL SL SL SL SL SL	N N B F F F	11.0 10.4 15.5 1.2 8.2 6.3 6.9	225 – 315 0 – 270 15 – 285 0 – 270 225 – 315 0 – 270 315 - 225	49.42 - 27.93 11.33 - 14.08 12.78 - 12.12 51.06 - 111.05 31.15 - 56.58 48.69 - 92.10 76.50 - 69.72
8	Mexicali Valley, Mexico	9/6/1980	6.4	SS	Cerro Prieto (CPR)	H R	F	6.5	45 - 315	24.49 - 9.04
9	Morgan Hill,CA,USA	24/4/1984	6.2	SS	Anderson Dam,Downstream (AND) Coyote Lake Dam,San Martin (CLD) Halls Valley (HAL)	SL S R SL	F F B	2.6 0.1 2.0	250 – 340 195 – 285 150 - 240	11.80 - 13.32 16.33-28.51 4.93-12.64
10	Nahanni, Canada	23/12/1985	6.7	RV	Iverson,NW Territories (SITE 1) Slide Mountain (SITE2)	H R H R	N N	9.4 5.2	10 – 280 240 - 330	29.04-34.37 13.44-11.72
11	Palm Springs,CA,USA	8/7/1986	6.1	OB	Cabazon Post Office (CAB) Desert Hot Springs (DSP) North Palm Springs Post Office (NPS) Palm Springs Airport (PSA) Whitewater Trout Farm (WWT)	SL SL SL - S R SL SL	F N F F F	6.0 6.4 4.0 10.8 6.5	180 – 270 0 – 90 210 – 300 0 – 90 180 - 270	6.44 - 7.05 15.42 - 9.79 24.95 - 11.03 7.69 - 7.31 11.08 - 7.80
12	Superstition Hills,CA,USA	24/11/1987	6.4	SS	Parachute Test Site (PTS) Superstition Mountain (SSM) Poe Road (POE) Kornbloom Poad (KRN) Westmorland Fire station (WST) El Centro (ELC)	- S R- H R - - SL SL	F N N N F F	0.7 5.7 10.7 17.8 13.2 13.6	225 – 315 45 – 135 270 – 360 270 – 360 90 – 180 0 – 90	89.62 – 51.31 14.47 - 19.76 24.99 - 28.25 15.60 - 15.15 68.58 - 77.22 95.43 - 103.15
13	Loma Prieta,USA	17/10/1989	6.9	OB	Corralitos (COR) Gavilan College Physics Sci. Bldg (.GIL) Gilroy 1-Gavilan Coll. Water Tank (G01) Lexington Dam-Left Abutment (LXD) Los Gatos Presentation Center (LGP) Saratoga-Aloha Avenue (STG) Gilroy Historic Building (GHB) Capitola Fire Station (CAP) Branciforte Drive (BRN)	S R SL S R R H R SL - SL -	N N N F F F B B	2.3 10.5 10.1 6.7 3.0 8.3 11.1 15.8 11.5	0 – 90 67 – 337 0 – 90 0 – 90 0 – 90 90 – 180 0 – 90 0 – 90	20.77 - 28.73 12.28 - 13.78 13.91 - 12.29 33.75 - 42.97 115.24 - 31.58 30.76 - 72.16 21.62 - 10.24 34.12 - 15.82 22.46 - 14.21
14	Sierra Madre,CA, USA	28/6/1991	5.6	RV	Cogswell Dam (COG) Eaton Canyon Park-Altadena (ETN)	- SL	F F	9.4 9.6	65 – 155 0 – 90	1.90 - 4.72 7.13 - 2.62



					Mt. Wilson-Caltech Station (MTW)	H	F	11.9	0 – 90	3.32 - 2.57
					San Marino-SW Academy (SNM)	R	F	15.6	0 - 90	2.73 - 2.24
						SL				
15	Erzincan, Turkey	13/3/1992	6.6	SS	Erzincan (ERZ)	SL	F	2.0	0 - 90	56.46 - 71.02
16	Petrolia,CA,USA	25/4/1992	6.9	RV	Cape Mendocino (CAP)	H	F	7.8	0 – 90	73.13 - 36.23
					Petrolia (PGS)	R	F	8.9	0 – 90	30.15 - 50.75
					Fortuna (FOR)	SL	N	13.5	0 – 90	42.75 - 32.34
					Rio Dell (RIO)	SL	N	13.1	270 - 360	35.93 –21.56
					-					
					S					
					R					
					SL					
					-					
					S					
					R					
17	Landers,CA,USA	28/6/1992	7.3	SS	Joshua Tree-Fire Station (JSH)	SL	B	11.6	0 – 90	19.09 - 35.07
					Lucerne Valley (LUC)	SL	F	1.1	0 – 90	36.74 – 156.90
18	Northridge,CA,US A	17/1/1994	6.7	RV	Jensen Filtration Plant (JFA)	SL	F	5.2	22 – 292	109.88 - 72.43
					Pacoima Kagel Canyon (PKC)	H	N	7.4	90 – 360	43.64 - 21.30
					Newhall,LA Country Fire Station (NWH)	R	F	6.5	90 – 360	38.92 - 60.13
					Arleta,Nordhoff Fire Station (SFY)	SL	N	8.0	90 – 360	21.31 - 29.37
					Pacoima Dam-Downstream (PCD)	SL	F	7.2	175 – 265	17.84 - 16.53
					Rinaldi Receiving Station (RRS)	H	F	6.0	318 – 228	66.95 - 58.09
					Sylmar Converter Station (SCG)	R	F	5.1	52 – 142	131.88 - 87.25
					Sylmar Converter Station East (SCH)	SL	F	5.0	11 – 281	97.63 - 69.41
					Sepulveda Veterans Hospital (VSP)	SL	F	8.0	270 – 360	29.70 - 55.36
					Los Angeles Dam (LDW)	SL	F	5.6	334 – 64	48.01 - 51.30
					Sylmar Country Hospital (SYH)	SL	F	5.5	90 – 360	59.99 - 77.68
					Canoga Park Epiphany Church (CPC)	SL	N	13.7	196 – 106	47.26 - 26.13
					Canyon Country (CCY)	SL	F	12.9	0 – 270	31.60 - 19.65
					LA Fire Station 108 (LF5)	SL	B	19.2	35 – 125	15.00 - 10.04
					LA Fire Station 99 (LF6)	SL	B	17.3	9 – 279	34.00 - 36.96
					LA UCLS Grounds (ULA)	SL	B	19.9	90 – 360	11.59 - 26.65
					LA Westlake School (LWS)	SL	B	19.0	0 – 90	8.00 - 10.14
					Newhall,Pico Canyon (NWS)	SL	F	5.3	46 – 316	83.66 - 47.60
					North Hollywood Coldwater Can. (NHW)	SL	N	11.8	270 – 180	26.10 - 29.72
					North Hollywood Coldwater Can. (NHW)	SL	F	11.5	90 – 180	53.81 - 28.39
					Northridge White Oak Cov.Church (NRG)	SL	N	12.4	0 – 90	20.12 - 17.26
					Northridge White Oak Cov.Church (NRG)	SL	N	9.3	0 – 90	21.38 - 29.07
					Simi Valley (SMI)	SL	B	14.8	90 – 360	38.62 - 42.64
					Sun Valley Grace Comm.. Church (SVG)	SL				
					Tarzana Nursery (TAR)	-				
						S				
						R				
19	Hanshin (Kobe), Japan	17/1/1995	6.8	SS	Kobe University (KBU)	H	F	0.7	0 – 90	41.58 - 24.14
					Kobe Port Island,Surface (KPI)	R	F	3.2	0 – 90	77.52 - 67.44
					Takarazuka (TAZ)	SL	F	0.4	0 – 90	50.88 - 41.71
					Takatori (TAK)	SL	F	1.1	0 – 90	114.89 - 95.42
					Nishi-Akashi (NIS)	SL	N	10.5	0 – 90	28.13 - 32.22
						SL				



20	Izmit, Turkey	17/8/1999	7.4	SS	Arcelik Arge Lab (ARC)	S	F	14.0	0 – 270	36.13 - 78.02
					Yarimca Petkim (YPT)	R	F	2.6	0 - 270	107.42 - 145.02
						SL				
21	Chi-Chi,Taiwan	20/9/1999	7.6	RV	CHY024	SL	F	7.7	90 – 360	96.88 - 111.29
					CHY028	SL	N	2.3	90 – 360	52.39 - 53.66
					CHY101	SL	F	7.7	90 – 360	107.61 - 223.06
					TCU049	SL	F	2.7	90 - 360	152.55 – 150.49
					TCU051	SL	F	6.9	90 – 360	121.08 - 164.26
					TCU052	SL	F	0.8	90 – 360	338.74 – 496.22
					TCU053	SL	F	4.6	90 – 360	130.10 – 166.76
					TCU054	SL	F	4.7	90 – 360	140.54 – 154.95
					TCU055	SL	F	6.5	90 - 360	40.25 – 135.96
					TCU065	SL	F	0.1	90 – 360	248.53 - 182.93
					TCU067	SL	F	0.2	90 – 360	188.42 – 110.20
					TCU068	SL	F	0.2	90 – 360	597.22 – 768.98
					TCU071	SL	F	4.1	90 – 360	49.43 – 108.32
					TCU072	SL	F	6.8	90 - 360	101.14 – 96.47
					TCU074	SL	F	11.4	90 – 360	55.73 - 46.24
					TCU075	SL	F	0.6	90 – 360	144.31 - 109.91
					TCU076	SL	F	2.3	90 – 360	69.75 – 69.84
					TCU078	SL	F	5.4	90 – 360	69.18 – 24.59
					TCU082	SL	F	5.0	90 - 360	148.13 – 140.59
					TCU087	S	F	5.8	90 – 360	158.30 – 83.87
					TCU089	R	F	6.2	90 – 360	64.53 – 51.24
					TCU101	S	F	1.5	90 – 360	165.26 - 122.05
					TCU102	R	F	0.6	90 – 360	199.98 - 123.92
TCU103	SL	F	4.4	90 - 360	180.67 - 75.22					
TCU116	SL	F	11.5	90 – 360	90.14 - 97.47					
TCU120	SL	F	6.1	90 – 360	90.55 - 125.74					
TCU122	SL	F	8.5	90 - 360	115.11 - 105.40					
TCU129	S	F	1.5	90 – 360	125.95 - 73.84					
					R					
					SL					
					SL					
22	Duzce, Turkey	12/11/1999	7.1	OB	Duzce (DZC)	SL	N	8.3	180 – 270	145.65 - 159.53
					Bolu (BOL)	SL	F	19.9	0 - 90	49.54 - 30.70

Table 7.1 Near-field ground motion having different site characteristics

Where:

M_w : Magnitude of the Earthquake

F/M: Fault Mechanism: SS-Strike slip, RV-Reverse, OB-Obverse.

S/C-Site Code: HR-hard rock, SR-sedimentary and conglomerate rock, SL-soil and alluvium.

DIR/TY: Directivity: F-forward, N-neutral, B-backward.

C/D: Closest distance:



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Normal distance from fault trace for events: 1, 4, 5, 7, 8, 9, 10, 11, 15, 20, 22,
23, 25

Normal distance from fault plane for events: 12, 13, 14, 16, 17, 19, 21, 24

Distance from point source(i.e. hypocentral distance): 2, 3

COMP: location of recorded station

SD_{max}: Maximum Spectral Displacement