Instructions – Set 1

- Please provide mean hazard results (probability of exceedance) for peak horizontal acceleration (PGA) defined at 0.001, 0.01, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.7, 0.8, 0.9, and 1.0 g.
- Assume a Poisson model when converting rates to annual probabilities of exceedance
- Use 16.05 (not 16.1) in the equation $\log M_o = 16.05 + 1.5\mathbf{M}$
- Use $3\text{x}10^{11}$ dyne/cm^2
- Use a magnitude integration step size small enough to define the specified magnitude density function. The bin size for magnitude integration should be defined such that the M_{min} is at the lower edge of a bin, not in the center (i.e., If your magnitude step size is 0.01, one magnitude bin should be from **M** 5.0 to 5.01)
- When integrating over the magnitude density function, integrate from zero (not M_{min})
- Use uniform slip with tapered edges. Downdip and along-strike integration step size should be small enough to produce uniform rupture location. Do not allow rupture off the ends of fault.
- Maintain the aspect ratio defined until maximum width is reached, then increase length (conservation of area at the expense of aspect ratio)
- Sigma = 0 for the ground motion model implies that the sigma in the relationship is artificially set to zero, not that the sigma is truncated
- Note that equation for ln(y) in Table 3.1 of Sadigh et al. (1997) has a typo in the third term. It should read C3*(8.5-M)^2.5 to match equation 2.2.
- Rupture dimension relationships:

Log (A) = **M** – 4	σ_A=0.25
Log (W) = 0.5***M** - 2.15	~~σ_W=0.125~~
Log (L) = 0.5***M** - 1.85	~~σ_L=0.20~~

  Aspect Ratio = 2

  Note: Sigma for all rupture dimension relationships should be set to zero for all cases except 3.
- For all faults, the slip rate is 2 mm/year, b-value = 0.9
- For the area source, number of events per year of M_{min} and greater N(**M**≥5) is 0.0395 for the whole area, b-value =0.9, and M_{max} = 6.5.
- You should be using as small a step size as feasible/necessary to produce stable results (for both magnitude density function and rupture distribution). This may be much smaller than you normally use on projects.
- For cases where you are asked to truncate the ground motion sigma (test cases 8b and 8c), you should be renormalizing the pdf so that the probabilities for ground motion sum to 1.

Set 1 Test Cases

Name	Description	Source	Mag-Density Function	Ground Motion Model[1,2]	Rupture Dimension Relationships[3,4,5,6]
Set 1 Case 1	Single rupture of entire fault plane. Tests distance, rate, and ground motion calculations.	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.5	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 2	Single rupture smaller than fault plane. Tests uniform slip and edge effects.	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 3	Single rupture smaller than fault plane, including variation of rupture plane ~~dimensions~~ area. Tests uniform slip and edge effects, variability of rupture areas.	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0.25$, truncate sigma at 2 st. dev. (low and high), use Aspect Ratio of 2 to calculate width for each area ~~Log (W)=0.5*M-2.15; $\sigma_W = 0.15$~~ ~~Log (L)=0.5*M-1.85; $\sigma_L = 0.20$~~
Set 1 Case 4	Single rupture smaller than fault plane on dipping fault.	Fault 2 (reverse 60°) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 5	Truncated exponential model.	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Truncated exponential model, $M_{max} = 6.5$ $M_{min} = 5$	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 6	Truncated normal model.	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Truncated normal model, $M_{char} = 6.2$, $M_{max} = 6.5$, $\sigma = 0.25$ $M_{min} = 5$	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$

Set 1 Case 7	Characteristic model (Youngs & Coppersmith 1985)	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Characteristic model, M_{char} = 6.2 M_{max} = 6.45 M_{min} = 5	Sadigh *et al.* (1997), rock $\sigma = 0$	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 8a	Single rupture smaller than fault plane. (Repeat of case 2 with gm variability untruncated).	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock Do not truncate sigma	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 8b	Single rupture smaller than fault plane. (Repeat of case 2 with gm variability truncated at 2 std. dev.)	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock Truncate sigma at 2 std. dev.	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
Set 1 Case 8c	Single rupture smaller than fault plane. (Repeat of case 2 with gm variability truncated at 3 std. dev.)	Fault 1 (vertical SS) b-value=0.9 slip rate=2mm/yr	Delta Function at M 6.0	Sadigh *et al.* (1997), rock Truncate sigma at 3 std. dev.	Log (A)=M-4; $\sigma_A = 0$ Log (W)=0.5*M-2.15; $\sigma_W = 0$ Log (L)=0.5*M-1.85; $\sigma_L = 0$
~~Set 1 Case 9~~	~~——————~~	~~——————~~	~~——————~~	~~——————~~	~~——————~~
Set 1 Case 10	Area Source with fixed depth of 5 km.	Area 1 N(M≥5)=0.0395 b-value=0.9	Truncated Exponential, M_{max}=6.5 M_{min}=5	Sadigh *et al.* (1997), rock σ = ~~0~~ untruncated	Use ~~1~~ 0.5 km grid spacing of point sources or small faults to simulate uniform distribution.
Set 1 Case 11	Volume Source with depth of 5 km to 10 km.	Area 1 N(M≥5)=0.0395 b-value=0.9	Truncated Exponential, M_{max}=6.5 M_{min}=5	Sadigh *et al.* (1997), rock σ = ~~0~~ untruncated	Use ~~1~~ 0.5 km grid spacing of point sources or small faults to simulate uniform distribution. For the depth distribution use 1 km spacing, inclusive of 5 and 10 km.
~~Set 1 Case 12~~	~~——————~~	~~——————~~	~~——————~~	~~——————~~	~~——————~~

[1] Integration over magnitude zero.
[2] Use magnitude integration step size as small as necessary to model magnitude density function.
[3] For all cases, uniform slip with tapered slip at edges.
[4] No ruptures are to extend beyond the edge of the fault plane.
[5] Aspect Ratio to be maintained until maximum width is reached, then increase length (conserve area at the expense of aspect ratio).
[6] Downdip and along strike integration step size should be as small as necessary for uniform rupture location.

Figure 1. Sources for Set 1 Test Cases

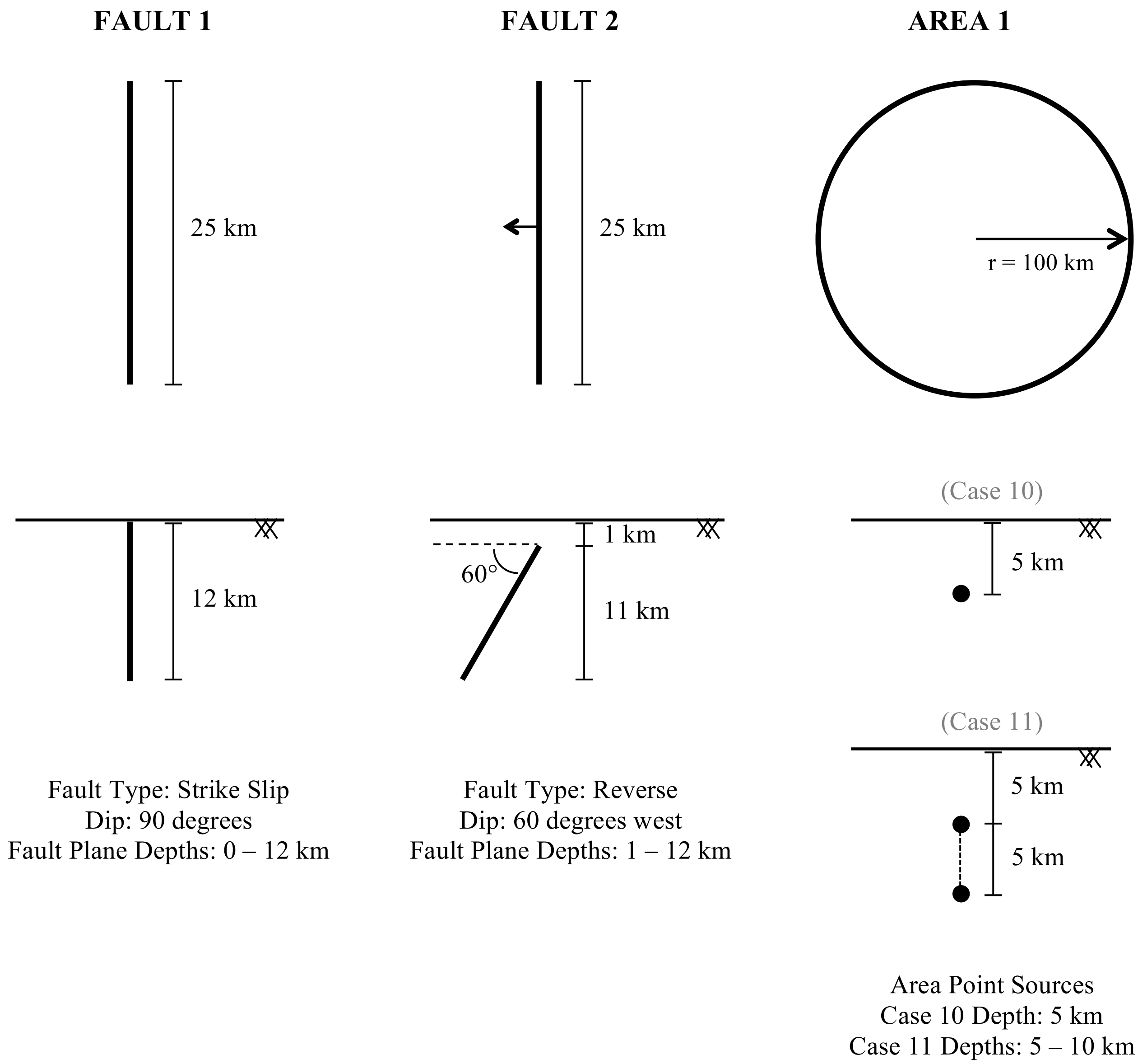
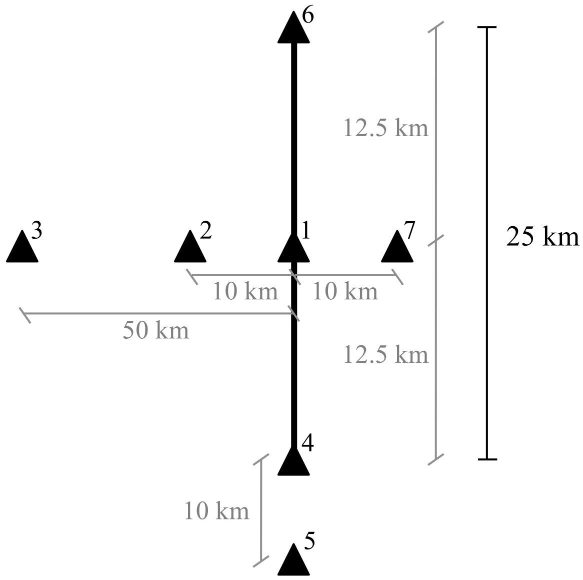
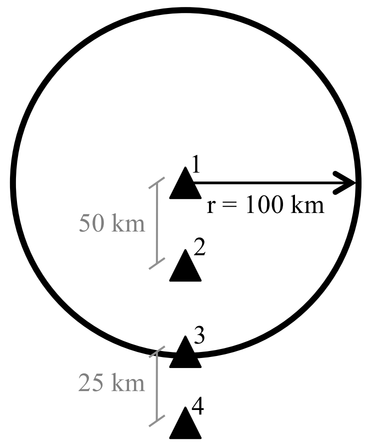


Figure 2. Sources with Sites for Set 1 Test Cases

FAULTS 1 & 2



AREA 1



Site 1: On fault, at midpoint along strike
Site 2: 10 km west of fault, at midpoint along strike
Site 3: 50 km west of fault, at midpoint along strike
Site 4: On fault, at southern end
Site 5: 10 km south of fault along strike
Site 6: On fault, northern end
Site 7: 10 km east of fault, at midpoint along strike

Site 1: At center of area
Site 2: 50 km from center (radially)
Site 3: On area boundary
Site 4: 25 km from boundary

Site and Source Coordinates

Sites for Test Set 1, Cases 1 through 8

Site	Latitude	Longitude	Comment
1	38.113	-122.000	On fault, at midpoint along strike
2	38.113	-122.114	10 km west of fault, at midpoint along strike
3	38.111	-122.570	50 km west of fault, at midpoint along strike
4	38.000	-122.000	On fault, at southern end
5	37.910	-122.000	10 km south of fault along strike
6	38.22~~5~~48	-122.000	On fault, at northern end
7	38.113	-121.886	10 km east of fault, at midpoint along strike

Coordinates for 25 km fault for Test Set 1, Cases 1 through 8

Latitude	Longitude	Comment
38.00000	-122.000	South end of fault
38.22480	-122.000	North end of fault

Sites for Test Set 1, Cases 10 and 11

Site	Latitude	Longitude	Comment
1	38.000	-122.000	At center of area
2	37.550	-122.000	50 km from center (radially)
3	37.099	-122.000	On area boundary
4	36.874	-122.000	25 km from boundary

Coordinates for Area Source for Test Set 1, Cases 10 and 11

Latitude	Longitude
38.901	-122.000
38.899	-121.920
38.892	-121.840
38.881	-121.760
38.866	-121.682
38.846	-121.606
38.822	-121.532
38.794	-121.460
38.762	-121.390
38.727	-121.324
38.688	-121.261
38.645	-121.202
38.600	-121.147
38.551	-121.096
38.500	-121.050
38.446	-121.008
38.390	-120.971
38.333	-120.940
38.273	-120.913

38.213	-120.892
38.151	-120.876
38.089	-120.866
38.026	-120.862
37.963	-120.863
37.900	-120.869
37.838	-120.881
37.777	-120.899
37.717	-120.921
37.658	-120.949
37.601	-120.982
37.545	-121.020
37.492	-121.063
37.442	-121.110
37.394	-121.161
37.349	-121.216
37.308	-121.275
37.269	-121.337
37.234	-121.403
37.203	-121.471
37.176	-121.542
37.153	-121.615
37.133	-121.690
37.118	-121.766
37.108	-121.843
37.101	-121.922
37.099	-122.000
37.101	-122.078
37.108	-122.157
37.118	-122.234
37.133	-122.310
37.153	-122.385
37.176	-122.458
37.203	-122.529
37.234	-122.597
37.269	-122.663
37.308	-122.725
37.349	-122.784
37.394	-122.839
37.442	-122.890
37.492	-122.937
37.545	-122.980
37.601	-123.018
37.658	-123.051
37.717	-123.079

37.777	-123.101
37.838	-123.119
37.900	-123.131
37.963	-123.137
38.026	-123.138
38.089	-123.134
38.151	-123.124
38.213	-123.108
38.273	-123.087
38.333	-123.060
38.390	-123.029
38.446	-122.992
38.500	-122.950
38.551	-122.904
38.600	-122.853
38.645	-122.798
38.688	-122.739
38.727	-122.676
38.762	-122.610
38.794	-122.540
38.822	-122.468
38.846	-122.394
38.866	-122.318
38.881	-122.240
38.892	-122.160
38.899	-122.080