

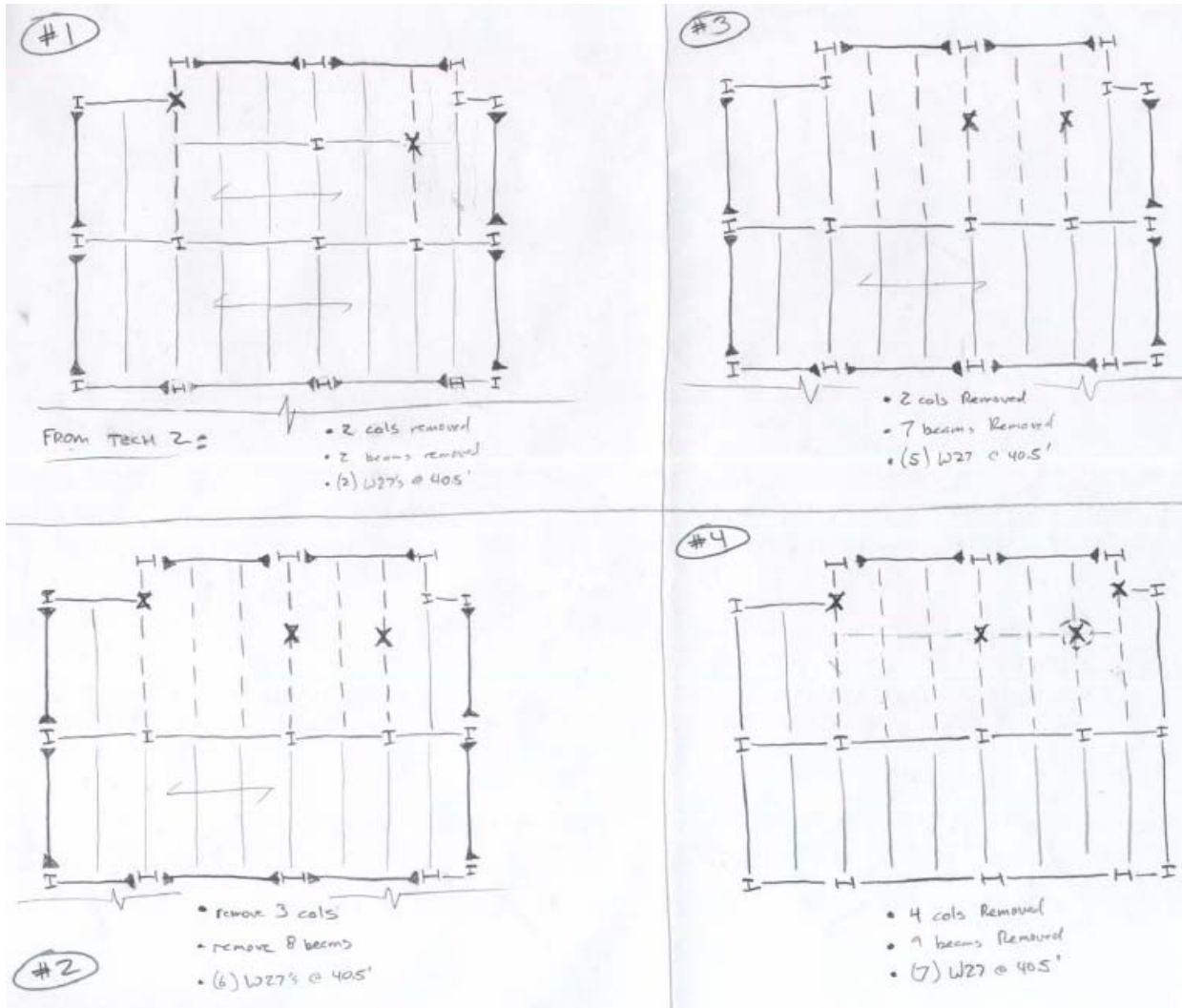
Philip Frederick
Structural Option
Advisor: Dr. Andres Lepage
April 9th, 2008

Swedish American Hospital
Heart and Vascular Center
1400 Charles St, Rockford, IL

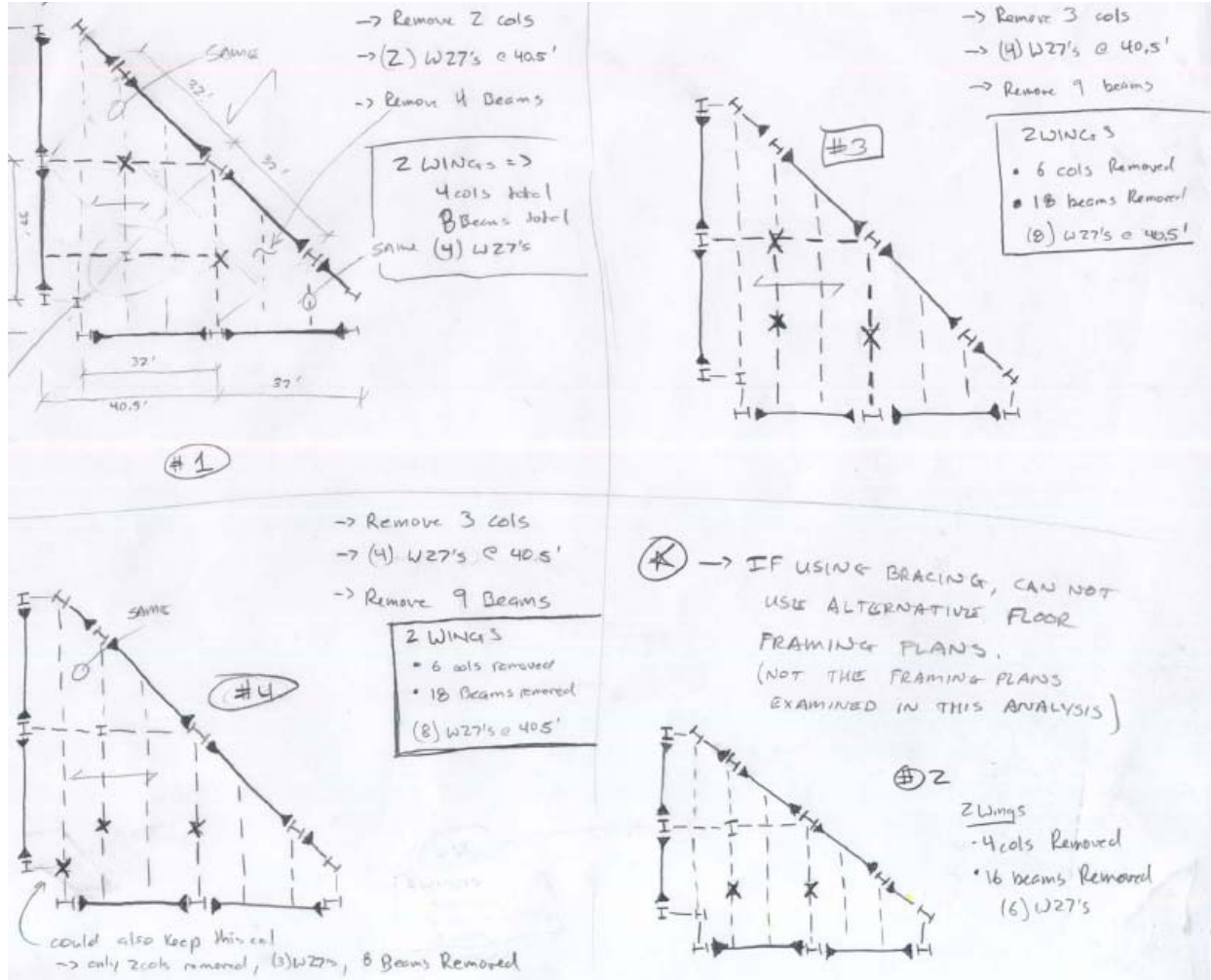
APPENDIX

APPENDIX A

Alternative gravity framing plans for the floor section.



Alternative gravity framing plans for the wing section.



APPENDIX B

Composite Castelled Beam Design Spreadsheet (calculations shown for typical gravity beam)

SmartBeam™

CASTELLATED BEAM INFORMATION		LOADING INFORMATION				EXPAND'D. SXN. PROP'S		
Job Name	Swedish American Hospital	Uniform Distributed Loads	plf	40.5	Avg. wt.	40.5	plf	
Beam Mark #	CB - Beam	Live Load	1036		Anet	8.753	in ²	
Span	40.500	Dead Load	831	Pre-comp %	0%	Agross	14.955	
Spac. Left	10.600	Concentrated Point Loads		Pre-comp %	80%	lx net	1406.79	
Spac. Right	10.600	Load #	Magnitude	Dist from	Percent DL	lx gross	1594.82	
Mat. Strength-Fy	50	(#)	(kips)	Lt. End (ft)	(%)	Sx net	90.75	
Round Duct Diam.	15.273	P1	0.00	0.00	0%	Sx gross	107.02	
Duct W x H	8.800 in	P2	0.00	0.00	0%	rx min	10.33	
Castellated Beam	CB27X35/46	P3	0.00	0.00	0%	ly	18.90	
Root Beams (T/B)	W18X35	P4	0.00	0.00	0%	Sy	6.30	
d	17.7	COMPOSITE INFORMATION						COMPOSITE SXN. PROP'S
bf	6.06	Concrete & Deck:	Shear Studs:		n	11.76		
tf	0.425	conc. strength - fc' (psi)	4000	stud dia. (in)	3/4"	beflec.	121.50	
tw	0.3	conc. wt. - wc (pcf)	115	stud ht. (in)	5 3/4	Actr	33.584	
CASTELLATION PARAMETERS:		conc. above deck - tc (in)	3 1/4	studs per rib	1	N.A. ht.	28.23	
Non-Standard e	7.100	rib height - hr (in)	3	composite %	100%	ltr	4288.71	
Beam-Label b	5.750	rib width - wr (in)	6	Stud Spacing:		leffec.	4288.71	
NS on Plans dt	4.250			N=40 Uniformly Dist.		Sxconc	811.92	
S	25.700			WARNINGS		Sxsteel	151.93	
dg	27.260	RESULTS		Failure Mode	Interaction	Status		
phi	58.485	Bending	0.936	<= 1.0 OK!!				
ho	18.760	Web Post	0.998	<= 1.0 OK!!				
wo	18.600	Shear	0.985	<= 1.0 OK!!				
		Concrete	0.273	<= 1.0 OK!!				
		Pre-Comp.	0.694	<= 1.0 OK!!				
		Overall	0.998	<= 1.0 OK!!				
		Pre-Composite Deflec.	1.078"	=L/451				
		Live Load Deflection	0.504"	=L/964				
		CONSTRUCTION BRIDGING		End Connection type	Double clip			
				Min. No. Of Bridging Rows	1			
				Max. Bridging Spacing (ft)	37			



3/24/2008

APPENDIX C

Hand calculations comparing existing floor framing weight with proposed castellated beam framing weight.

ALT FLOOR # 4: BEAMS ONLY

TYP/FUTURE = (12) 24x55, (2) 21x50
 MECH = (12) 24x55, (2) 21x50
 ROOF = (12) 24x55, (2) 21x50

REG: $(7)(12)(55)(40.5) = 187110$
 $+ (7)(2)(50)(40.5) = 28350$
215460^{lbs}

CAST BEAMS: BEAMS ONLY (405)

TYP/FUTURE = (14) CB 27 x 35/46
 MECH = (14) CB 36 x 62
 ROOF = (14) CB 24 x 31

NEW: $(5)(14)(40.5)(40.5) = 114317$
 $+ (1)(14)(62)(40.5) = 35154$
 $+ (1)(14)(31)(40.5) = 17577$
167548

ALT FLOOR:
 W = 615958

ORIGINAL FLOOR:
 W = 565174

$615958^{lb} - 215460^{lb} + 167548^{lb}$
 $= 568046 \geq 565174$

NO GOOD

NEED CAST. BEAMS
 $\leq 59 \text{ pif}$

OR

REPLACE HEAVIER
 CAVITY FRAMING MEMBERS
 (GIRDERS) W/ CASTELLATED
BEAMS

ALT #4 w/ SELECT BEAMS/GIRDERS AS CASTELLATED BEAMS

EXISTING ALT #4: TYP FLOOR - (12) 24x55 x 40.5' x 5 stays = 133650
 (2) 21x50 x 40.5 x 5 = 20250
 (2) 21x44 x 22.6' x 5 = 9944
 (2) 24x68 x 32' x 5 = 21760

MECH - (12) 24x55 x 40.5' = 26730
 (2) 21x50 x 40.5' = 4050
 (2) 30x99 x 32' = 6336
 (2) 24x62 x 22.6' = 2802

ROOF - (12) 24x55 x 40.5 = 26730
 (2) 21x50 x 40.5 = 4050
 (2) 18x40 x 22.6 = 1808
 (2) 24x68 x 32' = 4352

262462¹⁶

CAST BEAM REPLACEMENTS

TYP FLOOR - (14) CB 27 x 35/46 x 40.5' x 5 stays = 114817
 (2) CB 27 x 40 x 22.6' x 5 = 9040
 (2) CB 30 x 59/57 x 32' x 5 = 17120

MECH - (14) CB 36 x 62 x 40.5' = 35154
 (2) CB 30 x 50 x 22.6' = 2260
 (2) CB 30 x 93 x 32' = 5962

ROOF - (14) CB 24 x 31 x 40.5' = 17577
 (2) CB 30 x 40 x 32' = 2560
 (2) CB 24 x 31 x 22.6' = 1401

205881

ALT FLOOR #4

W = 615958¹⁵

ORIGINAL FLOOR

W = 565174¹⁵

615958 - 262462 + 205881 = 559,377¹⁵ ≤ 565174¹⁵

✓OK

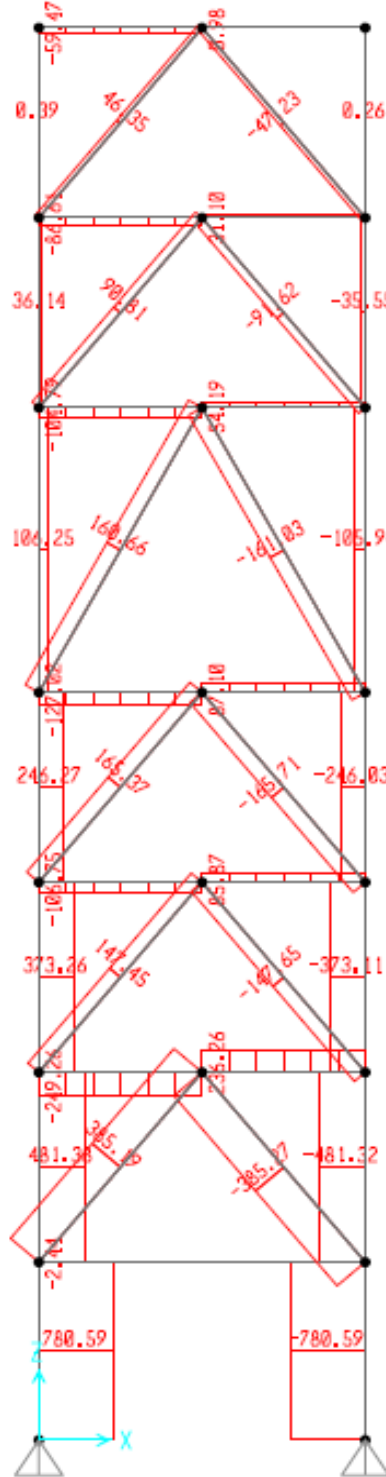
APPENDIX D

R.S. Means Structural Steel Framing Cost Sheet.

05 12 Structural Steel Framing									
05 12 23 – Structural Steel for Buildings									
05 12 23.77 Structural Steel Projects									
	Crew	Daily Output	Labor Hours	Unit	Material	2008 Bare Costs Labor	2008 Bare Costs Equipment	Total	Total Ind O&P
3000		Maximum	E-6 5.50 23.273	Ton	3,300	985	340	4,625	5,725
3040		Safety steel, minimum	2.50 51.200		3,200	2,175	745	6,120	8,150
3070		Maximum	1.50 85.333		4,225	3,625	1,250	9,100	12,400
3100		Roof trusses, minimum	E-5 13 6.154		3,075	261	131	3,467	4,000
3200		Maximum	8.30 9.639		3,750	410	205	4,365	5,075
3210		Schools, minimum	14.50 5.517		2,200	234	117	2,551	2,975
3220		Maximum	8.30 9.639		3,200	410	205	3,815	4,475
3400		Welded construction, simple commercial bldgs., 1 to 2 stories	E-7 7.60 10.526		2,250	445	241	2,936	3,525
3500		7 to 15 stories	E-9 8.30 15.422		2,600	655	268	3,523	4,300
3700		Welded rigid frame, 1 story, minimum	E-7 15.80 5.063		2,300	215	116	2,631	3,025
3800		Maximum	** 5.50 14.545		2,975	615	335	3,925	4,725
3810		Fabrication shop costs (included in project material cost, above)							
3820		Mini mill base price, A992		Ton	725			725	800
3830		Mill extra for delivery to shop			220			220	242
3840		Shop extra for shop drawings and detailing			240			240	264
3850		Shop fabricating and handling			800			800	880
3860		Shop sandblasting and primer coat of paint			125			125	138
3870		Shop delivery to the job site			90			90	99
3880		Total material cost, shop fabricated, primed, delivered			2,200			2,200	2,425
3900		High strength steel mill spec extras: A242, A441,							
3950		A529, A572 (42 ksi) and A992: same as A36 steel		Ton	100			100	110
4000		Add to A992 price for A572 (50, 60, 65 ksi)		"	92.50			92.50	102
4100		A588 Weathering							
4200		Mill size extras for W-Shapes: 0 to 30 pft: no extra charge							
4210		Member sizes 31 to 65 pft, add		Ton	.10			.10	.11
4220		Member sizes 66 to 100 pft, add			.10			.10	.11
4230		Member sizes 101 to 387 pft, add			56			56	61.50
4300		Column base plates, light, up to 150 lb	2 Sswk 2000 .008	Lb.	1.21	.34		1.55	1.95
4400		Heavy, over 150 lb	E-2 7500 .007	"	1.27	.31	.21	1.79	2.16
4600		Castellated beams, light sections, to 50#/L.F., minimum		Ton	2,300	219	146	2,665	3,100
4700		Maximum	7 8		2,525	335	224	3,084	3,600
4900		Heavy sections, over 50# per L.F., minimum	11.70 4.786		2,425	200	134	2,759	3,150
5000		Maximum	7.80 7.179		2,650	300	201	3,151	3,650
5390		For projects 75 to 99 tons, add				10%			
5392		50 to 74 tons, add				20%			
5394		25 to 49 tons, add				30%	10%		
5396		10 to 24 tons, add				50%	25%		
5398		2 to 9 tons, add				75%	50%		
5399		Less than 2 tons, add				100%	100%		
05 12 23.80 Subpurlins									
0010	SUBPURLINS R051223-50								
0020	Bull tees, shop fabricated, pointed, 32-5/8" O.C., 40 pft L.L.								
0100		Type 178, max 8'-9" span, 2.15 pft, 2" high x 1-5/8" wide	E-1 4200 .006	S.F.	1.53	.24	.03	1.80	2.12
0200		Type 218, max 10'-2" span, 3.19 pft, 2-1/8" high x 2-1/8" wide	" 3100 .008		1.77	.32	.04	2.13	2.54
1420		For 24-5/8" spacing, add			33%	33%			
1430		For 48-5/8" spacing, deduct			50%	50%			

APPENDIX E

Preliminary SAP analysis of typical braced frame showing the axial forces in each member.



APPENDIX F

Braced Frame - Pinned Bases								
Frame 1/8								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff
Column	W14x120	13.33	7	2	49.1	0.8	0.0	50
				4	44.1	4.8	0.4	52
Column	W14x120	13.33	7	2	20.3	0.8	0.0	22
				4	18.3	4.8	0.4	27
Column	W14x120	13.33	6	5	35.6	12.6	0.6	57
				6	84.8	8.4	0.7	99
Column	W14x120	13.33	6	5	107.8	12.6	0.7	129
Column	W14x120	20	5	5	27.3	16.3	1.4	55
				6	149.5	8.4	0.6	164
Column	W14x120	20	5	5	188.3	16.2	1.4	216
Column	W14x120	13.33	4	5	338.0	16.2	1.4	366
Column	W14x120	13.33	4	5	1.0	16.3	1.4	29
				6	246.6	4.5	0.0	254
Column	W14x120	13.33	3	5	447.7	18.0	1.5	479
Column	W14x120	13.33	3	5	38.0	19.0	1.6	71
				6	338.8	4.0	0.0	346
Column	W14x120	13.33	2	4	52.3	25.7	2.0	96
				5	577.0	18.0	0.3	608
Column	W14x120	13.33	2	4	434.0	29.6	2.4	485
Column	W14x120	12.5	1	5	722.6	86.2	7.4	870
Column	W14x120	12.5	1	4	553.9	67.1	5.8	669
				5	-173.0	82.5	7.1	-32
					Max P	Max M	Max V	Max Peff
					722.6	86.2	7.4	870
@ 13.3'	ØXn				1390.0	795.0		1390.0

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W10x12	13.25	8	2	1.9	1.5
Beam	W10x12	13.25	7	2	3.4	2.6
Beam	W10x12	13.25	6	2	4.5	2.7
Beam	W10x12	13.25	5	2	6.3	33.0
Beam	W10x12	13.25	4	2	5.2	2.8
Beam	W10x12	13.25	3	2	5.7	2.9
Beam	W21x68	13.25	2	5	94.9	18.5
					Max M	Max V
					94.9	33.0
W10x12	ØMr				46.9	56.3
W21x68	ØMr				600.0	273

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Tens) Max P (k)
1	HSS6x6x3/8	14.9	7	6	47.9	9	12.5
2	HSS6x6x3/8	14.9	7	9	14.1	6	-45.3
1	HSS6x6x3/8	14.9	6	6	51.6	9	-33.6
2	HSS6x6x3/8	14.9	6	9	35.2	6	-47.7
1	HSS6x6x3/8	21	5	6	67.7	5	-62.6
2	HSS6x6x3/8	21	5	5	66.5	6	-63.8
1	HSS6x6x3/8	14.9	4	4	85.8	5	-62.0
2	HSS6x6x3/8	14.9	4	5	67.9	4	-79.9
1	HSS6x6x3/8	14.9	3	4	96.7	5	-87.0
2	HSS6x6x3/8	14.9	3	5	91.3	4	-92.4
1	HSS6x6x3/8	14.9	2	4	105.7	5	-87.1
2	HSS6x6x3/8	14.9	2	5	91.5	4	-101.2
					Max Comp	Max Ten	-101.2
for HSS6x6x3/8			@15'	ØPn =	206.0	ØPn =	-248.0
for HSS6x6x3/8			@21'	ØPn =	138.0	ØPn =	-248.0

Braced Frame - Pinned Bases								
Frame 2								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff
Column	W14x120	13.33	7	2	28.8	0.1	0	29
				5	26.4	7.7	0.6	40
Column	W14x120	13.33	7	2	46.5	0.05	0	47
				5	41.7	7.7	0.6	55
Column	W14x120	13.33	6	2	98.2	0.1	0	98
				5	47.8	11.3	0.3	67
Column	W14x120	13.33	6	5	137.2	11.3	0.3	157
Column	W14x120	20	5	2	167.3	0.1	0	167
				5	23.5	18	1.5	54
Column	W14x120	20	5	5	275.7	18.3	1.5	307
Column	W14x120	13.33	4	2	268.2	0.9	0.1	270
				3	-84	18	1.9	-53
Column	W14x120	13.33	4	5	553	18.3	2	584
Column	W14x120	13.33	3	2	355.2	3.2	0.3	361
				5	-186.6	31.4	3	-133
Column	W14x120	13.33	3	5	795.1	35.2	3.3	855
Column	W14x120	13.33	2	2	411.2	13.3	1.3	434
				5	-282.1	31.4	1.8	-228
Column	W14x120	13.33	2	5	997.3	35.1	3.6	1057
Column	W14x120	12.5	1	2	458.6	12.5	1.1	480
				5	-450.7	142.9	12.3	-206
Column	W14x120	12.5	1	5	1260.1	126.4	10.9	1477
					Max P	Max M	Max V	Max Peff
					1260.1	142.9	12.3	1477
W14x120	@ 13.3'	∅Xn			1390.0	795.0		1390.0
W14x120	@12.5	∅Xn			1415		+/-5%	1415
W14x132	@12.5	∅Xn			1555			1555

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W16x26	18	8	2	2.34	39.6
Beam	W16x31	18	7	2	5.9	60.1
Beam	W16x31	18	6	2	13.5	60.9
Beam	W18x35	18	5	2	18.6	97.1
Beam	W16x31	18	4	2	14.2	61
Beam	W16x31	18	3	2	20	61.7
Beam	W21x68	18	2	5	154.9	72.2
					Max M	Max V
					154.9	97.1
W16x31	∅Mr				203.0	131
W21x68	∅Mr				600.0	273

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Tens) Max P (k)
1	HSS6x6x3/8	16	7	2	39.9	9	-28.9
2	HSS6x6x3/8	16	7	9	55	-	-
1	HSS6x6x3/8	16	6	2	57.7	9	-84
2	HSS6x6x3/8	16	6	5	118.4	-	-
1	HSS8x6x5/8	22	5	2	55.4	9	-185.1
2	HSS8x6x5/8	22	5	5	220	8	-0.5
1	HSS8x6x1/2	16	4	2	77	9	-191.6
2	HSS8x6x1/2	16	4	5	240	-	-
1	HSS6x6x3/8	16	3	2	48.6	9	-162.2
2	HSS6x6x3/8	16	3	5	201.3	-	-
1	HSS8x6x1/2	16	2	2	47.7	9	-222.1
2	HSS8x6x1/2	16	2	5	264.2	-	-
1	W10x88	15.5	1	2	53.7	9	-698.4
2	W10x88	15.5	1	5	756.9	-	-
					Max Comp	Max Ten	-222.1
	for HSS6x6x3/8	@16'	∅Pn =	195	∅Pn =	-248	
	for HSS6x6x1/2	@16'	∅Pn =	244	∅Pn =	-318	
	for HSS8x6x1/2	@16'	∅Pn =	303	∅Pn =	-378	
	for HSS8x6x5/8	@22'	∅Pn =	234.0	∅Pn =	-457.0	
	for W10x88	@15.5'	∅Pn =	808	∅Pn =	-946	

Braced Frame - Pinned Bases								
Frame 3/6								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff
Column	W14x120	13.33	7	2	39.5	0.1	0	40
				4	35.9	7.8	0.6	49
Column	W14x120	13.33	7	2	51.8	0.1	0	52
				4	46.5	7.8	0.6	60
Column	W14x120	13.33	6	2	111.6	0.9	0.1	113
				5	92	8.4	0.73	106
Column	W14x120	13.33	6	6	142.7	8.5	0.7	157
Column	W14x120	20	5	2	176.2	0.9	0.1	178
				4	93	8.4	0.6	107
Column	W14x120	20	5	6	241.4	8.5	0.6	256
Column	W14x120	13.33	4	2	291.4	0.9	0.1	293
				5	242.9	5	0.2	251
Column	W14x120	13.33	4	6	460.2	4.7	0.1	468
Column	W14x120	13.33	3	2	361	3.1	0.2	366
				10	-177	10.7	0.7	-159
Column	W14x120	13.33	3	6	621.6	13.5	0.8	645
Column	W14x120	13.33	2	2	416.1	11.9	1.2	437
				4	-81	40.4	3	-12
Column	W14x120	13.33	2	6	796.2	18.4	0.4	828
				8	605	24.8	1.5	648
Column	W14x120	12.5	1	2	461.3	12.4	1.1	483
				4	-206	95	8.2	-43
Column	W14x120	12.5	1	4	991.3	79.5	6.8	1128
					Max P	Max M	Max V	Max Peff
					991.3	95.0	8.2	1128
@ 13.3'	ØXn				1390.0	795.0		1390.0

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W12x19	18	8	2	15.2	8.8
Beam	W12x19	18	7	2	25.6	14.4
Beam	W12x19	18	6	2	28.3	14.7
Beam	W12x19	18	5	2	40.2	21.8
Beam	W12x19	18	4	2	29.2	14.8
Beam	W12x19	18	3	2	30.2	14.9
Beam	W21x68	18	2	2	138.5	33.1
					Max M	Max V
					138.5	33.1
W12x19	ØMr				92.6	85.7
W21x68	ØMr				600.0	273

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Tens) Max P (k)
1	HSS8x6x3/8	16	7	2	24.8	10	-41.5
2	HSS8x6x3/8	16	7	10	52.8	2	-3.6
1	HSS8x6x3/8	16	6	2	31.2	10	-49.2
2	HSS8x6x3/8	16	6	10	60.5	-	-
1	HSS8x6x3/8	22	5	5	41.8	10	-129.3
2	HSS8x6x3/8	22	5	6	141	5	-16.3
1	HSS8x6x3/8	16	4	2	38.1	8	-119.5
2	HSS8x6x3/8	16	4	4	138.8	-	-
1	HSS8x6x3/8	16	3	2	25.3	8	-156.7
2	HSS8x6x3/8	16	3	4	173.1	-	-
1	HSS8x6x3/8	16	2	2	22.8	8	-177.3
2	HSS8x6x3/8	16	2	4	195.1	-	-
1	HSS10x6x5/8	15.5	1	2	31.1	8	-400.2
2	HSS10x6x5/8	15.5	1	4	434.7	-	-
					Max Comp	Max Ten	-400.2
HSS8x6x3/8	@ 16'	ØPn =			239.0	ØPn =	-293.0
HSS8x6x5/8	@ 22'	ØPn =			234.0	ØPn =	-457.0
HSS10x6x5/8	@ 15.5'	ØPn =			443	ØPn =	-535

Braced Frame - Pinned Bases								
Frame 4/5								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff
Column	W14x120	13.33	7	2	11.5	0.1	0	12
				4	10.5	4.8	0.4	19
Column	W14x120	13.33	7	2	65.83	0.1	0	66
				4	59	4.8	0.4	67
Column	W14x120	13.33	6	5	93	12.6	0.7	115
Column	W14x120	13.33	6	5	69.6	12.6	0.6	91
				6	118.8	8.4	0.7	133
Column	W14x120	20	5	5	191	16.1	1.4	219
Column	W14x120	20	5	5	59.2	16.2	1.4	87
				6	181.3	8.5	0.6	196
Column	W14x120	13.33	4	5	316.4	16.3	1.4	344
Column	W14x120	13.33	4	5	78.2	16.2	1.4	106
				6	323.9	4.4	0.1	331
Column	W14x120	13.33	3	5	425.9	15.8	1.3	453
Column	W14x120	13.33	3	5	52	18	1.6	83
				6	428.5	4.8	0.1	437
Column	W14x120	13.33	2	5	545.8	22.5	1.6	584
Column	W14x120	13.33	2	6	543.2	23.9	1.5	584
Column	W14x120	12.5	1	5	674.9	94.4	8.1	837
Column	W14x120	12.5	1	4	693	63.3	5.5	802
					Max P	Max M	Max V	Max Peff
					693.0	94.4	8.1	837
@ 13.3'	ØXn				1390.0	795.0		1390.0

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W10x12	13.25	8	2	4	3.2
Beam	W10x12	13.25	7	2	6.9	5.3
Beam	W10x12	13.25	6	2	8.2	5.5
Beam	W10x12	13.25	5	2	11.3	8.1
Beam	W10x12	13.25	4	2	9	5.6
Beam	W10x12	13.25	3	2	9.6	5.7
Beam	W21x68	13.25	2	5	112.3	24
					Max M	Max V
					112.3	24.0
W10x12	ØMr				46.9	56.3
W21x68	ØMr				600.0	273

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Tens) Max P (k)
1	HSS6x6x3/8	14.9	7	-	-	5	-70.4
2	HSS6x6x3/8	14.9	7	5	76.4	-	-
1	HSS6x6x3/8	14.9	6	8	11.8	5	-87.7
2	HSS6x6x3/8	14.9	6	5	96.4	8	-8.2
1	HSS6x6x3/8	21	5	8	39.5	5	-104.9
2	HSS6x6x3/8	21	5	5	113.5	8	-35.9
1	HSS6x6x3/8	14.9	4	8	58.5	5	-103.1
2	HSS6x6x3/8	14.9	4	5	115.4	8	-54.7
1	HSS6x6x3/8	14.9	3	8	76.2	5	-117.6
2	HSS6x6x3/8	14.9	3	5	126.8	8	-72.4
1	HSS6x6x3/8	14.9	2	8	94.3	5	-103.1
2	HSS6x6x3/8	14.9	2	5	112.5	8	-90.4
					Max Comp	Max Ten	-117.6
	for HSS6x6x3/8	@ 15'	ØPn =		206.0	ØPn =	-248.0
	for HSS6x6x3/8	@ 21'	ØPn =		138.0	ØPn =	-248.0

Braced Frame - Pinned Bases								
Frame 9/10								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff
Column	W14x120	13.33	7	2	28.9	0.1	0	29
				5	26.5	6.4	0.5	37
Column	W14x120	13.33	7	2	84.1	0.2	0	84
				5	75.5	6.5	0.5	87
Column	W14x120	13.33	6	2	126.5	0.7	0.1	128
				5	74.8	6.4	0.4	86
Column	W14x120	13.33	6	5	186.7	6.5	0.2	198
Column	W14x120	20	5	2	216.2	1	0.1	218
				5	95	10.6	0.7	113
Column	W14x120	20	5	5	318.4	9.8	0.7	335
Column	W14x120	13.33	4	2	351.3	2.5	0.3	356
				5	69.7	10.6	1.5	88
Column	W14x120	13.33	4	5	586.2	9.8	1.1	603
Column	W14x120	13.33	3	2	458.8	12.6	1.1	480
				5	57.7	35.4	3.4	118
Column	W14x120	13.33	3	5	780.9	16.4	1.6	809
Column	W14x120	13.33	2	2	529.2	49.4	5	614
				5	5	36.2	5.7	67
Column	W14x120	13.33	2	5	982.3	39.7	1.9	1050
				6	875.9	55.3	4.3	971
Column	W14x120	12.5	1	2	624	47.5	4.1	705
				9	-438	76.9	6.6	-306
Column	W14x120	12.5	1	5	1236.1	119.7	10.3	1441
					Max P	Max M	Max V	Max Peff
					1236.1	119.7	10.3	1441
W14x120	@ 13.3'	∅Xn			1390.0	795.0		1390.0
W14x120	@12.5	∅Xn			1415		+/-5%	1415
W14x132	@12.5	∅Xn			1555			1555

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W16x31	17.9	8	2	5.2	44.4
Beam	W18x35	17.9	7	2	8.9	65.5
Beam	W18x35	17.9	6	2	25.2	67.3
Beam	W18x35	17.9	5	2	27.7	108
Beam	W18x35	17.9	4	2	27.6	67.7
Beam	W18x35	17.9	3	2	35.8	68.6
Beam	W21x68	17.9	2	5	166.3	36.8
					Max M	Max V
					166.3	108.0
W18x35	∅Mr				249.0	159.0
W21x68	∅Mr				600.0	273

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Tens) Max P (k)
1	HSS6x6x3/8	16	7	2	77.1	9	-20.1
2	HSS6x6x3/8	16	7	9	49.6	2	-22.8
1	HSS6x6x3/8	16	6	2	90.2	9	-50.2
2	HSS6x6x3/8	16	6	9	80	2	-2.4
1	HSS8x6x1/2	22	5	2	99.1	9	-143.5
2	HSS8x6x1/2	22	5	9	172.2	2	-14.9
1	HSS6x6x3/8	16	4	2	106.1	9	-123.6
2	HSS6x6x3/8	16	4	9	154.8	-	-
1	HSS6x6x3/8	16	3	2	71.3	9	-147.1
2	HSS6x6x3/8	16	3	9	178.5	-	-
1	HSS6x6x1/2	16	2	2	64.5	9	-171
2	HSS6x6x1/2	16	2	5	203.3	-	-
					Max Comp	Max Ten	
					203.3	-171.0	
	for HSS6x6x3/8	@16'	∅Pn =		195	∅Pn =	-248
	for HSS6x6x1/2	@16'	∅Pn =		244	∅Pn =	-318
	for HSS8x6x1/2	@22'	∅Pn =		201	∅Pn =	-378

APPENDIX G

Story Displacements for Final Braced Frame Design (as calculated by RAM Structural System)



RAM Frame v11.2
 DataBase: Braced Frame - Pinned Bases -
 Building Code: IBC

Story Displacements

CRITERIA:

Rigid End Zones: Ignore Effects
 Member Force Output: At Face of Joint
 P-Delta: No
 Ground Level: Base
 Wall Mesh Criteria :
 Wall Element Type : Shell Element with No Out-of-Plane Stiffness
 Max. Allowed Distance between Nodes (ft) : 8.00

LOAD CASE DEFINITIONS:

D	DeadLoad	RAMUSER
Lp	PosLiveLoad	RAMUSER
E1	Seismic E-W	EQ_User
E2	Seismic N-S	EQ_User
W1	Wind E-W	W_User
W2	Wind N-S	W_User

LOAD COMBINATIONS: User Specified

11	*	1.0D + 1.0W1 + 1.0Lp
12	*	1.0D + 1.0W2 + 1.0Lp
13	*	1.0D + 1.0E1 + 1.0Lp
14	*	1.0D + 1.0E2 + 1.0Lp
15	*	1.0D + 1.0W1
16	*	1.0D + 1.0W2
17	*	1.0D + 1.0E1 + .3E2
18	*	1.0D + 1.0E2 + .3E1

* = Load combination currently selected to use

Level: 8th future roof, Diaph: 1

Center of Mass (ft): (-16.35, 94.19)

LdC	Disp X in	Disp Y in	Theta Z rad
11	1.45133	0.03323	0.00004
12	0.04982	2.16015	0.00007
13	4.66293	0.10974	0.00003
14	0.10957	4.73251	0.00016
15	1.45164	0.03289	0.00001
16	0.05013	2.15981	0.00004
17	4.69603	1.52909	0.00003
18	1.50867	4.76503	0.00012

Level: 7th future, Diaph: 1

Center of Mass (ft): (-16.28, 94.17)

LdC	Disp X	Disp Y	Theta Z
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RAM Frame v11.2
 DataBase: Braced Frame - Pinned Bases -
 Building Code: IBC

Story Displacements

	in	in	rad
11	1.28476	0.02863	0.00003
12	0.04300	1.91519	0.00005
13	4.02553	0.08991	0.00002
14	0.09010	4.09889	0.00014
15	1.28513	0.02835	0.00000
16	0.04337	1.91490	0.00003
17	4.05294	1.31923	0.00002
18	1.29814	4.12552	0.00010

Level: 6th future, Diaph: 1

Center of Mass (ft): (-16.28, 94.17)

LdC	Disp X in	Disp Y in	Theta Z rad
11	1.09806	0.02330	0.00002
12	0.03580	1.63596	0.00004
13	3.32770	0.06826	0.00000
14	0.06940	3.39355	0.00011
15	1.09807	0.02307	-0.00000
16	0.03581	1.63573	0.00002
17	3.34840	1.08604	0.00000
18	1.06759	3.41374	0.00008

Level: 5th Floor, Diaph: 1

Center of Mass (ft): (-16.28, 94.17)

LdC	Disp X in	Disp Y in	Theta Z rad
11	0.77669	0.02293	-0.00001
12	0.03430	1.12325	0.00002
13	2.19976	0.06743	-0.00003
14	0.06669	2.17443	0.00006
15	0.77682	0.02285	-0.00002
16	0.03443	1.12317	0.00001
17	2.21989	0.71968	-0.00003
18	0.72674	2.19457	0.00004

Level: 4rd Floor, Diaph: 1

Center of Mass (ft): (-16.30, 94.17)

LdC	Disp X in	Disp Y in	Theta Z rad
11	0.57189	0.01507	-0.00002
12	0.02283	0.79545	0.00001
13	1.52912	0.04216	-0.00005
14	0.04164	1.45170	0.00004
15	0.57184	0.01502	-0.00002



Story Displacements

RAM Frame v11.2
 DataBase: Braced Frame - Pinned Bases -
 Building Code: IBC

16	0.02278	0.79540	0.00000
17	1.54150	0.47762	-0.00004
18	0.50026	1.46430	0.00002

Level: 3rd Floor, Diaph: 1

Center of Mass (ft): (-16.30, 94.17)

LdC	Disp X in	Disp Y in	Theta Z rad
11	0.35858	0.00524	-0.00002
12	0.00828	0.47869	0.00000
13	0.88857	0.01308	-0.00005
14	0.01284	0.80988	0.00002
15	0.35857	0.00522	-0.00003
16	0.00827	0.47867	0.00000
17	0.89239	0.25602	-0.00005
18	0.27938	0.81378	0.00000

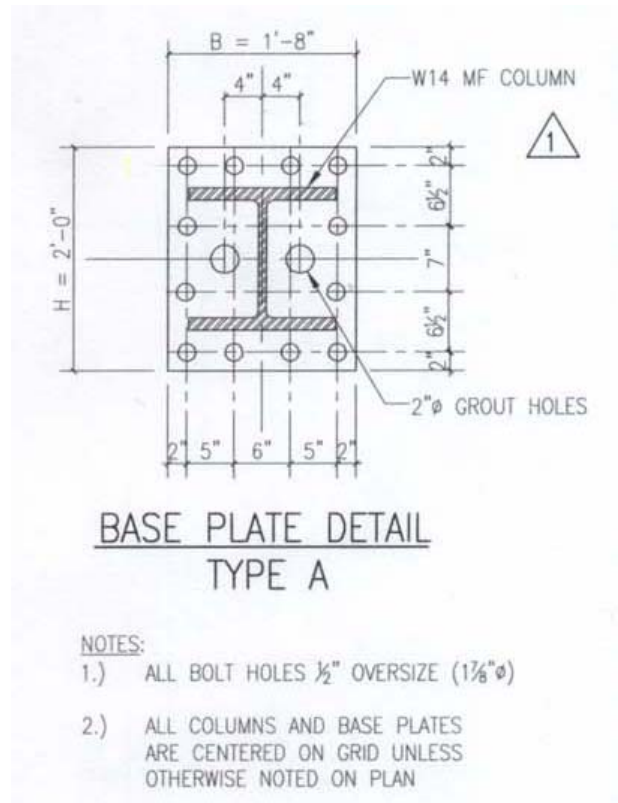
Level: 2nd Floor, Diaph: 1

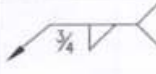
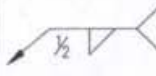
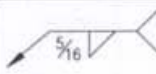
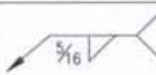
Center of Mass (ft): (-16.26, 94.17)

LdC	Disp X in	Disp Y in	Theta Z rad
11	0.18977	0.00131	-0.00003
12	0.00213	0.21059	-0.00000
13	0.43024	0.00253	-0.00006
14	0.00186	0.32144	0.00001
15	0.18980	0.00131	-0.00003
16	0.00216	0.21059	-0.00000
17	0.43084	0.09896	-0.00006
18	0.13097	0.32220	-0.00001

APPENDIX H

Structural details of lateral column base plate connection



TYPE	ANCHOR ROD		ROD MATERIAL	NUT MATERIAL	WELD	GROUT	NOTES
	DIAMETER	L					
A	1 1/4"φ	2'-0"	*	A563 GRADE A		1 1/2" MIN.	-
B	1 1/4"φ	2'-0"	*	A563 GRADE A		1 1/2" MIN.	-
C	1 1/4"φ	1'-0"	*	A563 GRADE A		1 1/2" MIN.	-
D	1 1/4"φ	1'-0"	*	A563 GRADE A		1 1/2" MIN.	-

APPENDIX I

Braced Frame - Fixed Bases								
Frame 1/8								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff (k)
Column	W14x120	13.33	7	2	49.1	0.3	0.0	50
				6	44.1	2.5	0.2	48
Column	W14x120	13.33	7	2	20.3	0.3	0.0	21
				6	18.3	2.5	0.2	23
Column	W14x120	13.33	6	6	94.5	40.6	2.9	164
Column	W14x120	13.33	6	5	117.7	40.5	2.9	187
Column	W14x120	20	5	6	195.0	43.5	4.2	270
Column	W14x120	20	5	5	217.3	43.5	4.2	292
Column	W14x120	13.33	4	5	302.7	43.5	3.8	377
Column	W14x120	13.33	4	5	35.6	43.5	3.8	110
				6	229.2	40.0	3.0	298
Column	W14x176	13.33	3	5	433.3	15.5	1.7	460
Column	W14x176	13.33	3	5	-22.5	16.4	1.8	6
				6	355.5	7.0	0.6	368
Column	W14x176	13.33	2	5	570.5	35.7	1.7	632
				6	8.2	41.2	2.7	79
Column	W14x176	13.33	2	6	472.8	44.6	3.1	549
Column	W14x176	12.5	1	5	754.3	374.5	52.0	1396
Column	W14x176	12.5	1	4	555.5	377.7	53.6	1203
				6	634.6	353.9	49.6	1241
					Max P	Max M	Max V	Max Peff
					754.3	377.7	53.6	1396
W14x120	@ 13.3'	∅Xn			1390.0	795.0		1390.0
W14x176	@ 12.5'	∅Xn			2105			2105

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W10x12	13.25	8	2	1.9	1.6
Beam	W10x12	13.25	7	2	3.4	2.6
Beam	W10x12	13.25	6	2	-	4.1
Beam	W10x12	13.25	5	2	6.3	33.0
Beam	W10x12	13.25	4	2	4.4	2.7
Beam	W10x12	13.25	3	2	4.7	2.8
Beam	W27x146	13.25	2	4	303.0	53.0
					Max M	Max V
					303.0	53.0
W10x12	∅Mr				46.9	56.0
W27x146	∅Mr				1740.0	497.0

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Ten) Max P- (k)
1	HSS6x6x3/8	14.9	7	6	58.7	9	-20.6
2	HSS6x6x3/8	14.9	7	9	22.1	6	-56.1
1	HSS6x6x3/8	14.9	6	6	90.0	5	-49.4
2	HSS6x6x3/8	14.9	6	5	53.2	6	-86.2
1	HSS6x6x3/8	14.9	4	6	120.8	5	-84.6
2	HSS6x6x3/8	14.9	4	5	90.5	6	-114.9
1	HSS6x6x3/8	14.9	3	6	111.2	5	-95.2
2	HSS6x6x3/8	14.9	3	5	99.2	6	-107.2
1	HSS6x6x3/8	14.9	2	6	105.5	5	-93.7
2	HSS6x6x3/8	14.9	2	5	97.8	4	-101.3
					Max Comp	Max Ten	
					120.8	-114.9	
					∅Pn = 206.0	∅Pn =	-248.0

Braced Frame - Fixed Bases								
Frame 2/7								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff (k)
Column	W14x120	13.33	7	2	28.8	0.1	0	29
				5	26.4	2.6	0.2	31
Column	W14x120	13.33	7	2	46.5	0.1	0	47
				5	41.7	2.6	0.2	46
Column	W14x120	13.33	6	2	97.6	0.4	0	98
				5	72.4	58	4.1	172
Column	W14x120	13.33	6	5	114	57.8	4.1	213
Column	W14x120	20	5	2	166.2	0.4	0	167
				5	67.4	65	6.1	179
Column	W14x120	20	5	5	231.8	64.6	6.1	343
Column	W14x120	13.33	4	2	268.2	1	0.1	270
				5	-171	65	6.1	-60
Column	W14x120	13.33	4	5	640.2	64.5	5.8	751
Column	W14x176	13.33	3	2	354.9	7.4	0.6	368
				5	-251.8	27.8	3.3	-204
Column	W14x176	13.33	3	5	861.5	16.3	2.2	889
				9	703.6	19.3	2.6	737
Column	W14x176	13.33	2	2	410.8	29	3	461
Column	W14x176	13.33	2	5	1044.3	52.5	3	1134
Column	W14x176	12.5	1	2	491.3	32.2	4.2	547
				9	-698	480	65.9	125
Column	W14x176	12.5	1	5	1356	493.7	69	2202
					Max P	Max M	Max V	Max Peff
					1356.0	493.7	69.0	2202
W14x120	@ 13.3'	ØXn			1390.0	795.0		1390
W14x145	@ 12.5'	ØXn			1730			1730
W14x176	@ 12.5'	ØXn			2105		+/-5%	2105
W14x193	@ 12.5'	ØXn			2310			2310

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W16x26	18	8	2	2.34	39.6
Beam	W16x31	18	7	2	5.9	60.1
Beam	W16x31	18	6	2	13.5	60.9
Beam	W18x35	18	5	2	18.6	97.1
Beam	W16x31	18	4	2	11.8	60.7
Beam	W16x31	18	3	2	17.1	61.3
Beam	W27x146	18	2	5	401.6	97.1
					Max M	Max V
					401.6	97.1
W16x31	ØMr				203.0	131
W27x146	ØMr				1740.0	497

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Ten) Max P- (k)
1	HSS6x6x3/8	16	7	2	39.2	-	-
2	HSS6x6x3/8	16	7	5	25.1	-	-
1	HSS6x6x3/8	16	6	2	56.9	9	-60.6
2	HSS6x6x3/8	16	6	5	95.1	-	-
1	HSS12x6x5/8	22	5	2	56.7	9	-333.5
2	HSS12x6x5/8	22	5	5	363.9	-	-
1	HSS8x6x1/2	16	4	2	75.5	9	-164.3
2	HSS8x6x1/2	16	4	5	214.3	-	-
1	HSS6x6x3/8	16	3	2	47.4	9	-138
2	HSS6x6x3/8	16	3	5	177.3	-	-
1	HSS8x6x1/2	16	2	2	46.7	9	-218.3
2	HSS8x6x1/2	16	2	5	258.2	-	-
					Max Comp	Max Ten	-333.5
	for HSS6x6x3/8			ØPn =	195	ØPn =	-248
	for HSS8x6x1/2			ØPn =	303	ØPn =	-378
	for HSS12x6x5/8			ØPn =	340.0	ØPn =	-609.0

Braced Frame - Fixed Bases								
Frame 3/6								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff (k)
Column	W14x120	13.33	7	2	39.5	0.1	0	40
				10	22.4	4.7	0.3	30
Column	W14x120	13.33	7	2	51.8	0.1	0	52
				10	28.2	4.7	0.3	36
Column	W14x120	13.33	6	2	112.6	2.8	0.2	117
				10	30.4	55	3.8	125
Column	W14x120	13.33	6	6	122.8	56.4	3.9	219
Column	W14x120	20	5	2	177.3	2.9	0.3	182
				6	63.8	57.6	5.7	163
Column	W14x120	20	5	6	241.3	57.3	5.7	340
Column	W14x120	13.33	4	2	281.4	2.8	0.4	286
				6	-175	57.6	4.7	-76
Column	W14x120	13.33	4	6	65.8	57.3	4.6	164
Column	W14x193	13.33	3	2	351.6	3.9	0.4	358
				6	-245	22.4	2.1	-207
Column	W14x193	13.33	3	6	843.4	18.5	1.8	875
Column	W14x193	13.33	2	2	407.9	16.2	1.6	436
				10	-508	26	0.4	-463
Column	W14x193	13.33	2	6	1037	45.7	2.4	1115
Column	W14x193	12.5	1	2	474.1	17.1	2.3	503
				4	-301	584	80.8	700
Column	W14x193	12.5	1	4	1124.7	597.5	84.3	2149
				6	1328.5	560.5	78	2289
					Max P	Max M	Max V	Max Peff
					1328.5	597.5	84.3	2289
	W14x120	@ 13.3'	ØXn		1390.0	795.0		1390
	W14x176	@ 12.5'	ØXn		2105			2105
	W14x193	@ 12.5'	ØXn		2310			2310

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W12x19	18	8	2	15.3	8.8
Beam	W12x19	18	7	2	25.6	14.4
Beam	W12x19	18	6	2	28.3	14.7
Beam	W12x19	18	5	2	40.2	21.8
Beam	W12x19	18	4	2	27.6	14.6
Beam	W12x19	18	3	2	28.6	14.7
Beam	W27x146	18	2	4	460.3	69.9
					Max M	Max V
					460.3	69.9
	W12x19	ØMr			92.6	85.7
	W27x146	ØMr			1740.0	497

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Ten) Max P- (k)
1	HSS8x6x3/8	16	7	2	26.2	10	-17.3
2	HSS8x6x3/8	16	7	10	28.6	2	-5
1	HSS8x6x3/8	16	6	2	31.4	10	-72.7
2	HSS8x6x3/8	16	6	10	84.1	-	-
1	HSS12x6x5/8	22	5	2	22.9	10	-343.2
2	HSS12x6x5/8	22	5	6	357.2	-	-
1	HSS8x6x3/8	16	4	2	37.1	10	-146.6
2	HSS8x6x3/8	16	4	6	166.5	-	-
1	HSS8x6x3/8	16	3	2	25	10	-164.6
2	HSS8x6x3/8	16	3	6	178.1	-	-
1	HSS8x6x3/8	16	2	2	22.8	10	-213.1
2	HSS8x6x3/8	16	2	6	227.6	-	-
					Max Comp	Max Ten	-343.2
	HSS8x6x3/8	@ 16'	ØPn =		239.0	ØPn =	-293.0
	HSS12x6x5/8	@ 22'	ØPn =		340.0	ØPn =	-457.0

Braced Frame - Fixed Bases								
Frame 4/5								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff (k)
Column	W14x120	13.33	7	2	11.5	0.3	0	12
				6	10.5	2.5	0.2	15
Column	W14x120	13.33	7	2	65.83	0.3	0	66
				6	59	2.5	0.2	63
Column	W14x120	13.33	6	5	104.8	40	2.9	173
Column	W14x120	13.33	6	6	126.7	40.5	2.8	196
Column	W14x120	20	5	5	226.5	43.2	4.2	301
Column	W14x120	20	5	5	31	43.5	4.2	106
				6	224.6	40.4	4	294
Column	W14x120	13.33	4	5	245	43.2	3.7	319
Column	W14x120	13.33	4	5	146.6	43.5	3.8	221
				6	340.2	39.7	3	408
Column	W14x176	13.33	3	5	375	12.3	1.4	396
Column	W14x176	13.33	3	5	102.4	14.1	1.6	127
				6	479.8	9.3	0.8	496
Column	W14x176	13.33	2	5	501.5	48.5	3	585
Column	W14x176	13.33	2	5	56	41.6	2.2	127
				6	618.1	35.4	2.1	679
Column	W14x176	12.5	1	5	669.8	381.3	53.8	1323
Column	W14x176	12.5	1	6	808.8	349	48.2	1407
					Max P	Max M	Max V	Max Peff
					808.8	381.3	53.8	1407
W14x120	@ 13.3'			ØXn	1390.0	795.0		1390
W14x176	@ 12.5'			ØXn	2105			2105

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W10x12	13.25	8	2	4	3.2
Beam	W10x12	13.25	7	2	6.9	5.3
Beam	W10x12	13.25	6	2	-	8.6
Beam	W10x12	13.25	5	2	11.3	8.1
Beam	W10x12	13.25	4	2	8	5.5
Beam	W10x12	13.25	3	2	8.4	5.7
Beam	W27x146	13.25	2	5	309.9	58
					Max M	Max V
					309.9	58.0
W10x12				ØMr	46.9	56.0
W27x146				ØMr	1740.0	497

Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Ten) Max P (k)
1	HSS6x6x3/8	14.9	7	10	5	5	-83.6
2	HSS6x6x3/8	14.9	7	5	89.6	10	-1.5
1	HSS6x6x3/8	14.9	6	10	29.5	5	-109.8
2	HSS6x6x3/8	14.9	6	5	118.5	10	-25.9
1	HSS6x6x3/8	14.9	4	6	81.8	5	-123.6
2	HSS6x6x3/8	14.9	4	5	135.9	6	-69.4
1	HSS6x6x3/8	14.9	3	6	83	5	-123.3
2	HSS6x6x3/8	14.9	3	5	132.3	8	-74.9
1	HSS6x6x3/8	14.9	2	8	91.5	5	-107.6
2	HSS6x6x3/8	14.9	2	5	116.7	8	-87.7
					Max Comp	Max Ten	
					135.9	-123.6	
					ØPn =	ØPn =	
					206.0	-248.0	

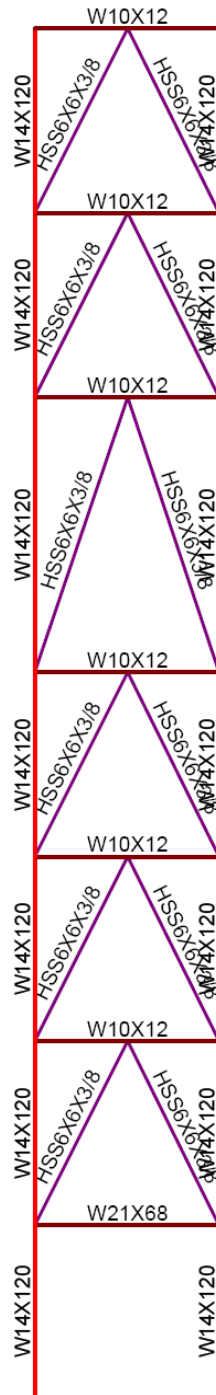
Braced Frame - Fixed Bases								
Frame 9/10								
Column	Member	Length	Story	LC	Max P (k)	Max M (k-ft)	Max V (k)	Peff (k)
Column	W14x120	13.33	7	2	28.9	0.2	0	29
				6	26.5	4	0.3	33
Column	W14x120	13.33	7	2	84.1	0.2	0	84
				6	75.5	4	0.3	82
Column	W14x120	13.33	6	2	129.8	1.5	0.1	132
				10	-1	50.8	3.5	86
Column	W14x120	13.33	6	5	202	39.7	2.8	270
				9	154.4	52.1	3.6	244
Column	W14x120	20	5	2	253.4	1.4	0.1	256
				9	-60	59.4	5.6	42
Column	W14x120	20	5	5	383.7	46.1	4.3	463
				9	323	59.2	5.6	424
Column	W14x120	13.33	4	2	313.7	1.2	0	316
				9	-44	59.4	4.9	58
Column	W14x120	13.33	4	5	530.3	46.1	4.4	609
				9	368.3	59.2	5.6	470
Column	W14x176	13.33	3	2	425.3	10.1	0.8	443
				5	81.1	30	3.4	133
Column	W14x176	13.33	3	5	759.6	16.2	2.2	787
Column	W14x176	13.33	2	2	497.1	39.2	4	564
Column	W14x176	13.33	2	5	971.2	45	2.3	1048
Column	W14x176	12.5	1	2	593.6	43.9	5.7	669
				10	-488	580	80.8	506
Column	W14x176	12.5	1	5	1272.2	475	67.7	2086
				9	1113.6	605.8	85	2152
					Max P	Max M	Max V	Max Peff
					1272.2	605.8	85.0	2152
W14x120	@ 13.3'	ØXn			1390.0	795.0		1390
W14x176	@ 12.5'	ØXn			2105		+/-5%	2105

Beam	Member	Length	Story	LC	Max M (k-ft)	Max V (k)
Beam	W16x31	17.9	8	2	5.2	44.4
Beam	W18x35	17.9	7	2	8.9	65.5
Beam	W18x35	17.9	6	2	-	35.8
Beam	W18x35	17.9	5	2	27.7	108
Beam	W18x35	17.9	4	2	19.4	66.8
Beam	W18x35	17.9	3	2	25.8	67.5
Beam	W27x146	17.9	2	9	465.8	65.5
					Max M	Max V
					465.8	108.0
W18x35	ØMr				249.0	159.0
W27x146	ØMr				1740.0	497

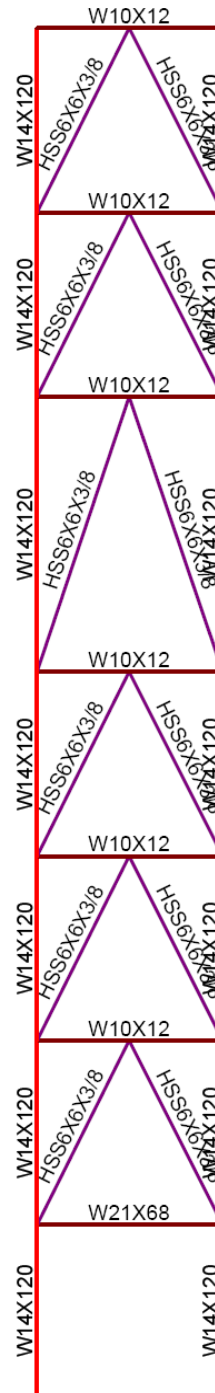
Brace	Member	Length	Story	LC	(Comp) Max P+ (k)	LC	(Ten) Max P- (k)
1	HSS6x6x3/8	16	7	2	81.4	9	-46.3
2	HSS6x6x3/8	16	7	9	75.8	2	-27.1
1	HSS6x6x3/8	16	6	2	95.8	9	-102.3
2	HSS6x6x3/8	16	6	9	132.1	2	-8
1	HSS6x6x1/2	16	4	2	107.9	10	-192.4
2	HSS6x6x1/2	16	4	10	223.5	-	-
1	HSS6x6x3/8	16	3	2	69.6	9	-169.5
2	HSS6x6x3/8	16	3	9	200.2	-	-
1	HSS6x6x1/2	16	2	2	62.3	9	-205
2	HSS6x6x1/2	16	2	10	236.1	-	-
					Max Comp	Max Ten	-205.0
	for HSS6x6x3/8			ØPn =	195.0	ØPn =	-248.0
	for HSS6x6x1/2			ØPn =	244.0	ØPn =	-318.0

APPENDIX J

Member sizes of Frame 1 and Frame 4, respectively. (Also frames 5 and 8 due to symmetry)

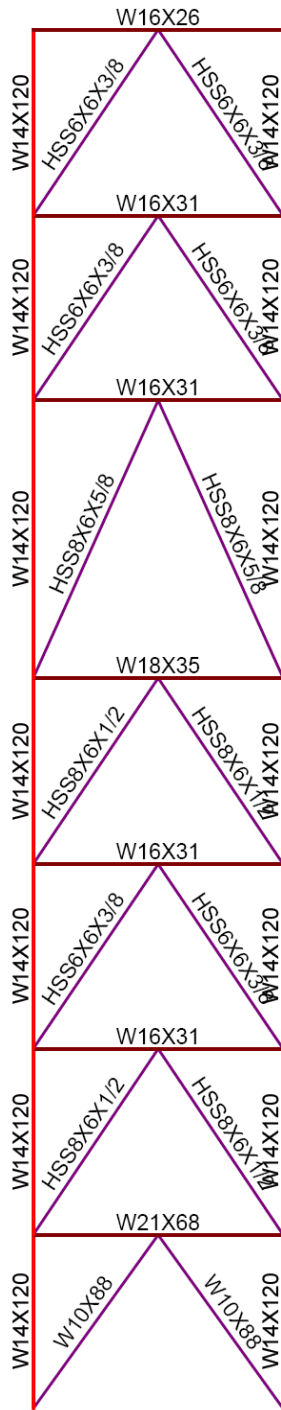


FRAME 1

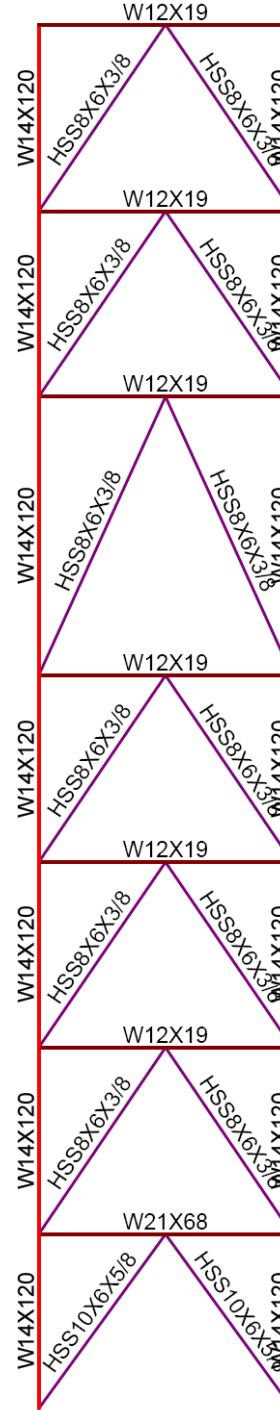


FRAME 4

Member sizes of Frame 2 and Frame 3, respectively. (Also frames 6 and 7 due to symmetry)

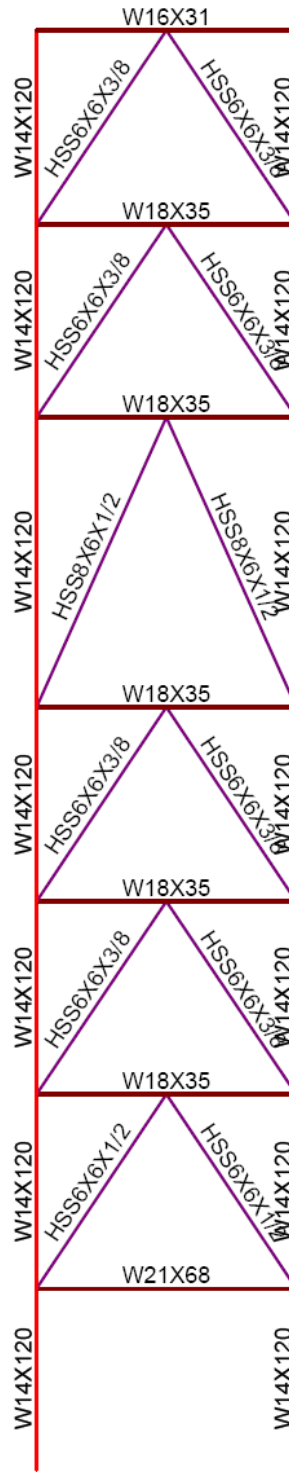


FRAME 2



FRAME 3

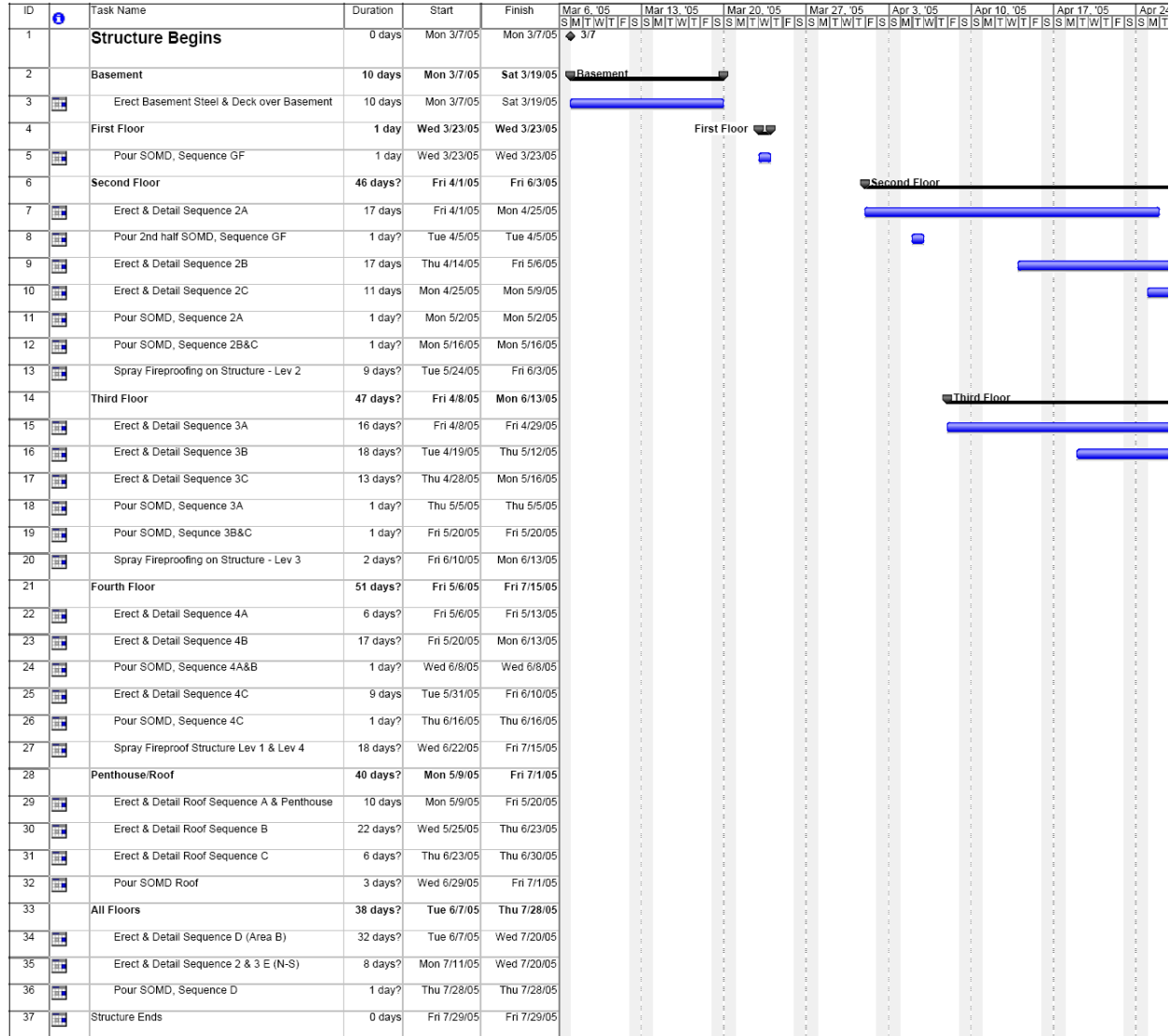
Member sizes of Frame 9. (Also frame 10 due to symmetry)

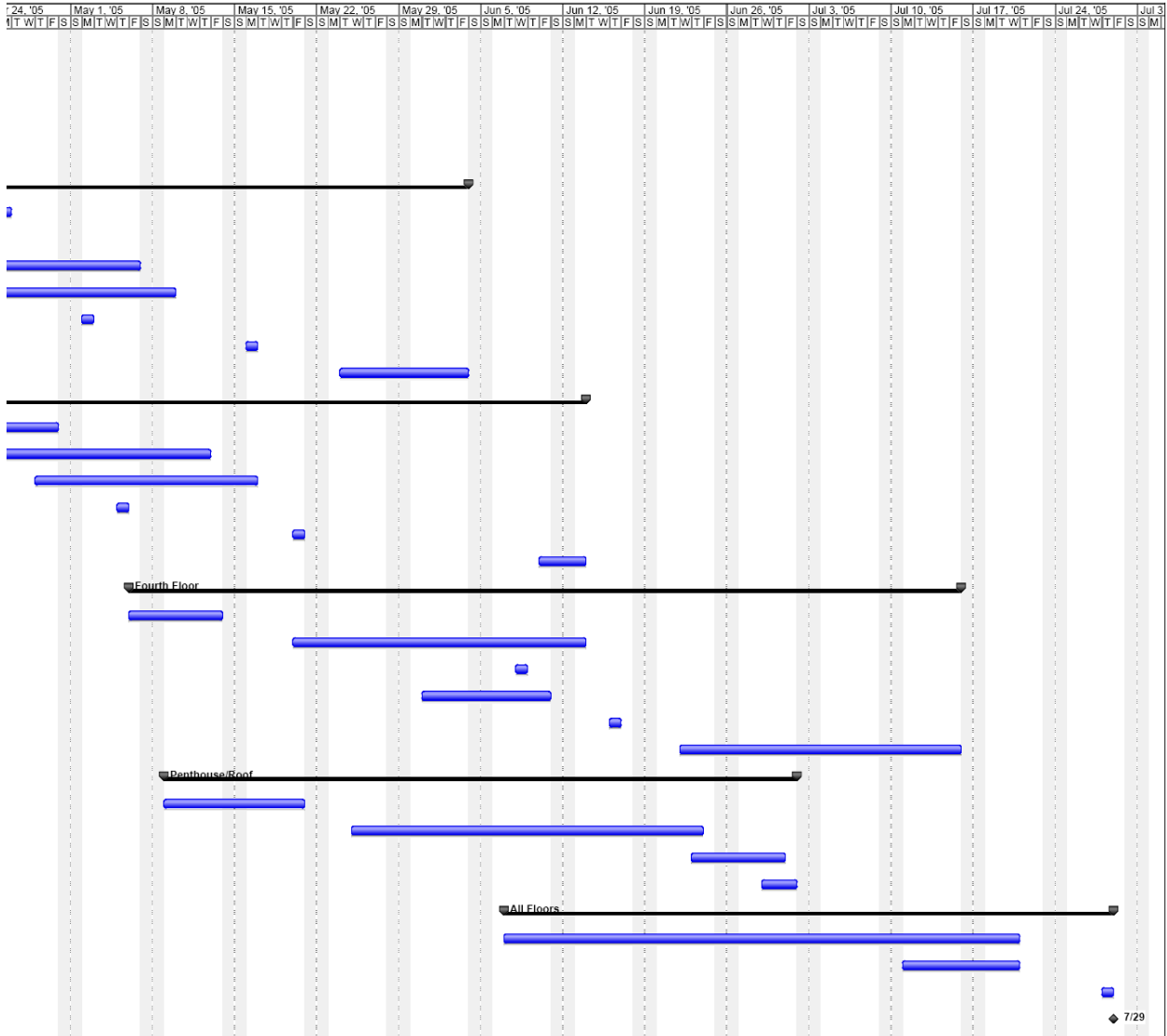


FRAME 9

APPENDIX K

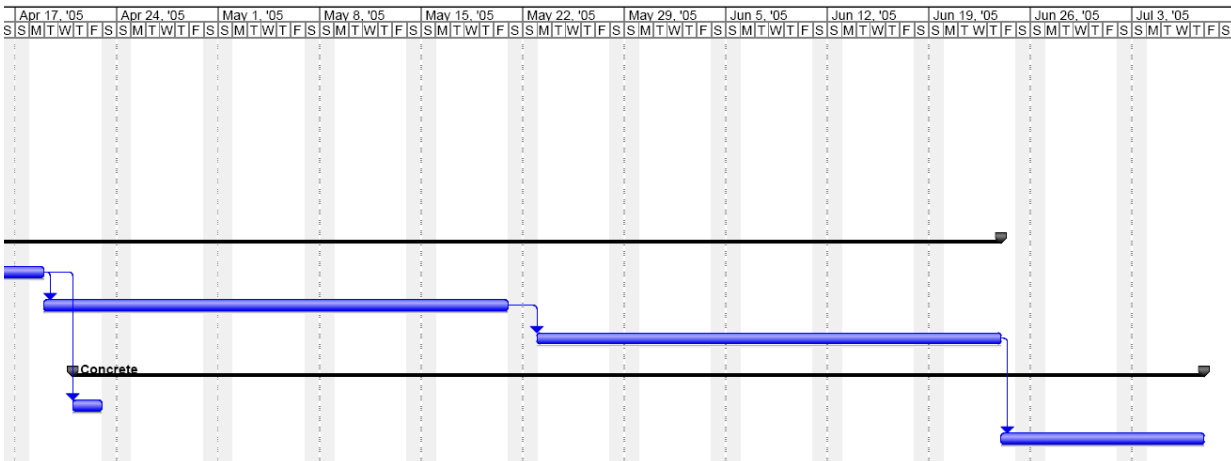
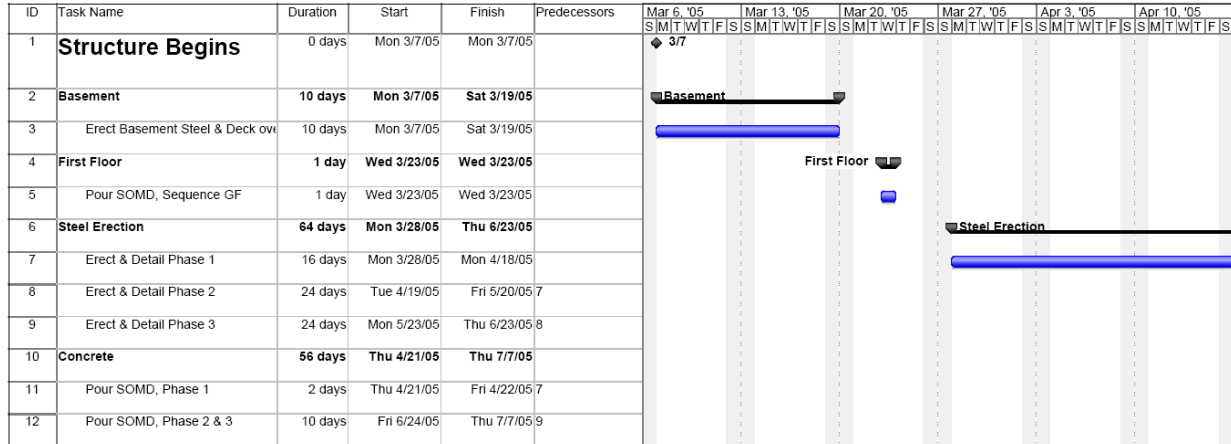
Existing CPM Construction Schedule for Moment Frame Steel System





APPENDIX L

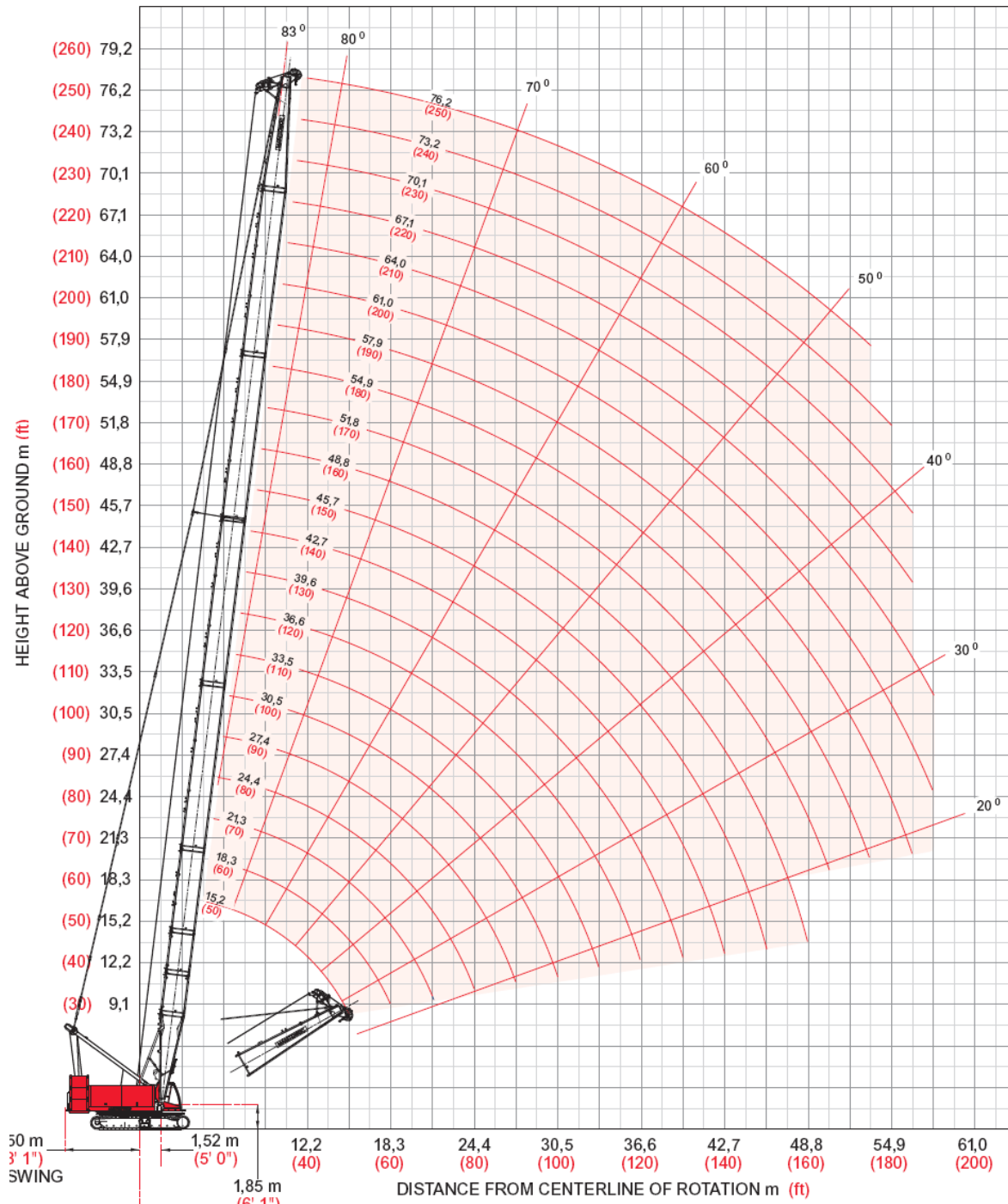
Proposed CPM Construction Schedule for Braced Frame Steel System.



APPENDIX M

HEAVY-LIFT BOOM RANGE DIAGRAM

No. 84 Main Boom



HEAVY-LIFT LOAD CHARTS

**Liftcrane Boom Capacities - Series 2
 Boom No. 84**

44 678 kg (98,500 lb) Upperworks Counterweight 19 958 kg (44,000 lb) Carbody Counterweight

360° Rating kg (lb) x 1 000

Boom m (ft)	15,2 (50.0)	18,3 (60)	21,3 (70)	27,4 (90)	33,5 (110)	39,6 (130)	45,7 (150)	51,8 (170)	57,9 (190)	64,0 (210)	70,1 (230)	76,2 (250)				
Radius																
4,6 (15)	136,0 (300.0)	135,6 (299.0)														
5,0 (17)	125,0 (266.5)	125,0 (266.4)	123,7 (266.2)													
6,0 (20)	104,9 (228.0)	104,9 (227.9)	104,8 (227.7)	100,3 (220.4)												
7,0 (24)	88,3 (179.9)	88,7 (180.6)	88,6 (180.9)	88,9 (181.1)	84,0 (181.3)	- (159.3)										
8,0 (28)	70,9 (141.9)	71,2 (142.5)	71,3 (142.8)	71,4 (142.9)	71,5 (143.0)	69,6 (142.8)	61,9 (133.6)	- (115.7)								
9,0 (32)	59,4 (116.6)	59,7 (117.1)	59,8 (117.4)	59,8 (117.4)	59,9 (117.5)	60,0 (117.3)	58,9 (116.9)	51,5 (110.3)	- (94.8)							
11,0 (36)	44,5 (98.5)	44,7 (99.0)	44,8 (99.2)	44,8 (99.3)	44,8 (99.3)	44,7 (99.0)	44,6 (98.7)	44,4 (98.3)	40,8 (90.2)	36,0 (79.5)						
12,0 (40)	39,3 (84.9)	39,6 (85.4)	39,7 (85.6)	39,7 (85.7)	39,6 (85.6)	39,5 (85.3)	39,4 (85.0)	39,2 (84.6)	38,7 (84.2)	34,5 (75.6)	30,3 (66.3)	- (54.3)				
15,0 (50)	28,7 (62.0)	29,0 (62.7)	29,1 (62.9)	29,1 (63.0)	29,1 (62.9)	29,0 (62.6)	28,8 (62.2)	28,6 (61.7)	28,4 (61.3)	28,4 (60.7)	26,6 (58.1)	21,9 (47.9)				
18,0 (60)		22,4 (48.5)	22,6 (48.9)	22,7 (49.0)	22,6 (48.9)	22,5 (48.6)	22,3 (48.2)	22,1 (47.7)	21,8 (47.2)	21,6 (46.6)	21,4 (46.1)	19,0 (41.4)				
20,0 (70)			19,5 (39.2)	19,6 (39.5)	19,6 (39.4)	19,4 (39.0)	19,2 (38.7)	19,0 (38.1)	18,7 (37.7)	18,5 (37.1)	18,2 (36.5)	17,2 (35.4)				
24,0 (80)				15,0 (32.5)	15,0 (32.5)	14,9 (32.2)	14,7 (31.8)	14,4 (31.2)	14,3 (30.8)	14,0 (30.2)	13,7 (29.6)	13,4 (28.9)				
26,0 (90)				13,3 (27.2)	13,4 (27.3)	13,2 (27.0)	13,0 (26.6)	12,8 (26.0)	12,6 (25.5)	12,3 (24.9)	12,0 (24.3)	11,8 (23.7)				
30,0 (100)					10,7 (23.2)	10,6 (22.9)	10,4 (22.5)	10,2 (21.9)	10,0 (21.5)	9,7 (20.8)	9,4 (20.2)	9,1 (19.6)				
32,0 (110)					9,7 (19.8)	9,5 (19.5)	9,4 (19.2)	9,1 (18.7)	8,9 (18.2)	8,6 (17.5)	8,3 (16.9)	8,1 (16.3)				
36,0 (120)						7,8 (16.8)	7,7 (16.5)	7,4 (15.9)	7,2 (15.5)	6,9 (14.8)	6,6 (14.2)	6,3 (13.6)				
38,0 (130)							7,1 (14.4)	6,9 (14.2)	6,7 (13.7)	6,5 (13.2)	6,2 (12.6)	5,9 (12.0)	5,6 (11.3)			
42,0 (140)								5,7 (12.2)	5,5 (11.7)	5,2 (11.2)	5,0 (10.6)	4,7 (10.0)	4,4 (9.4)			
44,0 (150)									5,1 (10.5)	4,9 (10.0)	4,7 (9.6)	4,4 (9.0)	3,9 (7.7)			
48,0 (160)										4,0 (8.6)	3,8 (8.1)	3,5 (7.5)	3,2 (6.9)	3,0 (6.3)		
50,0 (170)											3,6 (7.9)	3,4 (7.5)	3,1 (6.9)	2,9 (6.3)		
54,0 (180)												3,6 (7.9)	3,4 (7.5)	3,1 (6.9)		
56,0 (185)													2,7 (5.7)	2,4 (5.1)	2,1 (4.5)	
														2,3 (5.1)	2,1 (4.6)	1,8 (4.0)