Appendix

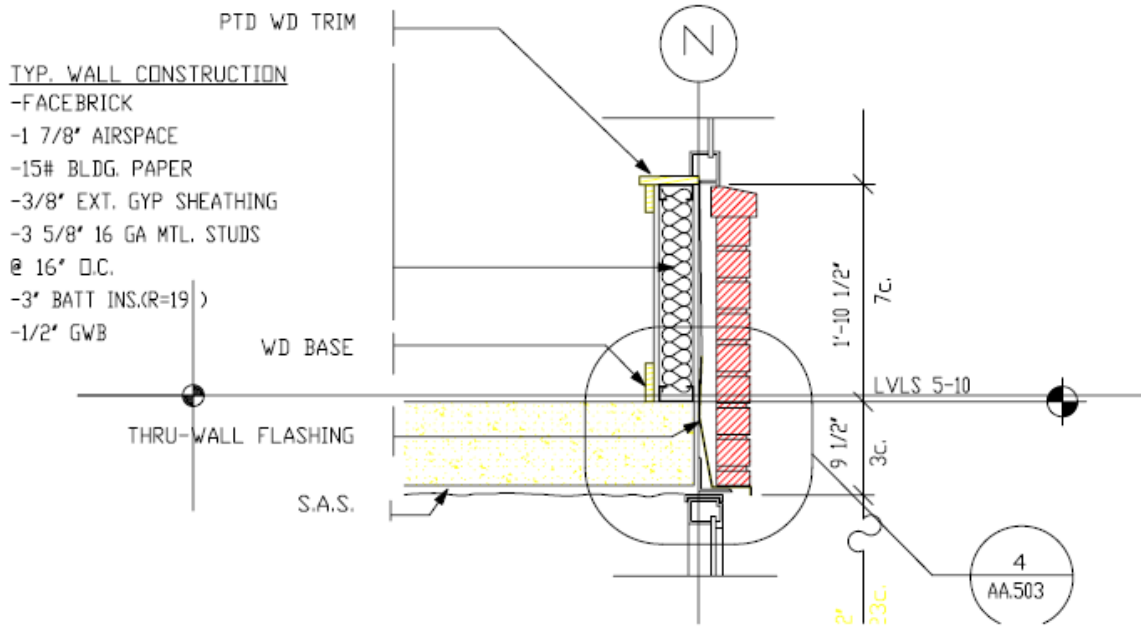


Figure A-1
Typical Wall Section

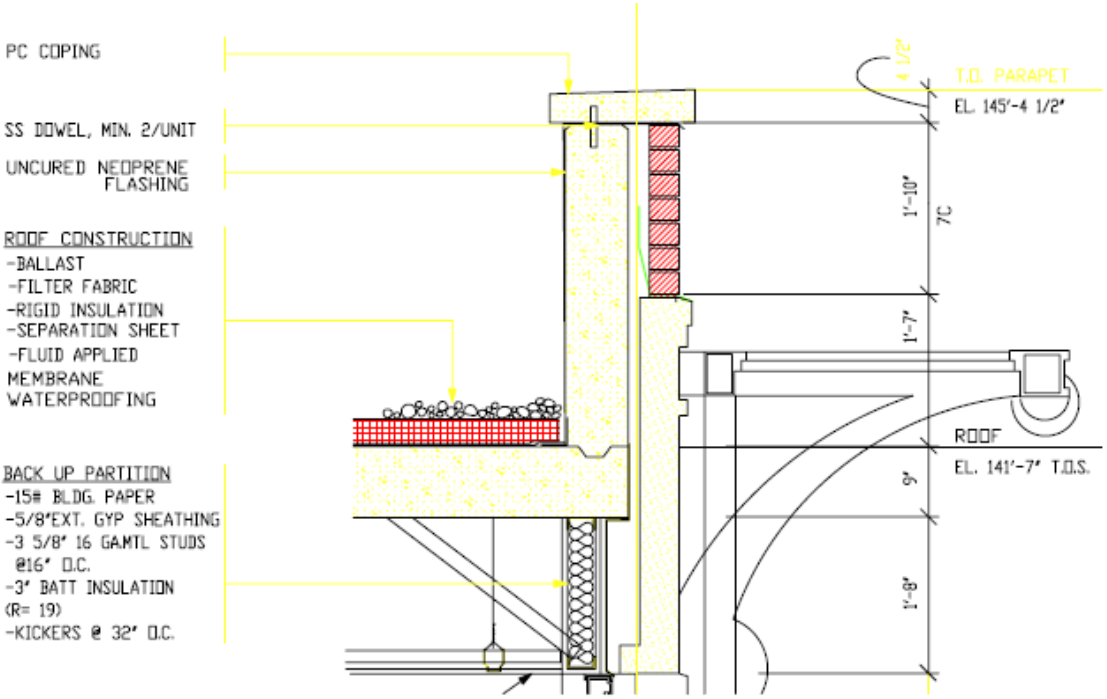


Figure A-2
Typical Roof Section

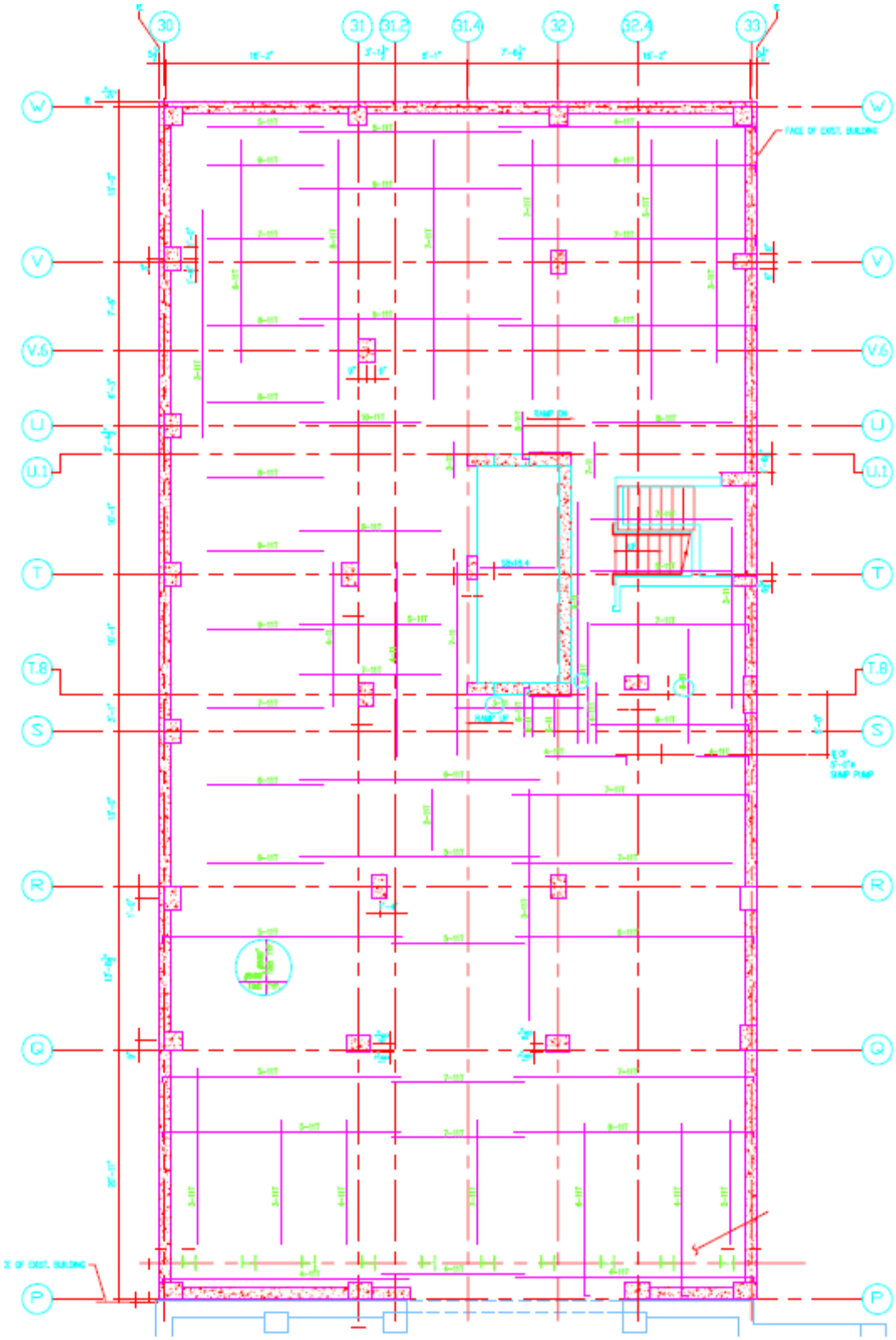


Figure A-3
Foundation Plan

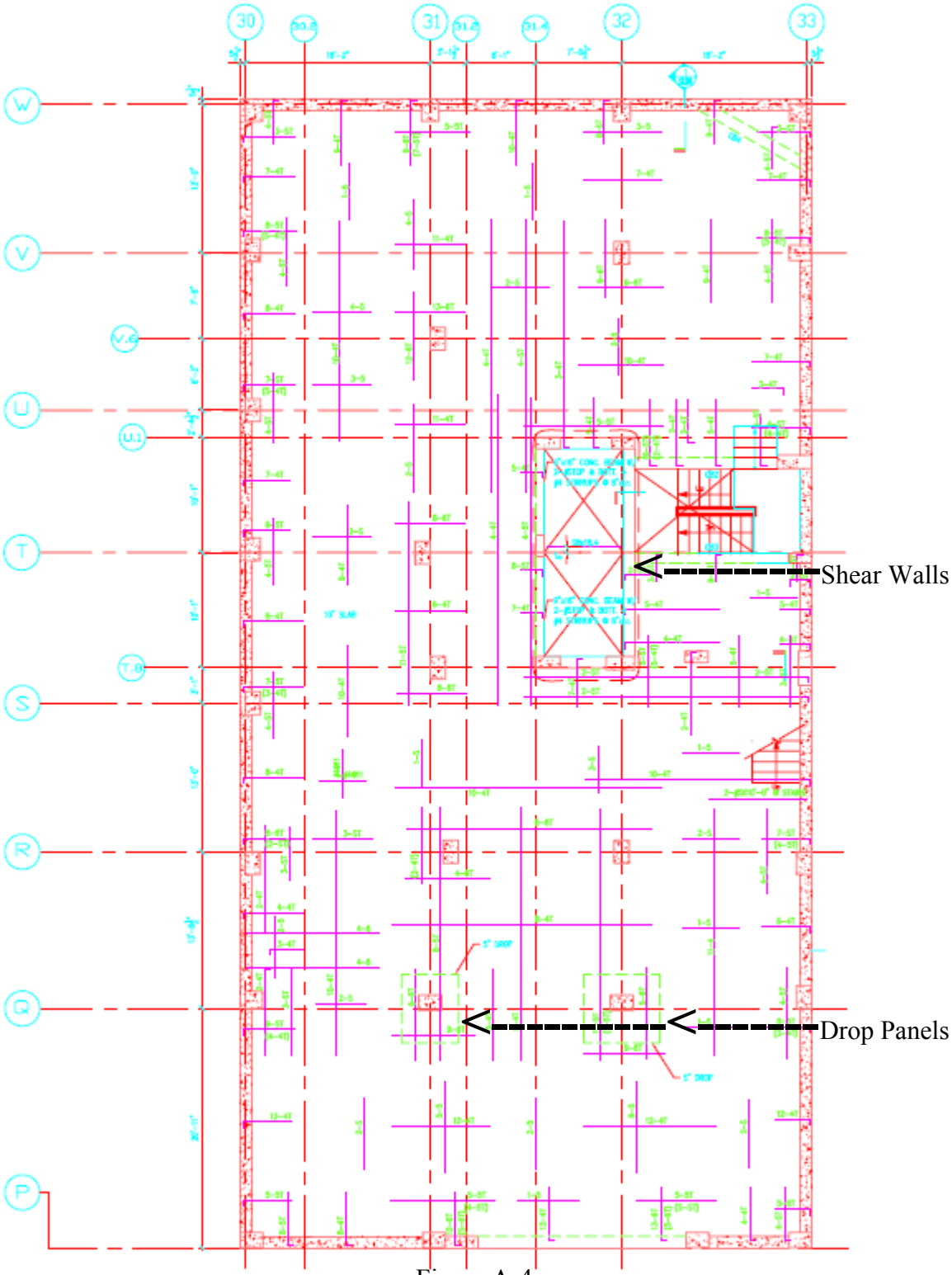


Figure A-4
Concourse Framing Plan
Purple= top rebar (with bar size in green)

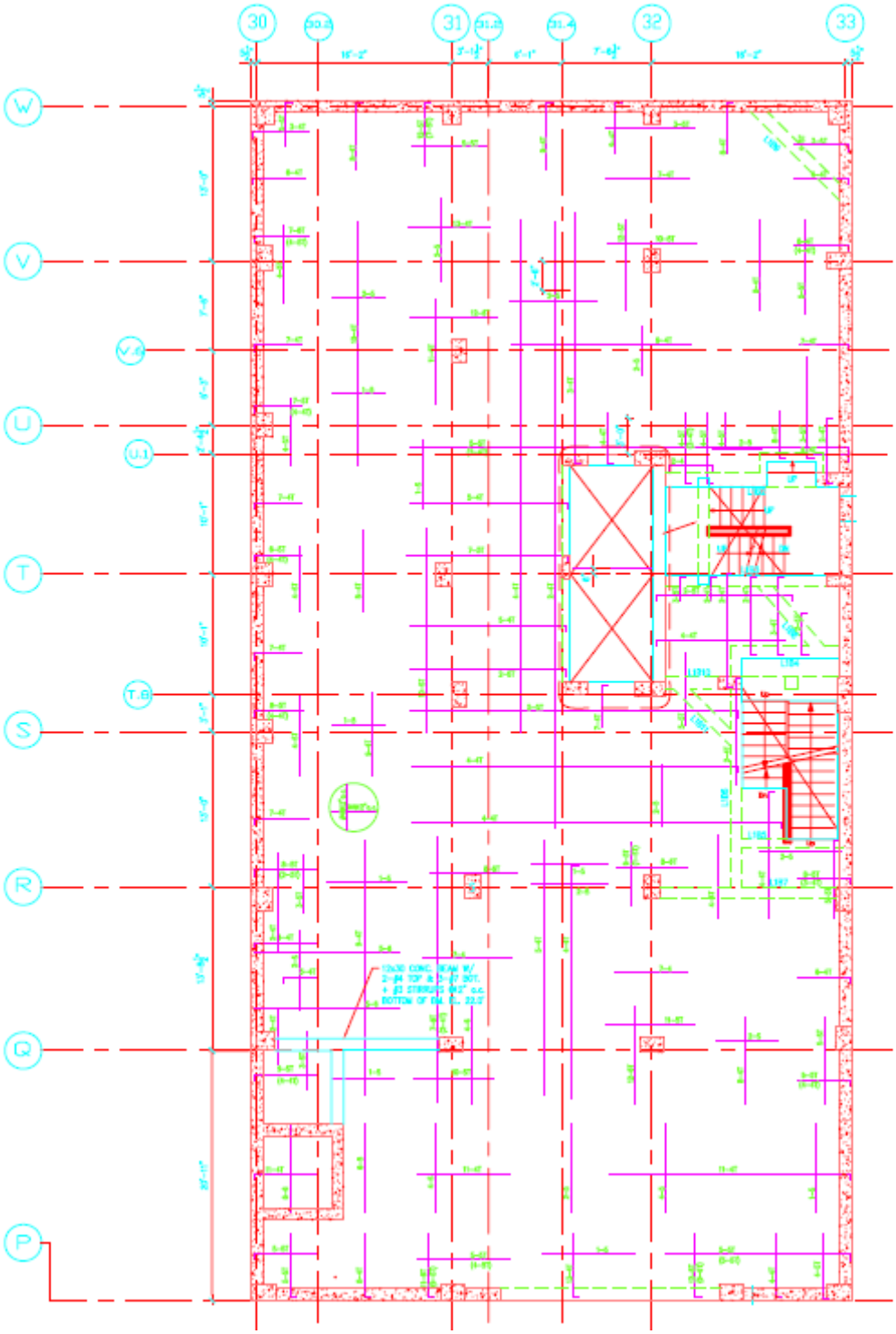


Figure A-5
L-1 Framing Plan

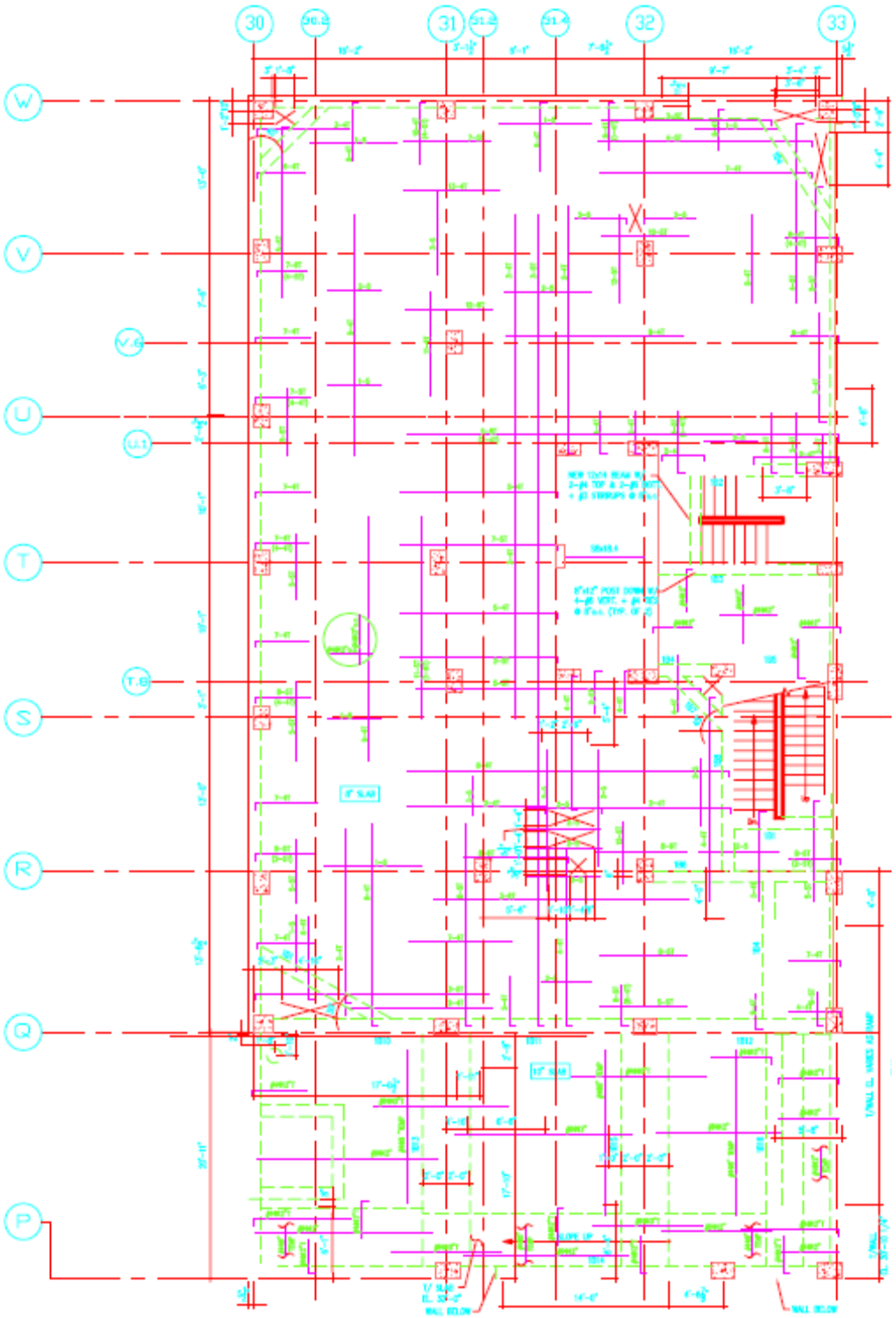


Figure A-6
Ground Level Framing Plan

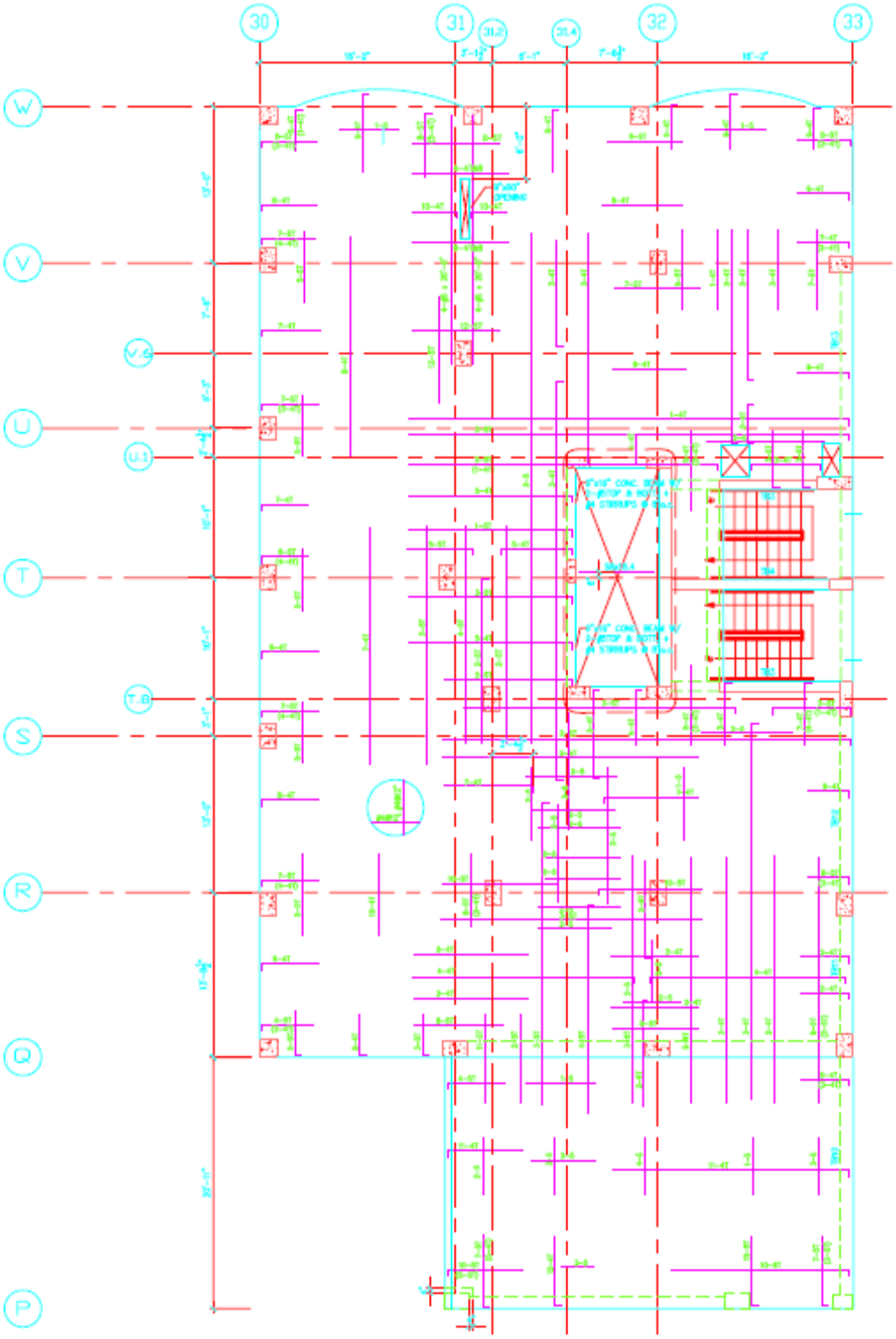


Figure A-7
Framing Plan Levels 2 to 7

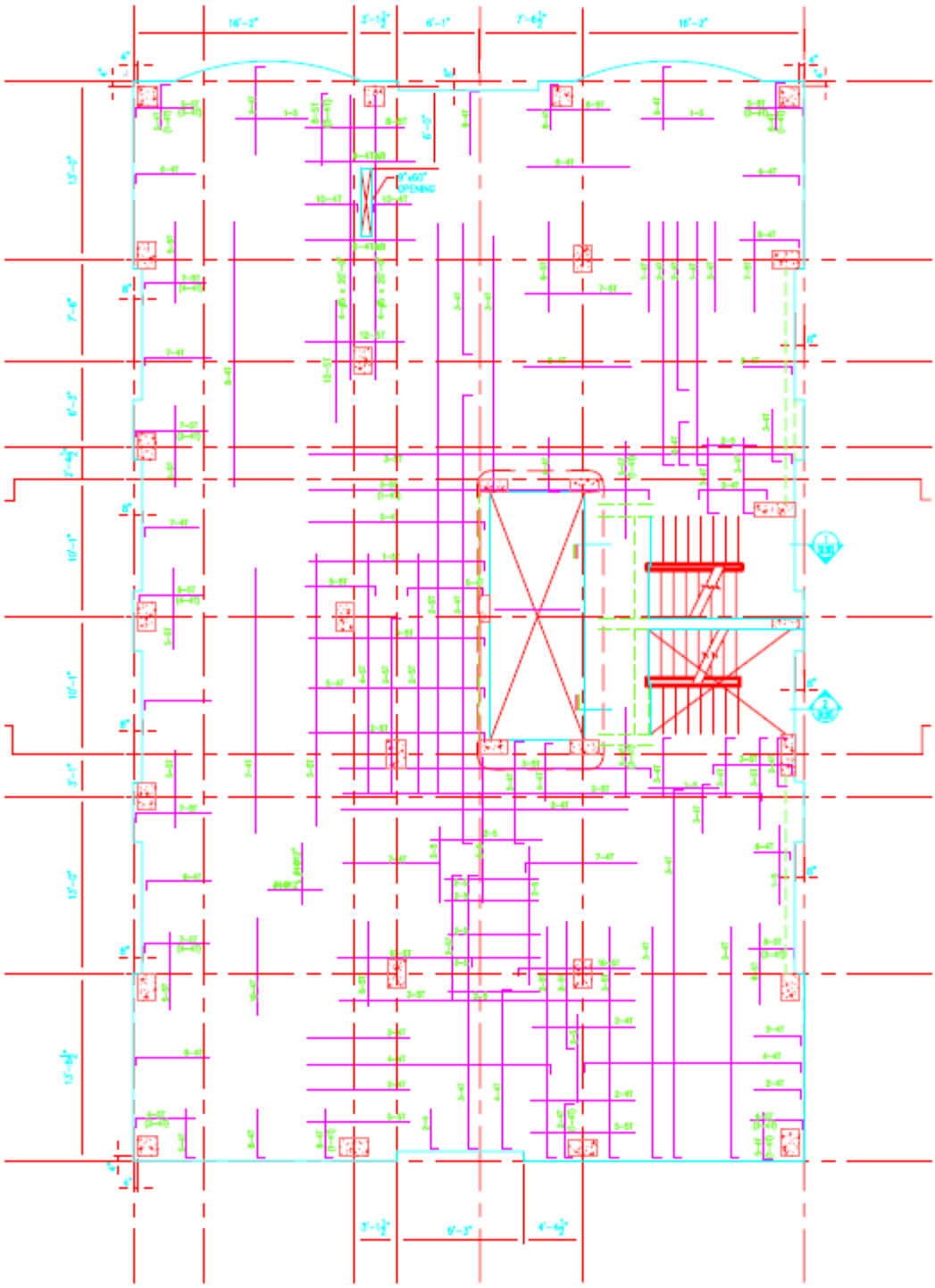


Figure A-8
Framing Plan Levels 8 to 12

Load Calculations:

Self Weight:

8” Slab: 150psf * 8”thick slab / 12” per foot = 100psf
10” Slab: 150psf*10” thick slab/ 12” per foot = 125psf

Roof Live Load:

A_t= 16.2’ * 13’ (for a typical bay)
= 208 ft^2
R_1= 1.2 - .001* A_t
= 1.2 - .001*208
= .992
F = 0 for a flat roof
R_2 =1

L_r=20*(.992) (.1)
= 20psf

Snow Load:

C_e = .9 (Table 7.2, B-urban, partially exposed)
C_t = 1 (Table 7.3)
I = 1 (Table 7.4, Category II)
P_g = 25psf (Fig. 7-1)

P_f= .7*(.9)(1)(1)(25) = 15.75psf

Wind Load:

WindCals

Basic Wind Speed (V)	90	Fig 6-1	L	50	build. Geo	qz factor	17.6256
Wind Directionality (kd)	0.85	Table 6-4	B	100	build. Geo	qh	18.330624
Importance Factor (I)	1	Table 6-4	H	116.33	build. Geo		
Topical Factor (kzt)	1		l	320	Table 6-2		

Cp windward	0.8	Fig 6-6
Cp leeward	-0.5	Fig 6-7
Cp leeward	-0.3	Fig 6-8
Gcpi (internal pressure)	0.18	Fig 6-5

Gust Factor	**0.849930408**
Iz	0.264788883
Z bar	69.798
c	0.3
Q (n/s)	0.865816967
Lz	410.7645834
gv	3.4

Table A-1

Wind Load Continued:

Floor		Height	Kz values	qz
ground		0	0.57	10.05
	1	11.5	0.57	10.05
	2	20.292	0.66	11.63
	3	29.08	0.7	12.34
	4	37.875	0.76	13.40
	5	46.67	0.81	14.28
	6	55.458	0.85	14.98
	7	64.25	0.89	15.69
	8	73.04	0.93	16.39
	9	81.83	0.96	16.92
	10	90.625	0.99	17.45
	11	99.42	0.99	17.45
	12	108.83	1.04	18.33
roof		116.33	1.04	18.33

N/S direction (lbs/ft^2)

P (windward)	P (leeward)	P (net)
10.13	-11.09	21.22
10.13	-11.09	21.22
11.21	-11.09	22.30
11.69	-11.09	22.78
12.41	-11.09	23.50
13.01	-11.09	24.10
13.49	-11.09	24.58
13.97	-11.09	25.06
14.45	-11.09	25.53
14.80	-11.09	25.89
15.16	-11.09	26.25
15.16	-11.09	26.25
15.76	-11.09	26.85
15.76	-11.09	26.85

Floor		Height	Kz values	qz
ground		0	0.57	10.05
	1	11.5	0.57	10.05
	2	20.292	0.66	11.63
	3	29.08	0.7	12.34
	4	37.875	0.76	13.40
	5	46.67	0.81	14.28
	6	55.458	0.85	14.98
	7	64.25	0.89	15.69
	8	73.04	0.93	16.39
	9	81.83	0.96	16.92
	10	90.625	0.99	17.45
	11	99.42	0.99	17.45
	12	108.83	1.04	18.33
roof		116.33	1.04	18.33

E/W direction (lbs/ft^2)

P (windward)	P (leeward)	P (net)
10.13	-1.37	11.51
10.13	-1.37	11.51
11.21	-1.37	12.58
11.69	-1.37	13.06
12.41	-1.37	13.78
13.01	-1.37	14.38
13.49	-1.37	14.86
13.97	-1.37	15.34
14.45	-1.37	15.82
14.80	-1.37	16.18
15.16	-1.37	16.54
15.16	-1.37	16.54
15.76	-1.37	17.14
15.76	-1.37	17.14

Table A- 1 Continued

Seismic Load:

Seismic Cals

Seisimc Use Group		I	Table 9.1.3
Occupancy Category		II	Table 1
Impartance Factor	I	1	Table 9.1.4
Max Ground Motions			
	Ss	18.7	Fig 4.1.1
	Si	6.3	Fig 4.1.1
Site Class		C	9.4.2.4
Stie Class Factors			
	Fa	1	Table 9.4.1.3.4a
	Fv	1.3	Table 9.4.1.3.4b

height (ft)	108.58		
Ct	0.02	Table 9.5.5.3.2	
x	0.75	Table 9.5.5.3.2	

Sms	18.7
Smi	8.19

Sds	12.47
Sdi	5.46

Seismic Design Cat.		A	Table 9.4.21
Response Mod. Fact.	R (n/s)	5	Table 9.5.2.2
	R (e/w)	5	Table 9.5.2.2
Building Frame	Wo (n/s)	2.5	Table 9.5.2.2
	Wo (e.w)	2.5	Table 9.5.2.2
	Cd (n/s)	4.5	Table 9.5.2.2
	Cd (e/w)	4.5	Table 9.5.2.2
Structure Type	Ct	0.02	Table 9.5.5.3.2
	x	0.75	Table 9.5.5.3.2

Seismic Resp. Coef	Cs	0.025	9.5.5.2.1
	Cs (max)	0.016	
	Cs (min)	0.005	
	Cs	0.016	

Period	Ta	0.67	Eq 9.5.5.3.2-1
	k	1.09	9.5.4.4

Seismic Base Shear	V (kips)	105.73	Eq 9.5.5.2-1

exterior wall weight (ft^2)	30

Table A-2

Seismic Loading Continued:

Floor	height (ft)	Floor Area (fts)	Slab thickness (in)	Floor Load (kips)	Exterior Wall length (ft)	Exterior wall trib height (ft)	Wall Load (kips)
roof	108.58	3871.00	8.00	387.10	256	4.71	36.13
12	99.17	3871.00	8.00	387.10	256	9.10	69.91
11	90.38	3871.00	8.00	387.10	256	8.79	67.55
10	81.58	3871.00	8.00	387.10	256	8.79	67.53
9	72.79	3871.00	8.00	387.10	256	8.79	67.51
8	64.00	3871.00	8.00	387.10	256	8.79	67.51
7	55.21	4560.64	8.00	456.06	298	8.79	78.58
6	46.42	4699.34	8.00	469.93	298	8.79	78.60
5	37.63	4699.34	8.00	469.93	298	8.80	78.63
4	28.83	4699.34	8.00	469.93	298	8.79	78.60
3	20.04	4699.34	8.00	469.93	298	8.79	78.58
2	11.25	4560.64	8.00	456.06	298	10.02	89.59
Ground	0.00	4900.00	8.00	490.00	298	5.63	50.29

Floor	height (ft)	Total Load (kips)	wx*hx^k	Cvx	Fx (kips)	Vx (kips)	Mx (kip ft)
roof	108.58	423.23	68449.38	0.14	14.88		1615.74
12	99.17	457.01	66987.79	0.14	14.56	14.88	1444.20
11	90.375	454.65	60253.93	0.12	13.10	29.44	1183.82
10	81.58	454.63	53916.66	0.11	11.72	42.54	956.22
9	72.79	454.61	47641.36	0.10	10.36	54.26	753.89
8	64	454.61	41432.54	0.09	9.01	64.62	576.47
7	55.21	534.65	41510.32	0.09	9.02	73.63	498.23
6	46.42	548.54	35284.38	0.07	7.67	82.65	356.07
5	37.625	548.56	28094.23	0.06	6.11	90.32	229.80
4	28.83	548.53	21044.17	0.04	4.57	96.43	131.90
3	20.042	548.52	14183.91	0.03	3.08	101.01	61.80
2	11.25	545.65	7540.78	0.02	1.64	104.09	18.44
Ground	0	540.29	0.00	0.00	0.00	105.73	0.00
			486339.46				

Total Building Weight (kips)	6513.46
Overturning Moment	7826.58

Table A-2 Continued

Load Cases:

Case 1: 1.4D
Case 2: 1.2D + 1.6L + .5Lr
Case 3: 1.2D + 1.6Lr + (L or .8W)
Case 4: 1.2D + 1.6W + .5L + .5Lr
Case 5: 1.2D + E + .2S
Case 6: .9D + 1.6W + 1.6H
Case 7: .9D + 1E + 1.6H

Story	D (psf)	L (psf)	Lr (psf)	S (psf)	W (psf)	E (psf)
12	120	60	20	15.75	26.85	3.84
11	120	60	20	15.75	26.25	3.76
10	120	60	20	15.75	26.25	3.38
9	120	60	20	15.75	25.89	3.02
8	120	60	20	15.75	25.53	2.67
7	120	60	20	15.75	25.06	2.32
6	120	60	20	15.75	24.58	1.97
5	120	60	20	15.75	24.1	1.632
4	120	60	20	15.75	23.5	1.299
3	120	60	20	15.75	22.78	0.973
2	120	60	20	15.75	22.3	0.656
1	120	100	20	15.75	21.22	0.359

Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
168	250	197.48	226.96	78.99	150.96	111.84
168	250	197	226	78.91	150	111.76
168	250	197	226	78.53	150	111.38
168	250	196.712	225.424	78.17	149.424	111.02
168	250	196.424	224.848	77.82	148.848	110.67
168	250	196.048	224.096	77.47	148.096	110.32
168	250	195.664	223.328	77.12	147.328	109.97
168	250	195.28	222.56	76.782	146.56	109.632
168	250	194.8	221.6	76.449	145.6	109.299
168	250	194.224	220.448	76.123	144.448	108.973
168	250	193.84	219.68	75.806	143.68	108.656
168	314	192.976	237.952	123.509	141.952	108.359

Table A-3

Beam Summary

RAM Steel v8.1
DataBase: total
Building Code: IBC

02/13/06 10:02:34
Steel Code: AISC LRFD

STEEL BEAM DESIGN SUMMARY:

Floor Type: resid 2

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	13.00	62.9	0.0	75.8	50.0	W8X10	10
16	27.00	92.8	0.0	132.3	50.0	W12X14	14
32	27.00	113.1	0.0	139.4	50.0	W12X14	16
2	16.00	95.2	0.0	113.6	50.0	W10X12	16
18	27.00	126.0	0.0	153.1	50.0	W12X14	22
31	27.00	136.9	0.0	161.7	50.0	W12X14	27
3	20.00	149.1	0.0	174.7	50.0	W12X16	24
20	27.00	151.1	0.0	185.6	50.0	W12X19	20
30	27.00	164.6	0.0	199.1	50.0	W12X19	26
4	16.00	95.2	0.0	113.6	50.0	W10X12	16
22	27.00	151.1	0.0	185.6	50.0	W12X19	20
29	27.00	136.9	0.0	161.7	50.0	W12X14	27
5	13.00	62.9	0.0	75.8	50.0	W8X10	10
24	27.00	126.0	0.0	153.1	50.0	W12X14	22
28	27.00	113.1	0.0	139.4	50.0	W12X14	16
26	27.00	92.8	0.0	132.3	50.0	W12X14	14
6	13.00	101.1	0.0	121.8	50.0	W10X12	18
17	23.00	67.2	0.0	93.4	50.0	W10X12	10
33	23.00	81.9	0.0	100.0	50.0	W10X12	12
7	16.00	152.9	0.0	181.9	50.0	W12X16	24
19	23.00	91.3	0.0	109.4	50.0	W10X12	16
34	23.00	100.6	0.0	122.4	50.0	W10X12	22
8	20.00	131.9	0.0	157.3	50.0	W12X14	22
21	23.00	53.7	0.0	79.4	50.0	W8X10	14
9	16.00	152.9	0.0	181.9	50.0	W12X16	24
23	23.00	53.7	0.0	79.4	50.0	W8X10	14
35	23.00	100.6	0.0	122.4	50.0	W10X12	22
10	13.00	101.1	0.0	121.8	50.0	W10X12	18
25	23.00	91.3	0.0	109.4	50.0	W10X12	16
36	23.00	81.9	0.0	100.0	50.0	W10X12	12
27	23.00	67.2	0.0	93.4	50.0	W10X12	10
11	13.00	54.8	0.0	65.3	50.0	W8X10	6
12	16.00	82.9	0.0	100.4	50.0	W10X12	10
13	20.00	23.4	0.0	56.3	50.0	W8X10	6
14	16.00	82.9	0.0	100.4	50.0	W10X12	10
15	13.00	54.8	0.0	65.3	50.0	W8X10	6

Floor Type: resid 1

Table A-4

Beam Summary

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	13.00	62.9	0.0	75.8	50.0	W8X10	10
21	16.13	32.9	0.0	60.1	50.0	W8X10	6
38	27.00	113.1	0.0	139.4	50.0	W12X14	16
2	16.00	95.2	0.0	113.6	50.0	W10X12	16
24	27.00	126.0	0.0	153.1	50.0	W12X14	22
37	27.00	136.9	0.0	161.7	50.0	W12X14	27
3	20.00	149.1	0.0	174.7	50.0	W12X16	24
26	27.00	151.1	0.0	185.6	50.0	W12X19	20
36	27.00	164.6	0.0	199.1	50.0	W12X19	26
4	16.00	95.2	0.0	113.6	50.0	W10X12	16
28	27.00	151.1	0.0	185.6	50.0	W12X19	20
35	27.00	136.9	0.0	161.7	50.0	W12X14	27
5	13.00	62.9	0.0	75.8	50.0	W8X10	10
30	27.00	126.0	0.0	153.1	50.0	W12X14	22
34	27.00	113.1	0.0	139.4	50.0	W12X14	16
32	27.00	92.8	0.0	132.3	50.0	W12X14	14
6	21.00	78.7	0.0	101.5	50.0	W10X12	10
19	10.88	6.5	0.0	57.7	50.0	W8X10	4
22	10.88	9.2	0.0	66.0	50.0	W8X10	6
7	21.00	173.0	0.0	209.0	50.0	W12X19	24
20	23.00	92.3	0.0	111.9	50.0	W12X14	8
39	23.00	127.4	0.0	152.4	50.0	W12X14	22
8	13.00	101.1	0.0	121.8	50.0	W10X12	18
23	23.00	107.0	0.0	127.4	50.0	W12X14	12
40	23.00	81.9	0.0	100.0	50.0	W10X12	12
9	16.00	152.9	0.0	181.9	50.0	W12X16	24
25	23.00	91.3	0.0	109.4	50.0	W10X12	16
41	23.00	100.6	0.0	122.4	50.0	W10X12	22
10	20.00	131.9	0.0	157.3	50.0	W12X14	22
27	23.00	53.7	0.0	79.4	50.0	W8X10	14
11	16.00	152.9	0.0	181.9	50.0	W12X16	24
29	23.00	53.7	0.0	79.4	50.0	W8X10	14
42	23.00	100.6	0.0	122.4	50.0	W10X12	22
12	13.00	101.1	0.0	121.8	50.0	W10X12	18
31	23.00	91.3	0.0	109.4	50.0	W10X12	16
43	23.00	81.9	0.0	100.0	50.0	W10X12	12
33	23.00	67.2	0.0	93.4	50.0	W10X12	10
13	21.00	143.0	0.0	168.9	50.0	W12X16	20
14	13.00	54.8	0.0	65.3	50.0	W8X10	6
15	16.00	82.9	0.0	100.4	50.0	W10X12	10
16	20.00	23.4	0.0	56.3	50.0	W8X10	6
17	16.00	82.9	0.0	100.4	50.0	W10X12	10
18	13.00	54.8	0.0	65.3	50.0	W8X10	6

Table A-4, Continued

Beam Summary

Floor Type: Ground

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
2	21.00	292.6	0.0	346.0	50.0	W16X31	20
20	27.00	778.6	0.0	930.5	50.0	W24X68	13, 12
39	27.00	320.3	0.0	383.7	50.0	W16X31	34
3	13.00	81.0	0.0	98.9	50.0	W10X12	10
22	27.00	1067.1	0.0	1259.1	50.0	W27X84	14, 13
38	27.00	151.6	0.0	185.4	50.0	W12X19	20
4	16.00	122.6	0.0	146.0	50.0	W12X14	18
24	27.00	168.8	0.0	199.0	50.0	W12X19	27
37	27.00	183.1	0.0	222.1	50.0	W14X22	18
5	20.00	192.0	0.0	229.4	50.0	W14X22	18
26	27.00	200.3	0.0	237.6	50.0	W14X22	24
36	27.00	217.6	0.0	272.5	50.0	W16X26	16
6	16.00	122.6	0.0	146.0	50.0	W12X14	18
28	27.00	200.3	0.0	237.6	50.0	W14X22	24
35	27.00	183.1	0.0	222.1	50.0	W14X22	18
7	13.00	81.0	0.0	98.9	50.0	W10X12	10
30	27.00	168.8	0.0	199.0	50.0	W12X19	27
34	27.00	151.6	0.0	185.4	50.0	W12X19	20
32	27.00	109.4	0.0	148.8	50.0	W12X14	22
8	21.00	472.0	0.0	559.2	50.0	W21X44	18
21	23.00	150.5	0.0	181.0	50.0	W12X19	20
40	23.00	240.8	0.0	287.3	50.0	W16X26	20
9	13.00	135.3	0.0	160.2	50.0	W12X14	22
23	23.00	181.0	0.0	215.2	50.0	W14X22	16
41	23.00	109.6	0.0	133.6	50.0	W12X14	14
10	16.00	205.1	0.0	243.9	50.0	W14X22	22
25	23.00	122.1	0.0	148.1	50.0	W12X14	20
42	23.00	134.8	0.0	162.2	50.0	W12X16	20
11	20.00	174.9	0.0	212.0	50.0	W14X22	12
27	23.00	69.1	0.0	93.3	50.0	W10X12	10
12	16.00	205.1	0.0	243.9	50.0	W14X22	22
29	23.00	69.1	0.0	93.3	50.0	W10X12	10
43	23.00	134.8	0.0	162.2	50.0	W12X16	20
13	13.00	135.3	0.0	160.2	50.0	W12X14	22
31	23.00	122.1	0.0	148.1	50.0	W12X14	20
44	23.00	109.6	0.0	133.6	50.0	W12X14	14
33	23.00	79.2	0.0	106.9	50.0	W10X12	16
14	21.00	251.8	0.0	298.5	50.0	W16X26	20
15	13.00	69.9	0.0	82.8	50.0	W8X10	14
16	16.00	105.9	0.0	128.4	50.0	W12X14	10
17	20.00	21.6	0.0	44.2	50.0	W8X10	6
18	16.00	105.9	0.0	128.4	50.0	W12X14	10

Table A-4, Continued

Beam Summary

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
19	13.00	69.9	0.0	82.8	50.0	W8X10	14

Floor Type: L-1

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	21.00	211.8	0.0	258.3	50.0	W16X26	10
19	27.00	156.2	0.0	199.2	50.0	W14X22	12
38	27.00	226.0	0.0	272.5	50.0	W16X26	16
2	13.00	81.0	0.0	98.9	50.0	W10X12	10
21	27.00	191.7	0.0	227.9	50.0	W14X22	20
37	27.00	151.6	0.0	185.4	50.0	W12X19	20
3	16.00	122.6	0.0	146.0	50.0	W12X14	18
23	27.00	168.8	0.0	199.0	50.0	W12X19	27
36	27.00	183.1	0.0	222.1	50.0	W14X22	18
4	20.00	192.0	0.0	229.4	50.0	W14X22	18
25	27.00	200.3	0.0	237.6	50.0	W14X22	24
35	27.00	217.6	0.0	272.5	50.0	W16X26	16
5	16.00	122.6	0.0	146.0	50.0	W12X14	18
27	27.00	200.3	0.0	237.6	50.0	W14X22	24
34	27.00	183.1	0.0	222.1	50.0	W14X22	18
6	13.00	81.0	0.0	98.9	50.0	W10X12	10
29	27.00	168.8	0.0	199.0	50.0	W12X19	27
33	27.00	151.6	0.0	185.4	50.0	W12X19	20
31	27.00	109.4	0.0	148.8	50.0	W12X14	22
7	21.00	332.7	0.0	394.1	50.0	W16X31	36
20	23.00	112.8	0.0	136.6	50.0	W12X14	16
39	23.00	169.5	0.0	208.1	50.0	W14X22	14
8	13.00	135.3	0.0	160.2	50.0	W12X14	22
22	23.00	143.4	0.0	174.3	50.0	W12X19	16
40	23.00	109.6	0.0	133.6	50.0	W12X14	14
9	16.00	205.1	0.0	243.9	50.0	W14X22	22
24	23.00	122.1	0.0	148.1	50.0	W12X14	20
41	23.00	134.8	0.0	162.2	50.0	W12X16	20
10	20.00	174.9	0.0	212.0	50.0	W14X22	12
26	23.00	69.1	0.0	93.3	50.0	W10X12	10
11	16.00	205.1	0.0	243.9	50.0	W14X22	22
28	23.00	69.1	0.0	93.3	50.0	W10X12	10
42	23.00	134.8	0.0	162.2	50.0	W12X16	20
12	13.00	135.3	0.0	160.2	50.0	W12X14	22
30	23.00	122.1	0.0	148.1	50.0	W12X14	20
43	23.00	109.6	0.0	133.6	50.0	W12X14	14
32	23.00	79.2	0.0	106.9	50.0	W10X12	16
13	21.00	183.1	0.0	219.6	50.0	W14X22	14
14	13.00	69.9	0.0	82.8	50.0	W8X10	14
15	16.00	105.9	0.0	128.4	50.0	W12X14	10

Table A-4, Continued

Beam Summary

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
16	20.00	21.6	0.0	44.2	50.0	W8X10	6
17	16.00	105.9	0.0	128.4	50.0	W12X14	10
18	13.00	69.9	0.0	82.8	50.0	W8X10	14

Floor Type: Concourse

Bm #	Length ft	+Mu kip-ft	-Mu kip-ft	Mn kip-ft	Fy ksi	Beam Size	Studs
1	21.00	368.3	0.0	438.5	50.0	W18X35	22
19	27.00	257.4	0.0	309.2	50.0	W16X26	24
38	27.00	402.2	0.0	474.7	50.0	W18X35	44
2	13.00	141.0	0.0	168.5	50.0	W12X19	10
21	27.00	345.5	0.0	408.0	50.0	W16X31	50
37	27.00	275.1	0.0	327.3	50.0	W16X26	30
3	16.00	213.7	0.0	264.5	50.0	W16X26	10
23	27.00	306.5	0.0	364.2	50.0	W16X26	54
36	27.00	331.0	0.0	392.8	50.0	W16X31	40
4	20.00	334.2	0.0	396.2	50.0	W18X35	14
25	27.00	360.2	0.0	427.5	50.0	W18X35	24
35	27.00	388.4	0.0	459.7	50.0	W18X35	36
5	16.00	213.7	0.0	264.5	50.0	W16X26	10
27	27.00	360.2	0.0	427.5	50.0	W18X35	24
34	27.00	331.0	0.0	392.8	50.0	W16X31	40
6	13.00	141.0	0.0	168.5	50.0	W12X19	10
29	27.00	306.5	0.0	364.2	50.0	W16X26	54
33	27.00	275.1	0.0	327.3	50.0	W16X26	30
31	27.00	173.2	0.0	205.8	50.0	W14X22	12
7	21.00	594.2	0.0	699.1	50.0	W21X44	46
20	23.00	186.5	0.0	221.6	50.0	W14X22	16
39	23.00	304.7	0.0	361.2	50.0	W16X31	26
8	13.00	245.7	0.0	290.1	50.0	W16X26	14
22	23.00	260.4	0.0	310.4	50.0	W16X26	24
40	23.00	199.3	0.0	238.4	50.0	W14X22	20
9	16.00	372.5	0.0	444.7	50.0	W18X35	22
24	23.00	222.4	0.0	280.9	50.0	W16X26	16
41	23.00	245.2	0.0	290.0	50.0	W16X26	18
10	20.00	317.1	0.0	382.8	50.0	W18X35	12
26	23.00	125.2	0.0	150.5	50.0	W12X14	18
11	16.00	372.5	0.0	444.7	50.0	W18X35	22
28	23.00	125.2	0.0	150.5	50.0	W12X14	18
42	23.00	245.2	0.0	290.0	50.0	W16X26	18
12	13.00	245.7	0.0	290.1	50.0	W16X26	14
30	23.00	222.4	0.0	280.9	50.0	W16X26	16
43	23.00	199.3	0.0	238.4	50.0	W14X22	20
32	23.00	125.0	0.0	150.5	50.0	W12X14	18
13	21.00	316.6	0.0	371.3	50.0	W16X31	24

Table A-4, Continued

Beam Summary

Bm #	Length	+Mu	-Mu	Mn	Fy	Beam Size	Studs
14	13.00	121.0	0.0	146.9	50.0	W12X14	14
15	16.00	183.6	0.0	219.4	50.0	W14X22	12
16	20.00	21.6	0.0	45.2	50.0	W8X10	5
17	16.00	183.6	0.0	219.4	50.0	W14X22	12
18	13.00	121.0	0.0	146.9	50.0	W12X14	14

* after Size denotes beam failed stress/capacity criteria.
# after Size denotes beam failed deflection criteria.
u after Size denotes this size has been assigned by the User.

Table A-4, Continued

Girder Design:

Ultimate Moment

W= 1.2D + 1.6L = 270 psf

W= Trib. Width * W = 18.5' * 270 psf = 5 klf

Design Top Steel:

$$M= \frac{wl\text{^}2}{12} = \frac{5*27\text{^}2}{12}^2 = 303.75 \text{ ft-k}$$

$$Mu= \frac{M}{\phi} = \frac{303.75}{.9} = 337.5 \text{ ft-k}$$

Assume d= 12" + 3" slab= 15"

Assume b= 2' = 24"

$$As= \frac{Mn}{fy(d-\frac{a}{2})}$$

Assume $(d-\frac{a}{2}) = .9d$

Let d = 15- 2.5 = 12.5"

$$As= \frac{337.5}{60*.9*12.5} = 6 \text{ square inches}$$

From *Design of Concrete Structures by Nilson*

Table A.2, use 6 #9's as bottom steel in girder ρ=.0167

Check:

d= 15 – 1/2 – 1.5" cover = 13"

$$a_s= \frac{Asfy}{.85f'cbeff} = \frac{6*60}{.85*4*24} = 4.41$$

Mn= $Asfy\ (d-\frac{a}{2})$ = 6*60*(13 – 4.41/2) = 3886.2/12= 323.85 <337.5

This does not work.

Try 7 #9's ρ=.02

Check:

d= 15 – 1/2 – 1.5" cover = 13"

$$a_s= \frac{Asfy}{.85f'cbeff} = \frac{7*60}{.85*4*24} = 5.14$$

Mn= $Asfy\ (d-\frac{a}{2})$ = 7*60(13-5.14/2) = 4380.6/12 = 365 <337.5 OK!

Design Bottom Steel:

$M = \frac{wl^2}{24} = \frac{5 * 27^2}{24}^2 = 151.875$ ft-k

$Mu = \frac{M}{\phi} = \frac{151.875}{.9} = 168.75$ ft-k

Assume d= 12" + 3" slab= 15"

Assume b= 2' = 24"

$As = \frac{Mn}{fy(d - \frac{a}{2})}$

Assume $(d - \frac{a}{2}) = .9d$

Let d = 15- 2.5 = 12.5"

$As = \frac{168.75}{60 * .9 * 12.5} = 3$ square inches

From *Design of Concrete Structures by Nilson*

Table A.2, use 4 #8's as bottom steel in girder

Check:

d= 15 – .79/2 – 1.5" cover = 13.1"

$a_s = \frac{Asfy}{.85 f'cbeff} = \frac{3.16 * 60}{.85 * 4 * 24} = 2.32$

Mn= $Asfy\ (d - \frac{a}{2})$ = 3.16*60*(13.1 – 2.32/2) = 2263.8/12= 188.6 <169

Ductility Check:

T=C

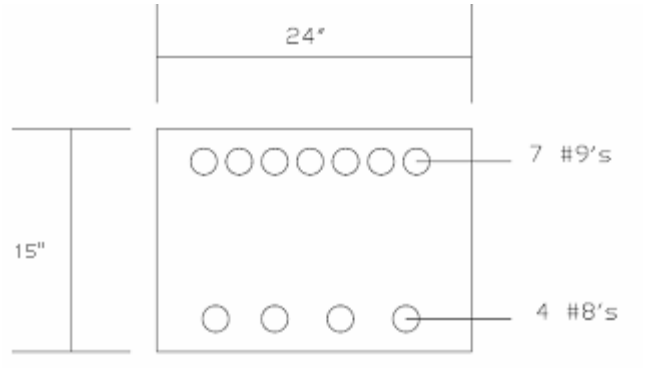
Asfy = (As' Fy') + (.85*f'c*b*a)

7*60= (60*3.16) + (.85*4*24*a)

A=2.8

C= a/β = 2.8 / .85 = 3.32

E = .003*(13-3.32) / 3.32 = .008 > .005 OK



Girder Cross Section

Figure A-9

Bar Cut Offs

Top Reinforcement, 7 #9's A=7 in^2

Development length: L_d= 62d = 62* 9/8 = 70 in = 5.8'

Theoretical cutoff: 3 #9 A=3 in^2

$a_s = \frac{Asfy}{.85f'cbeff} = \frac{3*60}{.85*4*24}$ =2.2 in

$\Phi Mn = .9\,Asfy\,(d - \frac{a}{2})$ = .9*3*60*(13-2.2/2) = 160 ft-k

Point at which Mn= 160 ft kips is x = 2.33'

Therefore the cutoff is at $x+12d_b$=28+ 12*9/8 = 41.5"

Or cutoff = 62"

Or development length = 69.6" ← Controls

Point of inflection = .211l = .211*27'=68.36 in

Cutoff at 68.36 + 13 = 81.36"

Or 55.02" + 70" = 125.02" ← Controls

Bottom Reinforcement, 4 #8 A= 3.16 in^2

Not continuous, 2 bars need to be carried into supports

Theoretical cutoff: 2 #8's A=1.58 in2

$a_s = \frac{Asfy}{.85f'cbeff} = \frac{1.58*60}{.85*4*24}$ =1.16 in

$\Phi Mn = .9\,Asfy\,(d - \frac{a}{2})$ = .9*1.58*60*(13-1.16/2) = 88.3 ft-k

Point at which Mu= 88.3 ft-k is at x = 8.5' ← Controls

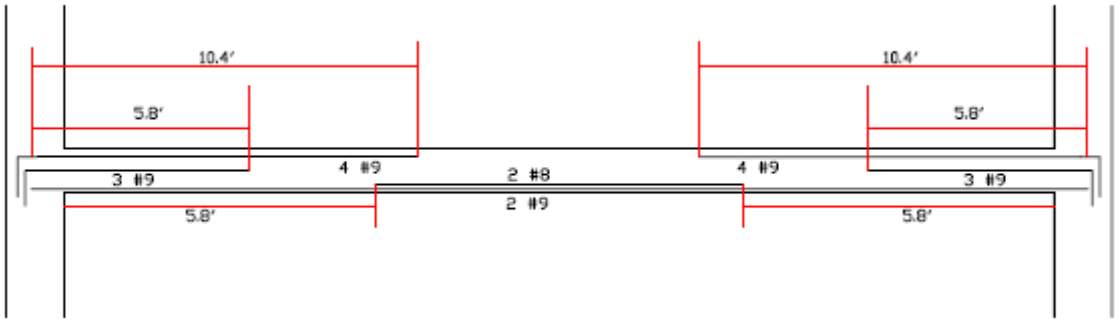
Point of inflection= 68.36"

Check 12.11.3 ACI

$$Ld \le \frac{Mn}{Vu} + La$$

28 < 88.3/ 42.5 +13 = 15 in

Not okay, bottom bars must be hooked at column centerline.



Reinforcement Cut Offs
Figure A-10

Shear Design

Vu at d from support = 61.25 kips (by similar triangles)

$$Vs = \frac{Vu}{\phi} - Vc$$

$$Vc = 2\sqrt{4000} * 24 * 13 = 39.5 \text{ kips}$$

Vs = 61.25/.8 – 39.5 = 37 kips

Max Spacing S= d/2 = 13/2 = 6.5”

Min Av = .75* $\sqrt{4000}$ *24* 6.5 / 60000 = .1233

Min Av = 50*24*6.5/ 60000 = .13 ← Controls

From *Design of Concrete Structures by Nilson*

Table A.3 Try #3 bars every 6.5” Av= .22”

Vs min = AvFy*d/s = .22*60*13/6.5 =26.4 kips

Spacing at supports

$$S = \frac{Avfyd}{Vs} = \frac{.22 * 60 * 13}{37} = 4.63” \approx 4.5”$$

Spacing Cut offs

Vu = Φ(Vc + Vs) = .8(39.5 + 26.4) = 52.72 kips

By similar triangles, cut off is at 10.5 ft

Vu=ΦVc/2 = .8*39.5/2 = 15.8

By similar triangles, cut off is at 3.16 ft

Solution:

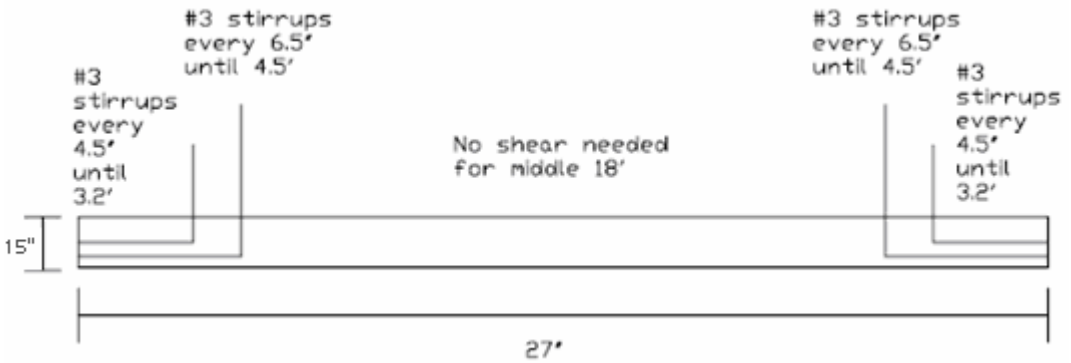
Top Steel = 7 #9’s

Bottom Steel = 4 #8’s

Shear:

#3 stirrups every 6.5” until 4.5 feet from the support

#3 stirrups every 4.5” until 3.2 feet from the support



Stirrup Spacing

Figure A-11

Column Design:

Assume a square column. Assume **b=16"** and #8 bars

Pick an interaction diagram based on γ:

$$\gamma = \frac{b - 2\left(\frac{d}{2} + cover\right)}{b} = \frac{16 - 2\left(\frac{1}{2} + 2.5\right)}{16} = .667 \text{ round to } .7$$

Use graph A.5 in *Design of Concrete Structures by Nilson*

Kn=$\frac{Pu}{\phi f'cAg}$ See Excel for results Rn=$\frac{Mu}{\phi f'cAgh}$ See Excel for results

Rn is very insignificant Design for ρ=.04

As= 10.24 **Use 16 #8 As=12.566 ρ=.049**

Check with Load Contour Method:

Kn=1.11 Let ρ= .049

Therefore Rn=.125

φMn= 1331.2 in-k

$\left(\frac{\phi Mnx}{\phi Mnxo}\right)^{\alpha} + \left(\frac{\phi Mny}{\phi Mnyo}\right)^{\alpha} > 1$ All columns checked on Excel.

The above was done for both the actual moment on the columns, and the axial load offset by 1" in off directions.

assumed	
b	16

Column	Axial (kips)	Mux (ft-k)	Muy (ft-k)	Kn	Rnx	Rny	contour	< 1
A-1	171.3	9.1	7.7	0.26	0.01	0.01	0.102912	yes
A-2	401.3	10.1	5.3	0.60	0.01	0.01	0.093847	yes
A-3	476	8.4	3.3	0.72	0.01	0.00	0.068986	yes
A-4	591.4	10.7	4.2	0.89	0.01	0.00	0.091101	yes
A-5	591.4	10.7	4.2	0.89	0.01	0.00	0.091101	yes
A-6	476	8.4	3.3	0.72	0.01	0.00	0.068986	yes
A-7	300.4	5.9	4.3	0.45	0.01	0.00	0.058065	yes
B-1	94.7	0.7	3.6	0.14	0.00	0.00	0.022361	yes
B-2	134	3.3	3.3	0.20	0.00	0.00	0.035122	yes
C-1	432.8	1.2	11.6	0.65	0.00	0.01	0.080025	yes
C-2	737.1	1.6	8.6	1.11	0.00	0.01	0.060474	yes
C-3	735.8	1.3	5.8	1.11	0.00	0.01	0.039605	yes
C-4	692.6	6.6	6.2	1.04	0.01	0.01	0.075236	yes
C-5	692.6	6.6	6.2	1.04	0.01	0.01	0.075236	yes
C-6	735.8	1.3	5.8	1.11	0.00	0.01	0.039605	yes
C-7	472	0.9	7.1	0.71	0.00	0.01	0.046325	yes
D-1	263.5	7.1	6.4	0.40	0.01	0.01	0.079999	yes
D-2	420.7	8.4	4.5	0.63	0.01	0.01	0.076512	yes

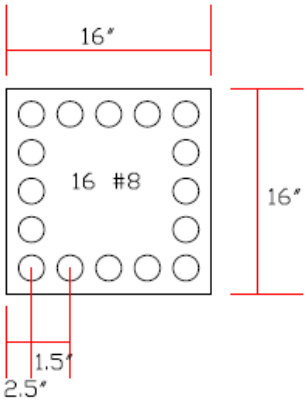
D-3	417.7	7.2	2.9	0.63	0.01	0.00	0.058207	yes
D-4	312	4.5	3.8	0.47	0.01	0.00	0.045741	yes
D-5	312	4.5	3.8	0.47	0.01	0.00	0.045741	yes
D-6	417.7	7.2	2.9	0.63	0.01	0.00	0.058207	yes
D-7	263.3	5	4	0.40	0.01	0.00	0.050227	yes

Actual Moment

Column	Axial (kips)	Mux (in-k)	Muy (in-k)	Kn	Rnx	Rny	contour	< 1
A-1	171.3	171.3	171.3	0.26	0.02	0.02	3.296891	yes
A-2	401.3	401.3	401.3	0.60	0.04	0.04	8.775527	yes
A-3	476	476	476	0.72	0.04	0.04	10.67903	yes
A-4	591.4	591.4	591.4	0.89	0.06	0.06	13.70715	yes
A-5	591.4	591.4	591.4	0.89	0.06	0.06	13.70715	yes
A-6	476	476	476	0.72	0.04	0.04	10.67903	yes
A-7	300.4	300.4	300.4	0.45	0.03	0.03	6.289825	yes
B-1	94.7	94.7	94.7	0.14	0.01	0.01	1.667578	yes
B-2	134	134	134	0.20	0.01	0.01	2.485731	yes
C-1	432.8	432.8	432.8	0.65	0.04	0.04	9.572249	yes
C-2	737.1	737.1	737.1	1.11	0.07	0.07	17.6579	yes
C-3	735.8	735.8	735.8	1.11	0.07	0.07	17.62209	yes
C-4	692.6	692.6	692.6	1.04	0.07	0.07	16.4376	yes
C-5	692.6	692.6	692.6	1.04	0.07	0.07	16.4376	yes
C-6	735.8	735.8	735.8	1.11	0.07	0.07	17.62209	yes
C-7	472	472	472	0.71	0.04	0.04	10.57589	yes
D-1	263.5	263.5	263.5	0.40	0.02	0.02	5.409802	yes
D-2	420.7	420.7	420.7	0.63	0.04	0.04	9.265141	yes
D-3	417.7	417.7	417.7	0.63	0.04	0.04	9.189202	yes
D-4	312	312	312	0.47	0.03	0.03	6.569941	yes
D-5	312	312	312	0.47	0.03	0.03	6.569941	yes
D-6	417.7	417.7	417.7	0.63	0.04	0.04	9.189202	yes
D-7	263.3	5	263.3	0.40	0.00	0.02	2.730859	yes

1” eccentricity

Table A-5



Final Column Design

Figure A-12

Base Plate Design:

vertical load on column	V (kips)	350
concrete strenght	Fc (ksi)	4

Area of plate	A (in^2)	350

Depth of column	d (in)	10
width of column	b (in)	10

lenght of effective area	E (in)	4.986657

Plate length	L (in)	19.47331
Plate Width	W (in)	17.97331

Steel Strength	Fy (ksi)	36
Plate Thickness	t (in)	3.324438

Table A-6

Cost Estimates:

Excavation:

#	Item	Unit	Crew	Mat	Labor	Equip	Total/ unit	Total
424 0250	Backhoe	BCY	B-12A	0	0.66	0.9	1.56	1084.2
400 4000	Wood Sheathing	SF	B-31	1.83	3.92	0.45	6.2	18600
490 0540	Hauling	LCY		0	1.81	3.81	5.62	3905.9
								23590.1

Foundation:

#	Item	Unit	Crew	Mat	Labor	Equip	Total/ unit	Total
240 4050	Concrete, MAT	CY	C-14C	156	67	0.38	223.38	144750.2
								144750.2

Sub-Grade Levels:

#	Item	Unit	Crew	Mat	Labor	Equip	Total/ unit	Total
240 2500	One Way Joist	CY	C-14B	410	270	26.5	706.5	168853.5
240 0820	Columns	CY	C-14A	410	565	57.5	1032.5	14279.48
240 4260	Grade Walls	CY	C-14D	150	143	14.65	307.15	34124.37
240 4260	Shear Wall	CY	C-14D	150	143	14.65	307.15	7509.818
								224767.2
								per level

Super Structure Levels:

	#	Item	Unit	Crew	Mat	Labor	Equip	Total/ unit	Total
Levels 12-8	300 ####	Composite Deck	SF	E-4	1.97	0.38	0.03	2.38	9401
	240 3150 840	Elevated Slab	SF	C-8	1.16	0.66	0.27	2.11	8334.5
	#### 640	Shear Studs	Each	E-10	0.43	0.69	0.28	1.4	826
	0300 640	W 8 x 10	LF	E-2	10.45	3.63	2.38	16.46	855.92
	0600 640	W 10 x 12	LF	E-2	12.55	3.63	2.38	18.56	5085.44
	1200 640	W 12 x 16	LF	E-2	16	2.48	1.62	20.1	1045.2
	1100 640	W 12 x 14	LF	E-2	14.65	2.48	1.62	18.75	4425
	1250 640	W 12 x 19	LF	E-2	20	2.48	1.62	24.1	1952.1
	1560	W 12 x 50	LF	E-2	52.5	2.9	1.9	57.3	3781.8
									35706.96

	300								
Levels 7-2	####	Composite Deck	SF	1 E-4	1.97	0.38	0.03	2.38	11075.33
	240								
	3150	Elevated Slab	SF	2 C-8	1.16	0.66	0.27	2.11	9818.885
	840								
	####	Shear Studs	Each	1 E-10	0.43	0.69	0.28	1.4	943.6
	640								
	0300	W 8 x 10	LF	1 E-2	10.45	3.63	2.38	16.46	1407.33
	640								
	0600	W 10 x 12	LF	1 E-2	12.55	3.63	2.38	18.56	4807.04
	640								
	1200	W 12 x 16	LF	1 E-2	16	2.48	1.62	20.1	1467.3
	640								
	1100	W 12 x 14	LF	1 E-2	14.65	2.48	1.62	18.75	3937.5
	640								
	1250	W 12 x 19	LF	1 E-2	20	2.48	1.62	24.1	2458.2
	640								
	1560	W 12 x 50	LF	1 E-2	75	3.4	2.23	80.63	5321.58
									41236.77
									Per level
Braced	640								
Frames	1550	W 12x 45	LF	1 E-2	52.5	2.9	1.9	57.3	4297.5
	640								
Diagonals	1555	W 12 x 53	LF	1 E-2	52.5	2.9	1.9	57.3	2887.92
	640								
	1580	W 12 x 58	LF	1 E-2	60.5	2.9	1.9	65.3	3291.12
	640								
	1590	W 12 x 65	LF	1 E-2	75	3.4	2.23	80.63	10159.38
	641								
Columns	1590	W 12 x 65	LF	1 E-2	75	3.4	2	150	12000
		W 12 x 120	LF	1 E-2	120	4	2	150	1500
		W 12 x 170	LF	1 E-2	170	4	2	150	3000
		W 12 x 106	LF	1 E-2	106	4	2	150	1500
		W 12 x 152	LF	1 E-2	153	4	2	150	1500
		W 12 x 190	LF	1 E-2	190	4	2	150	1500
		W 12 x 230	LF	1 E-2	230	4	2	150	1500
		W 12 x 252	LF	1 E-2	252	4	2	150	1500
		W 12 x 279	LF	1 E-2	279	4	2	150	1500
		W 12 x 305	LF	1 E-2	305	4	2	150	1500
		W 12 x 336	LF	1 E-2	336	4	2	150	1500
		W 14 x 311	LF	1 E-2	311	4	2	150	1500
		W 14 x 342	LF	1 E-2	342	4	2	150	1500
									52135.92
									Per fram
	640								
Columns, not part of a frame	0740	W 10 x 33	LF	1 E-2	34.5	3.96	2.59	41.01	76278.6
		W 10 x 39	LF	1 E-2	39	3.96	2.59	45.55	7743.5
		W 10 x 45	LF	1 E-2	45	3.96	2.59	51.55	4124
	640								
	0900	W 10 x 49	LF	1 E-2	51	3.96	2.59	57.55	5179.5
		W 10 x 54	LF	1 E-2	54	3.96	2.59	60.55	1211
									94536.6