Appendix A

D4Cost Data

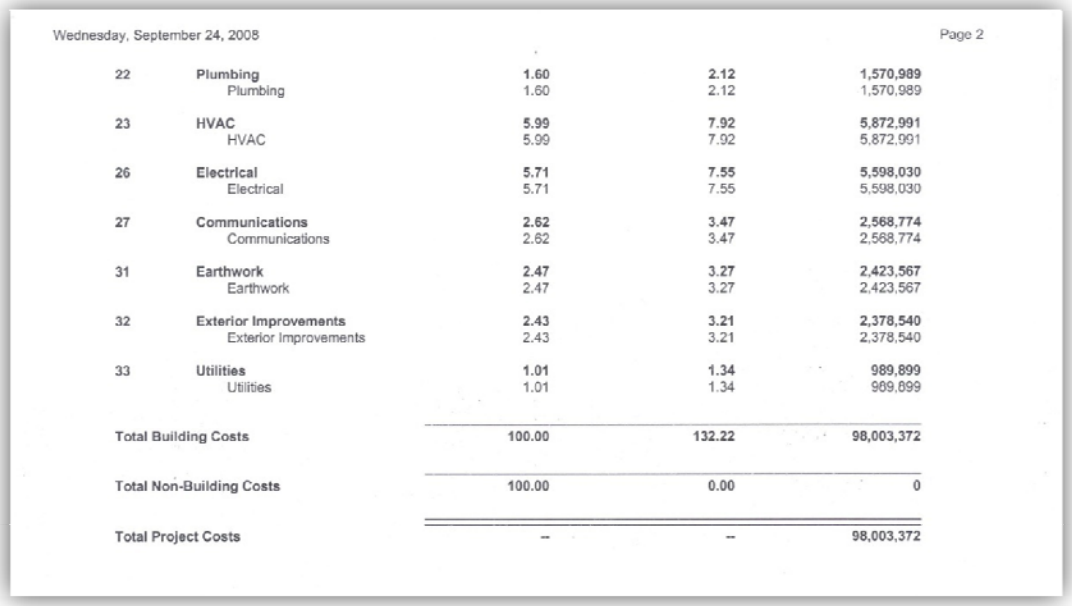
Wednesday, September 24, 2008 — Statement of Probable Cost — Page 1

Office Building - Aug 2009 - District of Columbia

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	741200	Site Sq. Size:	283390
Bid Date:		Building use:	
No. of floors:	4	Foundation:	
No. of buildings:		Exterior Walls:	
Project Height:		Interior Walls:	
1st Floor Height:		Roof Type:	
1st Floor Size:		Floor Type:	
		Project Type:	

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**4.67**	**6.18**	**4,581,205**
	Bidding Requirements	4.67	6.18	4,581,205
01	**General Requirements**	**4.47**	**5.91**	**4,379,911**
	General Requirements	4.47	5.91	4,379,911
02	**Site Work**	**4.73**	**6.26**	**4,637,096**
	Site Work	4.73	6.26	4,637,096
03	**Concrete**	**13.04**	**17.25**	**12,782,384**
	Concrete	13.04	17.25	12,782,384
04	**Masonry**	**2.56**	**3.38**	**2,506,310**
	Masonry	2.56	3.38	2,506,310
05	**Metals**	**6.68**	**8.83**	**6,544,552**
	Metals	6.68	8.83	6,544,552
06	**Wood, Plastics, and Composites**	**0.49**	**0.65**	**481,758**
	Wood, Plastics, and Composites	0.49	0.65	481,758
07	***Thermal and Moisture Protection***	**2.48**	**3.28**	**2,430,767**
	Thermal and Moisture Protection	2.48	3.28	2,430,767
08	**Openings**	**4.69**	**6.20**	**4,596,309**
	Openings	4.69	6.20	4,596,309
09	**Finishes**	**5.92**	**7.82**	**5,799,472**
	Finishes	5.92	7.82	5,799,472
10	**Specialties**	**1.05**	**1.39**	**1,028,425**
	Specialties	1.05	1.39	1,028,425
11	**Equipment**	**0.21**	**0.28**	**210,652**
	Equipment	0.21	0.28	210,652
12	**Furnishings**	**1.06**	**1.40**	**1,036,175**
	Furnishings	1.06	1.40	1,036,175
13	**Special Construction**	**0.19**	**0.25**	**182,922**
	Special Construction	0.19	0.25	182,922
14	**Conveying Systems**	**1.66**	**2.19**	**1,626,478**
	Conveying Systems	1.66	2.19	1,626,478
15	**Mechanical**	**10.83**	**14.33**	**10,617,964**
	Mechanical	10.83	14.33	10,617,964
16	**Electrical**	**11.61**	**15.35**	**11,374,770**
	Electrical	11.61	15.35	11,374,770
21	**Fire Suppression**	**1.82**	**2.41**	**1,783,436**
	Fire Suppression	1.82	2.41	1,783,436

Reference D4Cost 2002



Wednesday, September 24, 2008 Page 2

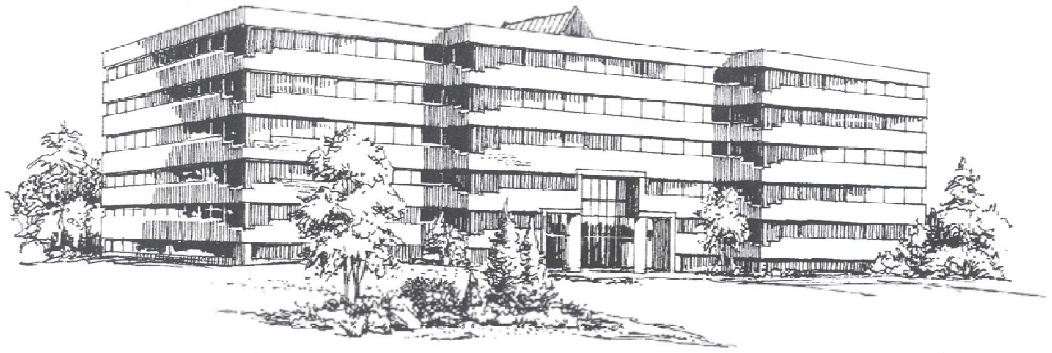
22	**Plumbing**	**1.60**	**2.12**	**1,570,989**
	Plumbing	1.60	2.12	1,570,989
23	**HVAC**	**5.99**	**7.92**	**5,872,991**
	HVAC	5.99	7.92	5,872,991
26	**Electrical**	**5.71**	**7.55**	**5,598,030**
	Electrical	5.71	7.55	5,598,030
27	**Communications**	**2.62**	**3.47**	**2,568,774**
	Communications	2.62	3.47	2,568,774
31	**Earthwork**	**2.47**	**3.27**	**2,423,567**
	Earthwork	2.47	3.27	2,423,567
32	**Exterior Improvements**	**2.43**	**3.21**	**2,378,540**
	Exterior Improvements	2.43	3.21	2,378,540
33	**Utilities**	**1.01**	**1.34**	**989,899**
	Utilities	1.01	1.34	989,899
Total Building Costs		**100.00**	**132.22**	**98,003,372**
Total Non-Building Costs		**100.00**	**0.00**	**0**
Total Project Costs		--	--	**98,003,372**

Reference D4Cost 2002

Appendix B

R.S. Means Source Data

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.470** | **Office, 5-10 Story**



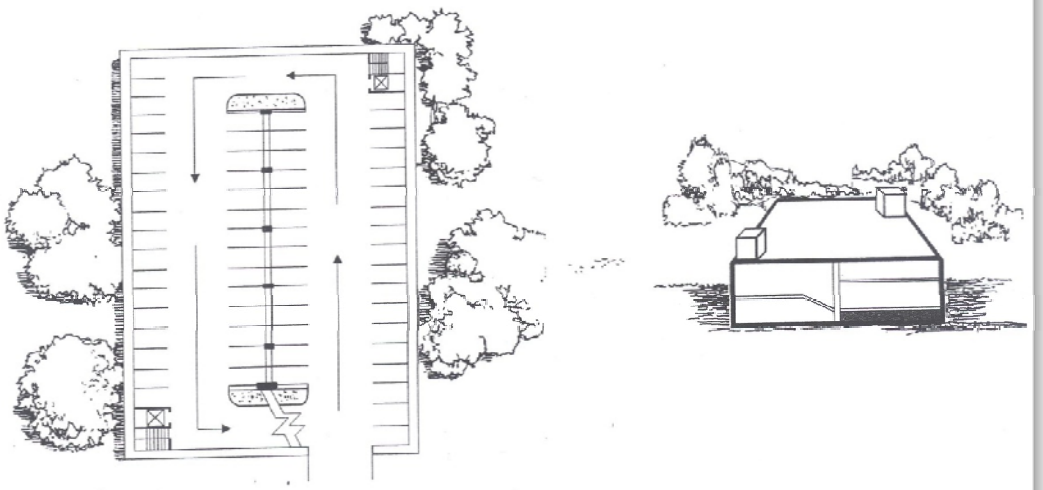
Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	40000	60000	80000	100000	150000	200000	250000	300000
	L.F. Perimeter	260	360	400	420	460	520	600	640	700
Precast Concrete Panel	Steel Frame	193.70	166.10	151.60	143.05	138.95	132.15	129.30	126.65	125.30
	R/Conc. Frame	193.10	165.25	150.70	142.10	137.90	131.10	128.20	125.60	124.20
Face Brick with Concrete Block Back-up	Steel Frame	184.25	159.40	146.65	139.10	135.50	129.55	127.00	124.70	123.50
	R/Conc. Frame	183.10	158.30	145.55	138.05	134.40	128.45	125.85	123.65	122.40
Limestone Panel Concrete Block Back-up	Steel Frame	231.60	192.30	171.00	158.30	152.25	142.20	137.95	134.10	132.05
	R/Conc. Frame	230.55	191.15	169.85	157.20	151.15	141.10	136.80	132.95	130.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	26.35	13.20	8.80	6.55	5.25	3.50	2.60	2.15	1.75
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	5.45	3.80	2.80	2.25	1.95	1.45	1.20	1.10	1.00

For Basement, add $33.50 per square foot of basement area

Reference R.S. Means 2008, Page 178

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.280** | **Garage, Underground Parking**



Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	30000	40000	50000	75000	100000	125000	150000	175000
	L.F. Perimeter	400	500	600	650	775	900	1000	1100	1185
Reinforced Concrete	R/Conc. Frame	81.90	75.95	73.00	70.15	66.45	64.65	63.30	62.35	61.70
Perimeter Adj., Add or Deduct	Per 100 L.F.	5.05	3.35	2.45	2.05	1.35	0.95	0.75	0.70	0.55
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.95	1.60	1.45	1.25	1.00	0.80	0.70	0.70	0.65
Basement—Not Applicable										

Reference R.S. Means 2008, Page 138

Appendix C

Detailed Structural System Estimate Take-Offs

Table 2: Mat Foundation Take-Off for Rebar

Mat Foundation Take-Off : Rebar						
No. of Bars (#)	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Subtotal (LBS)**	**Multiplier**	**Total (LBS)**
20	10	30	4.303	2,582	1	2,582
20	10	19	4.303	1,635	45	73,581
20	10	31	4.303	2,668	6	16,007
12	10	30	4.303	1,549	2	3,098
12	10	19	4.303	981	32	31,395
12	10	31	4.303	1,601	4	6,403
8	10	19	4.303	654	6	3,924
18	10	19	4.303	1,472	12	17,660
12	10	25	4.303	1,291	1	1,291
12	10	15	4.303	775	35	27,109
12	10	33	4.303	1,704	1	1,704
93	10	23	4.303	9,204	1	9,204
31	10	29	4.303	3,868	1	3,868
40	10	34	4.303	5,852	2	11,704
40	10	28	4.303	4,819	2	9,639
214	10	24	4.303	22,100	2	44,200
40	10	42	4.303	7,229	1	7,229
56	10	40	4.303	9,639	1	9,639
54	10	30	4.303	6,971	1	6,971
578	10	42	4.303	104,460	1	104,460
432	10	48	4.303	89,227	1	89,227
507	10	52	4.303	113,444	1	113,444
70	10	380	4.303	114,460	1	114,460
110	10	75	4.303	35,500	1	35,500
100	10	83	4.303	35,715	1	35,715
31	10	320	4.303	42,686	1	42,686
427	10	24	4.303	44,097	1	44,097
62	10	180	4.303	48,021	1	48,021
240	10	47	4.303	48,538	1	48,538
114	10	86	4.303	42,187	1	42,187
114	10	86	4.303	42,187	1	42,187
				Subtotal (LBS)		1,047,729
				Waste Factor (5%)		1.05
				TOTAL (LBS)		**1,100,115**
				TOTAL (TON)		**550**

Table 3: Composite Decking Take-Off for Rebar

Composite Decking : Rebar				
No. of Bars (#)	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Total (LBS)**
220	6	37	1.5025	12,230.35
74	6	108	1.5025	12,007.98
148	6	37	1.5025	8,227.69
74	6	68	1.5025	7,560.58
Subtotal (LBS)				40,027
Waste Factor (5%)				1.05
Total (LBS)				**42,028**
Total (TON)				**21**

Table 4: Typical 2nd thru Roof Take-Off for Rebar

Typical 2nd - Roof Take-0ff: Rebar						
No. of Bars (#)	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Subtotal (LBS)**	**Multiplier**	**Total (LBS)**
17	6	20	1.5025	511	15	7,663
22	6	20	1.5025	661	17	11,239
11	6	20	1.5025	331	20	6,611
10	6	20	1.5025	301	10	3,005
9	6	20	1.5025	270	23	6,220
15	6	20	1.5025	451	10	4,508
9	6	10	1.5025	135	9	1,217
14	6	12	1.5025	252		0
20	6	12	1.5025	361	3	1,082
16	6	15	1.5025	361	2	721
21	6	15	1.5025	473	2	947
12	6	15	1.5025	270	4	1,082
17	6	15	1.5025	383	3	1,149
18	6	15	1.5025	406	5	2,028
Subtotal (LBS)						47,471
Waste Factor (5%)						1.05
Total (LBS)						**49,845**
Total (TON)						**25**

Table 5: Column Take-Off for Rebar

Column Take-Off : Rebar							
Column	**No. of Bars (#)**	**Bar No. (#)**	**Height of Bar (FT)**	**LBS/FT**	**Subtotal (LBS)**	**Multiplier**	**Total (LBS)**
C1	98	4	10	0.67	655	18	11,784
	12	11	57	5.31	3,639	18	65,505
	8	11	73	5.31	3,113	18	56,042
C2	284	4	10	0.67	1,903	16	30,445
	12	11	142	5.31	9,053	16	144,854
C3	34	4	10	0.67	228	19	4,328
	8	11	33	5.31	1,403	19	26,650
	16	11	12	5.31	1,041	19	19,786
C4	284	4	10	0.67	1,897	1	1,897
	12	11	57	5.31	3,634	1	3,634
	8	11	85	5.31	3,613	1	3,613
C5	126	4	10	0.67	844	14	11,819
	12	11	58	5.31	3,698	14	51,770
	8	11	110	5.31	4,654	14	65,159
C6	45	4	10	0.67	301	1	301
	12	11	15	5.31	924	1	924
	8	11	45	5.31	1,923	1	1,923
C7	107	4	10	0.67	717	2	1,434
	12	11	57	5.31	3,634	2	7,268
	8	11	85	5.31	3,613	2	7,226
C8	126	4	10	0.67	842	14	11,784
	12	11	53	5.31	3,347	14	46,861
	8	11	72	5.31	3,039	14	42,547
C9	126	4	10	0.67	844	2	1,688
	12	11	53	5.31	3,347	2	6,694
	8	11	72	5.31	3,039	2	6,078
C10	126	4	10	0.67	842	8	6,733
	12	11	76	5.31	4,842	8	38,738
	8	11	110	5.31	4,654	8	37,234
C11	107	4	10	0.67	717	5	3,585
	12	11	85	5.31	5,419	5	27,096
	8	11	47	5.31	1,998	5	9,988
C12	98	4	10	0.67	655	4	2,619
	16	11	12	5.31	999	4	3,995
	12	11	45	5.31	2,885	4	11,540

	8	11	73	5.31	3,113	4	12,454
C13	98	4	10	0.67	657	1	657
	12	11	24	5.31	1,498	1	1,498
	8	11	107	5.31	4,537	1	4,537
C14	98	4	10	0.67	655	1	655
	16	11	12	5.31	999	1	999
	8	11	119	5.31	5,037	1	5,037
C15	98	4	10	0.67	657	1	657
	16	11	12	5.31	999	1	999
	8	11	119	5.31	5,037	1	5,037
C16	63	4	10	0.67	421	3	1,263
	16	11	12	5.31	999	3	2,997
	8	11	72	5.31	3,039	3	9,117
C17	54	4	10	0.67	362	2	724
	16	11	12	5.31	999	2	1,998
	8	11	60	5.31	2,540	2	5,079
C18	45	4	10	0.67	301	2	601
	12	11	15	5.31	924	2	1,849
	8	11	45	5.31	1,923	2	3,847
C19	34	4	10	0.67	228	10	2,278
	16	11	12	5.31	1,041	10	10,413
	8	11	23	5.31	978	10	9,776
C20	34	4	10	0.67	227	8	1,817
	12	11	12	5.31	781	8	6,248
	8	11	23	5.31	978	8	7,821
C21	33	4	10	0.67	221	4	884
	12	11	10	5.31	653	4	2,614
	8	11	13	5.31	542	4	2,168
C22	33	4	12	0.67	265	5	1,323
	10	11	23	5.31	1,222	5	6,110
C23	118	4	10	0.67	788	1	788
	12	11	158	5.31	10,042	1	10,042
C24	126	4	10	0.67	842	1	842
	12	11	38	5.31	2,423	1	2,423
	8	11	72	5.31	3,039	1	3,039
	20	11	35	5.31	3,746	1	3,746

Table 6: Structural Steel Take-Off for Rebar

Structural Steel Take-Off					
Level	**Steel Member**	**No. of Steel (#)**	**Length of Steel (FT)**	**No. of Shear Studs**	**Total (LBS)**
5th	W16X57	20	400	280	22800
	W16X26	4	80	56	2080
	W24x131	3	208	116	27248
	W12X22	4	32	24	704
	W24x76	2	28	28	2128
	W24x44	1	37	30	1628
	W24X103	2	74	96	7622
	W24X162	4	148	152	23976
6th	W16X57	22	440	308	25080
	W8X31	16	244	390	7564
	W12X22	2	16	12	352
	W21X68	4	56	56	3808
	W21X44	4	100	100	4400
	W21X132	7	262	332	34584
	W24X103	1	37	46	3811
	W24X162	1	37	46	5994
	W21X182	2	30	34	5460
	W21X57	1	2	3	114
	W16X26	1	20	32	520
	W21X50	1	38	1	1900
	W18X35	1	37	30	1295
7th	W8X31	19	308	486	9548
	W12X22	2	16	12	352
	W16X57	20	400	280	22800
	W21X68	4	56	56	3808
	W21X44	5	100	100	4400

	W21X132	8	296	384	39072
	W21X57	2	22	23	1254
	W21X182	2	34	34	6188
	W21X50	1	38	1	1900
	W18X35	1	37	30	1,295
8th	W8X31	19	308	486	9,548
	W12X22	2	16	12	352
	W16X57	20	400	280	22,800
	W21X68	4	56	56	3,808
	W21X44	5	100	100	4,400
	W21X132	8	296	384	39,072
	W21X57	2	22	23	1,254
	W21X182	2	34	34	6,188
	W21X50	1	38	1	1,900
	W18X35	1	37	30	1,295
9th	W8X31	19	308	486	9,548
	W12X22	2	16	12	352
	W16X57	20	400	280	22,800
	W21X68	4	56	56	3,808
	W21X44	5	100	100	4,400
	W21X132	8	296	384	39,072
	W21X57	2	22	23	1,254
	W21X182	2	34	34	6,188
	W21X50	1	38	1	1,900
	W18X35	1	37	30	1,295
10th	W8X31	19	308	486	9,548
	W12X22	2	16	12	352
	W16X57	20	400	280	22,800
	W21X68	4	56	56	3,808
	W21X44	5	100	100	4,400
	W21X132	8	296	384	39,072
	W21X57	2	22	23	1,254

	W21X182	2	34	34	6,188
	W21X50	1	38	1	1,900
	W18X35	1	37	30	1,295
Roof	W8X31	19	308	486	9,548
	W12X22	2	16	12	352
	W16X57	20	400	280	22,800
	W21X68	4	56	56	3,808
	W21X44	5	100	100	4,400
	W21X132	8	296	384	39,072
	W21X57	2	22	23	1,254
	W21X182	2	34	34	6,188
	W21X50	1	38	1	1,900
	W18X35	1	37	30	1,295

Total Shear Studs	9,202
Subtotal (LBS)	636,153
Waste Factor (5%)	1.05
Total (LBS)	**667,961**
Total (TON)	**334**

Table 7: Shear Wall Take-Off for Rebar

Shear Wall Take-Off : Rebar					
Wall	**No. of Bars (#)**	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Total (LBS)**
1	180	4	40	0.67	4810
	80	8	23	2.67	4913
	80	9	27	3.40	7276
	40	6	130	1.50	7780
2	180	4	40	0.67	4810
	80	8	23	2.67	4913
	80	9	27	3.40	7276
	40	6	130	1.50	7780
3	180	4	40	0.67	4810
	80	8	35	2.67	7529
	80	11	62	5.31	26140
	80	6	48	1.50	5768
	40	6	35	1.50	2073
4	180	4	28	0.67	3367
	56	6	97	1.50	8138
	28	6	83	1.50	3470
5	180	4	28	0.67	3367
	56	6	97	1.50	8138
	28	6	83	1.50	3470
6	180	4	40	0.67	4810
	80	8	35	2.67	7529
	80	9	62	3.40	16742
	40	6	83	1.50	4987
7	168	4	40	0.67	4489
	80	8	35	2.67	7529
	80	9	62	3.40	16728
	40	6	71	1.50	4251
8	168	4	40	0.67	4489
	80	8	35	2.67	7529
	80	9	62	3.40	16728
	40	6	71	1.50	4251

9	180	4	20	0.67	2405
	40	8	35	2.67	3765
	40	9	97	3.40	13158
	20	6	47	1.50	1419
10	180	4	18	0.67	2164
	36	8	35	2.67	3388
	36	9	97	3.40	11842
	18	6	47	1.50	1277
11	180	4	20	0.67	2405
	40	8	35	2.67	3765
	40	9	97	3.40	13158
	20	6	47	1.50	1419
12	180	4	18	0.67	2164
	36	8	35	2.67	3388
	36	9	97	3.40	11842
	18	6	47	1.50	1277
13	95	4	28	0.67	1777
	56	6	85	1.50	7150
14	60	4	12	0.67	481
	12	7	50	0.67	399
15	72	4	16	0.67	770
	16	7	62	1.50	1478
Subtotal (LBS)					316779
Waste Factor (5%)					1.05
Total (LBS)					**332618**
Total (TON)					**166**

Table 8: Typical P2 thru Ground Level Take-Off for Rebar

Typical P2 - Ground Level Take-Off : Rebar						
No. of Bars (#)	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Subtotal (LBS)**	**Multiplier**	**Total (LBS)**
8	6	9	1.5025	108	2	216
16	6	9	1.5025	216	3	649
14	6	15	1.5025	316	6	1893
16	6	32	1.5025	769	1	769
16	6	19	1.5025	457	2	914
12	4	12	0.668	96	1	96
8	6	16	1.5025	192	18	3462
16	6	16	1.5025	385	25	9616
8	6	16	1.5025	192	10	1923
12	6	19	1.5025	343	3	1028
21	6	34	1.5025	1073	1	1073
12	6	11	1.5025	198	1	198
10	6	35	1.5025	526	1	526
12	6	21	1.5025	379	1	379
16	6	20	1.5025	481	1	481
6	4	6	0.668	24	6	144
11	4	6	0.668	44	27	1190
24	6	2	1.5025	72	1	72
8	6	20	1.5025	240	1	240
6	6	14	1.5025	126	13	1641
24	6	18	1.5025	649	1	649
21	6	35	1.5025	1104	1	1104
16	6	28	1.5025	673	1	673
23	6	23	1.5025	795	2	1590
12	6	14	1.5025	252	30	7573
23	6	30	1.5025	1037	1	1037
25	6	20	1.5025	751	1	751
25	6	16	1.5025	601	3	1803
13	6	15	1.5025	293	22	6446
16	6	17	1.5025	409	8	3269
6	6	8	1.5025	72	2	144
14	6	18	1.5025	379	1	379

31	6	8	1.5025	373	1	373
16	6	8	1.5025	192	1	192
25	6	18	1.5025	676	3	2028
31	6	23	1.5025	1071	1	1071
16	6	23	1.5025	553	1	553
11	4	12	0.668	88	7	617
6	6	34	1.5025	307	3	920
12	6	34	1.5025	613	2	1226
6	6	28	1.5025	252	1	252
25	6	21	1.5025	789	10	7888
16	6	36	1.5025	865	1	865
12	4	6	0.668	48	1	48
25	6	35	1.5025	1315	3	3944
16	6	33	1.5025	793	1	793
25	6	12	1.5025	451	1	451
24	6	30	1.5025	1082	1	1082
8	6	37	1.5025	445	1	445
25	6	34	1.5025	1277	1	1277
8	4	11	0.668	59	3	176
6	6	25	1.5025	225	1	225
9	6	18	1.5025	243	1	243
11	6	25	1.5025	413	1	413
16	6	18	1.5025	433	3	1298
11	4	16	0.668	118	1	118
25	6	30	1.5025	1127	1	1127
16	6	36	1.5025	865	2	1731
8	6	24	1.5025	288	1	288
14	6	35	1.5025	736	1	736
18	6	24	1.5025	649	2	1298
18	6	27	1.5025	730	3	2191
25	6	41	1.5025	1540	1	1540
25	6	40	1.5025	1503	2	3005
24	6	9	1.5025	325	2	649
25	6	8	1.5025	301	32	9616
57	4	42	0.668	1599	6	9595
50	4	48	0.668	1603	12	19238
456	4	52	0.668	15840	1	15840
62	4	380	0.668	15738	35	550833

99	4	75	0.668	4960	1	4960
90	4	83	0.668	4990	1	4990
28	4	320	0.668	5985	1	5985
384	4	24	0.668	6156	2	12313
56	4	180	0.668	6733	2	13467
216	4	47	0.668	6782	2	13563
103	4	86	0.668	5917	1	5917
103	4	86	0.668	5917	1	5917
4	5	9	1.043	38	1	38
16	5	16	1.043	267	1	267
22	4	16	0.668	235	1	235
1	5	9	1.043	9	1	9
4	5	7	1.043	29	1	29
2	6	19	1.5025	57	1	57
1	6	32	1.5025	48	1	48
2	4	12	0.668	16	1	16
33	4	6	0.668	132	1	132
4	4	7	0.668	19	1	19
1	6	7	1.5025	11	1	11
2	6	9	1.5025	27	1	27
2	6	40	1.5025	120	1	120
8	6	21	1.5025	252	1	252
34	4	14	0.668	318	1	318
1	5	35	1.043	37	1	37
1	5	36	1.043	38	1	38
3	5	18	1.043	56	1	56
2	4	34	0.668	45	1	45
1	6	20	1.5025	30	1	30
22	5	15	1.043	344	1	344
1	5	20	1.043	21	1	21
4	6	11	1.5025	66	1	66
4	6	23	1.5025	138	1	138
2	6	36	1.5025	108	1	108
7	5	17	1.043	124	1	124
2	6	8	1.5025	24	1	24
1	4	25	0.668	17	1	17
1	6	25	1.5025	38	1	38
4	4	8	0.668	21	1	21

8	4	12	0.668	64	1	64
2	4	18	0.668	24	1	24
2	5	33	1.043	69	1	69
1	6	12	1.5025	18	1	18
3	6	18	1.5025	81	1	81
1	4	36	0.668	24	1	24
1	6	38	1.5025	57	1	57
1	6	34	1.5025	51	1	51
1	6	41	1.5025	62	1	62
2	4	11	0.668	15	1	15
1	4	10	0.668	7	1	7
1	4	35	0.668	23	1	23
1	6	16	1.5025	24	1	24
1	5	24	1.043	25	1	25
			Subtotal (LBS)			766,458
			Waste Factor (5%)			1.05
			Total (LBS)			804,780
			Total (TON)			402

Table 9: Shear Wall Take-Off for Concrete

Concrete Shear Wall Take-Off					
Wall	**Length (FT)**	**Thickness (FT)**	**Height (FT)**	**Volume (CF)**	**Volume (CY)**
1	40	1	179.25	7170	266
2	40	1	179.25	7170	266
3	40	1	179.25	7170	266
4	28	1	179.25	5019	186
5	28	1	179.25	5019	186
6	40	1	179.25	7170	266
7	40	1	167.5	6700	248
8	40	1	167.5	6700	248
9	20	1	179.25	3585	133
10	18	1	179.25	3227	120
11	20	1	179.25	3585	133
12	18	1	179.25	3227	120
13	28	1	95	2660	99
14	12	1	59.75	717	27
15	16	1	71.5	1144	42
Subtotal (CY)					2,602
Waste Factor (5%)					1.05
Total (CY)					2,732

Table 10: Concrete Slab Take-Off for Concrete

Concrete Slab Take-Off					
Level	**Width (FT)**	**Length (FT)**	**Thickness (FT)**	**Volume (CF)**	**Volume (CY)**
5th	37	108	0.35	1399	52
6th	37	70	0.35	907	34
	37	88	0.21	684	25
7th	37	156	0.21	1212	45
8th	37	156	0.21	1212	45
9th	37	156	0.21	1212	45
10th	37	156	0.21	1212	45
Roof	37	156	0.21	1212	45
Subtotal (CY)					335
Waste Factor (5%)					1.05
Total (CY)					352

Table 11: Concrete Columns Take-Off for Concrete

Concrete Column Take-Off					
Column	**Length (FT)**	**Width (FT)**	**Height (FT)**	**Volume (CF)**	**Volume (CY)**
C1	24	24	130.33	576	21
C2	24	24	130.33	576	21
C3	24	24	35.25	576	21
C4	24	24	132	576	21
C5	24	24	157.5	576	21
C6	24	24	49.75	576	21
C7	24	24	132	576	21
C8	27	2	157.5	54	2
C9	27	24	157.5	648	24
C10	27	24	157.5	648	24
C11	24	24	132	576	21
C12	24	24	120.25	576	21
C13	24	24	120.25	576	21
C14	24	24	120.25	576	21
C15	24	24	120.25	576	21
C16	24	24	73.25	576	21
C17	24	24	61.5	576	21
C18	24	24	49.75	576	21
C19	24	24	35.25	576	21
C20	24	24	35.25	576	21
C21	24	24	23	576	21
C22	24	36	23	864	32
C23	24	24	157.6	576	21
C24	24	24	157.6	576	21
C27	24	24	23	576	21
C28	12	18	35.5	216	8
C29	24	24	2.75	576	21
C30	24	24	35.5	576	21
C31	40	40	35.25	1600	59
C32	24	24	35.25	576	21
C33	24	24	73.25	576	21
C34	40	40	35.25	1600	59

C35	40	72	35.25	2880	107
C36	52	48	35.25	2496	92
C37	72	48	35.25	3456	128
C38	24	24	23	576	21
C39	24	24	73.25	576	21
Subtotal (CY)					1,112
Waste Factor (5%)					1.05
Total (CY)					1,167

Table 11: Concrete Columns Take-Off for Concrete

Concrete Slab Take-Off				
Level	**Area (FT^2)**	**Thickness (FT)**	**Volume (CF)**	**Volume (CY)**
P3	46597	4.5	209687	7766
	46597	0.5	23299	863
P2	46597	0.75	34948	1294
P1	46597	0.75	34948	1294
Lower	46597	0.75	34948	1294
Ground	46597	0.75	34948	1294
2nd	48616	1	48616	1801
3rd	49602	1	49602	1837
4th	46801	1	46801	1733
5th	51622	1	51622	1912
6th	53585	1	53585	1985
7th	53867	1	53867	1995
8th	45411	1	45411	1682
9th	32696	1	32696	1211
10th	32969	1	32969	1221
Roof	32969	1	32969	1221
Penthouse	12750	1	12750	472
Subtotal (CY)				30,876
Waste Factor (5%)				1.05
Total (CY)				32,420

Appendix D

Detail CIP Concrete System Estimate Take-Offs

Table 1: CIP Concrete Column Take-Off for Concrete

CIP Concrete Column Take-Off						
Level	**Number of Columns**	**Length (FT)**	**Width (FT)**	**Height (FT)**	**Volume (CF)**	**Volume (CY)**
10th	8	2	2	12.75	408	15
9th	8	2	2	11.75	376	14
8th	8	2	2	11.75	376	14
7th	8	2	2	11.75	376	14
6th	8	2	2	11.75	376	14
5th	6	2	2	11.75	282	10
Ramp 1	1	2	2	27.42	110	4
Ramp 2	1	2	2	32.22	129	5
Ramp 3	1	2	2	25.12	100	4
Ramp 4	1	2	2	29.92	120	4
Ramp 5	1	2	2	20	80	3
Ramp 6	1	2	2	20	80	3
Ramp 7	1	2	2	20	80	3
Ramp 8	1	2	2	20	80	3
Ramp 9	1	2	2	20	80	3
Ramp 10	1	2	2	20	80	3
Ramp 11	1	2	2	20	80	3
Ramp 12	1	2	2	33.94	136	5
Ramp 13	1	2	2	35.91	144	5
Ramp 14	1	2	2	28.51	114	4
Ramp 15	1	2	2	30.27	121	4
Ramp 16	1	2	2	32.11	128	5
Ramp 17	1	2	2	34.03	136	5
Ramp 18	1	2	2	35.99	144	5
Subtotal (CY)						153
Waste Factor (5%)						1.05
Total (CY)						**161**

Table 2: CIP Concrete Girder Take-Off for Concrete

CIP Concrete Girder Take-Off						
Level	**Number of Columns**	**Length (FT)**	**Width (FT)**	**Height (FT)**	**Volume (CF)**	**Volume (CY)**
Roof	7	20	2	1.58	442	16
10th	7	20	2	1.58	442	16
9th	7	20	2	1.58	442	16
8th	7	20	2	1.58	442	16
7th	7	20	2	1.58	442	16
6th	7	20	2	1.58	442	16
5th	7	20	2	1.58	442	16
All	6	12	2	1.58	228	8
All	7	8.25	2	1.58	182	7
				Subtotal (CY)		130
				Waste Factor (5%)		1.05
				Total (CY)		**136**

Table 3: CIP Concrete Beam Take-Off for Concrete

CIP Concrete Beam Take-Off						
Level	**Number of Columns**	**Length (FT)**	**Width (FT)**	**Height (FT)**	**Volume (CF)**	**Volume (CY)**
Roof	17	37	2	1.58	1988	74
10th	17	37	2	1.58	1988	74
9th	17	37	2	1.58	1988	74
8th	17	37	2	1.58	1988	74
7th	17	37	2	1.58	1988	74
6th	17	37	2	1.58	1988	74
5th	12	37	2	1.58	1403	52
				Subtotal (CY)		494
				Waste Factor (5%)		1.05
				Total (CY)		**518**

Table 4: CIP Concrete Slab Take-Off for Concrete

CIP Concrete Slab Take-Off					
Level	**Width (FT)**	**Length (FT)**	**Thickness (FT)**	**Volume (CF)**	**Volume (CY)**
5th	37	108	0.416	1662	62
6th	37	156	0.416	2401	89
7th	37	156	0.416	2401	89
8th	37	156	0.416	2401	89
9th	37	156	0.416	2401	89
10th	37	156	0.416	2401	89
Roof	37	156	0.416	2401	89
Subtotal (CY)					595
Waste Factor (5%)					1.05
Total (CY)					**625**

Table 5: CIP Concrete Slab and Curb Take-Off for Formwork

CIP Concrete Slab and Curb Take-Off					
Level	**Sides**	**Width (FT)**	**Length (FT)**	**Thickness (FT)**	**Contact Area (SF)**
5th	1	37	108	x	3996
				Subtotal (SFCA)	3996
				Waste Factor (5%)	1.05
				Total (SFCA)	**4196**
5th	1	x	108	0.416	11
5th	2	x	37	0.416	8
6th	1	37	156	x	1443
6th	1	x	156	0.416	16
6th	2	x	37	0.416	31
7th	1	37	156	x	1443
7th	1	x	156	0.416	16
7th	2	x	37	0.416	8
8th	1	37	156	x	1443
8th	1	x	156	0.416	16
8th	2	x	37	0.416	8
9th	1	37	156	x	1443
9th	1	x	156	0.416	16
9th	2	x	37	0.416	8
10th	1	37	156	x	1443
10th	1	x	156	0.416	16
10th	2	x	37	0.416	8
Roof	1	37	156	x	1443
Roof	1	x	156	0.416	16
Roof	2	x	37	0.416	8
				Subtotal Slab (SFCA)	8658
				Waste Factor (5%)	1.05
				Total Slab (SFCA)	**9091**
				Subtotal Curb(SFCA)	186
				Waste Factor (5%)	1.05
				Total Curb(SFCA)	**195**

Table 6: CIP Concrete Beam Take-Off for Formwork

Concrete Beam Take-Off					
Level	**Number of Columns**	**Sides**	**Length (FT)**	**Height (FT)**	**Contact Area (SF)**
Roof	17	2	37	1.58	497
Roof	17	1	37	2	315
10th	17	2	37	1.58	497
10th	17	1	37	2	315
9th	17	2	37	1.58	497
9th	17	1	37	2	315
8th	17	2	37	1.58	497
8th	17	1	37	2	315
7th	17	2	37	1.58	497
7th	17	1	37	2	315
6th	17	2	37	1.58	497
6th	17	1	37	2	315
5th	12	2	37	1.58	351
5th	12	1	37	2	222
Subtotal (SFCA)					5,441
Waste Factor (5%)					1.05
Total (SFCA)					**5,713**

Table 7: CIP Concrete Column Take-Off for Formwork

Concrete Column Form Take-Off					
Level	**Number of Columns**	**Sides**	**Width (FT)**	**Height (FT)**	**Contact Area (SF)**
10th	8	4	2	12.75	204
9th	8	4	2	11.75	188
8th	8	4	2	11.75	188
7th	8	4	2	11.75	188
6th	8	4	2	11.75	188
5th	6	4	2	11.75	141
Subtotal (SFCA)					1,097
Waste Factor (5%)					1.05
Total (SFCA) of 4 use					**1,152**
Ramp 1	1	4	2	27.42	219
Ramp 2	1	4	2	32.22	258
Ramp 3	1	4	2	25.12	201
Ramp 4	1	4	2	29.92	239
Ramp 5	1	4	2	20	160
Ramp 6	1	4	2	20	160
Ramp 7	1	4	2	20	160
Ramp 8	1	4	2	20	160
Ramp 9	1	4	2	20	160
Ramp 10	1	4	2	20	160
Ramp 11	1	4	2	20	160
Ramp 12	1	4	2	33.94	272
Ramp 13	1	4	2	35.91	287
Ramp 14	1	4	2	28.51	228
Ramp 15	1	4	2	30.27	242
Ramp 16	1	4	2	32.11	257
Ramp 17	1	4	2	34.03	272
Ramp 18	1	4	2	35.99	288
Subtotal (SFCA)					3,884
Waste Factor (5%)					1.05
Total (SFCA) of 1 use					**4,078**

Table 8: CIP Concrete Girder Take-Off for Formwork

Concrete Girder Form Take-Off					
Level	**Number of Columns**	**Sides**	**Length (FT)**	**Height (FT)**	**Contact Area (SF)**
Roof	7	2	20	1.58	111
Roof	7	1	20	2	70
10th	7	2	20	1.58	111
10th	7	1	20	2	70
9th	7	2	20	1.58	111
9th	7	1	20	2	70
8th	7	2	20	1.58	111
8th	7	1	20	2	70
7th	7	2	20	1.58	111
7th	7	1	20	2	70
6th	7	2	20	1.58	111
6th	7	1	20	2	70
5th	7	2	20	1.58	111
5th	7	1	20	2	70
All	6	2	12	1.58	57
All	6	1	12	2	36
All	7	2	8.25	1.58	46
All	7	1	8.25	2	29
Subtotal (SFCA)					1,432
Waste Factor (5%)					1.05
Total (SFCA)					**1,503**

Table 9: CIP Concrete Column Take-Off for Formwork

Composite Decking : Rebar						
Rebar Location	**Level**	**No. of Bars (#)**	**Bar No. (#)**	**Length of Bar (FT)**	**LBS/FT**	**Total (LBS)**
Floor Slab	5th	76	6	108	1.5025	12,332.52
	5th	119	6	37	1.5025	6,615.51
	6th	76	6	108	1.5025	12,332.52
	6th	76	6	50	1.5025	5,709.50
	6th	174	6	37	1.5025	9,673.10
	7th	76	6	108	1.5025	12,332.52
	7th	76	6	50	1.5025	5,709.50
	7th	174	6	37	1.5025	9,673.10
	8th	76	6	108	1.5025	12,332.52
	8th	76	6	50	1.5025	5,709.50
	8th	174	6	37	1.5025	9,673.10
	9th	76	6	108	1.5025	12,332.52
	9th	76	6	50	1.5025	5,709.50
	9th	174	6	37	1.5025	9,673.10
	10th	76	6	108	1.5025	12,332.52
	10th	76	6	50	1.5025	5,709.50
	10th	174	6	37	1.5025	9,673.10
	Roof	76	6	108	1.5025	12,332.52
	Roof	76	6	50	1.5025	5,709.50
	Roof	174	6	37	1.5025	9,673.10
Beams	5th	144	6	37	1.5025	8,005.32
	5th	384	3	1.3	0.376	187.70
	6th	204	6	37	1.5025	11,340.87
	6th	544	3	1.3	0.376	265.91
	7th	204	6	37	1.5025	11,340.87
	7th	544	3	1.3	0.376	265.91
	8th	204	6	37	1.5025	11,340.87
	8th	544	3	1.3	0.376	265.91
	9th	204	6	37	1.5025	11,340.87
	9th	544	3	1.3	0.376	265.91
	10th	204	6	37	1.5025	11,340.87
	10th	544	3	1.3	0.376	265.91
	Roof	204	6	37	1.5025	11,340.87
	Roof	544	3	1.3	0.376	265.91
Girder	5th	60	6	37	1.5025	3,335.55
	5th	240	3	1.3	0.376	117.31
	6th	85	6	37	1.5025	4,725.36

	6th	340	3	1.3	0.376	166.19
	7th	85	6	37	1.5025	4,725.36
	7th	340	3	1.3	0.376	166.19
	8th	85	6	37	1.5025	4,725.36
	8th	340	3	1.3	0.376	166.19
	9th	85	6	37	1.5025	4,725.36
	9th	340	3	1.3	0.376	166.19
	10th	85	6	37	1.5025	4,725.36
	10th	340	3	1.3	0.376	166.19
	Roof	85	6	37	1.5025	4,725.36
	Roof	340	3	1.3	0.376	166.19
Columns	Ramp	1	10	27.42	4.303	117.99
	Ramp	55	3	1.75	0.376	36.19
	Ramp	1	10	32.22	4.303	138.64
	Ramp	65	3	1.75	0.376	42.77
	Ramp	1	10	25.12	4.303	108.09
	Ramp	51	3	1.75	0.376	33.56
	Ramp	1	10	29.92	4.303	128.75
	Ramp	60	3	1.75	0.376	39.48
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	20	4.303	86.06
	Ramp	40	3	1.75	0.376	26.32
	Ramp	1	10	33.94	4.303	146.04
	Ramp	68	3	1.75	0.376	44.74
	Ramp	1	10	35.91	4.303	154.52
	Ramp	72	3	1.75	0.376	47.38
	Ramp	1	10	28.51	4.303	122.68
	Ramp	58	3	1.75	0.376	38.16
	Ramp	1	10	30.27	4.303	130.25
	Ramp	61	3	1.75	0.376	40.14
	Ramp	1	10	32.11	4.303	138.17
	Ramp	65	3	1.75	0.376	42.77

	Ramp	1	10	34.03	4.303	146.43
	Ramp	69	3	1.75	0.376	45.40
	Ramp	1	10	35.99	4.303	154.86
	Ramp	72	3	1.75	0.376	47.38
	5th	48	10	11.75	4.303	2,426.89
	5th	24	3	1.75	0.376	15.79
	6th	48	10	11.75	4.303	2,426.89
	6th	24	3	1.75	0.376	15.79
	7th	48	10	11.75	4.303	2,426.89
	7th	24	3	1.75	0.376	15.79
	8th	48	10	11.75	4.303	2,426.89
	8th	24	3	1.75	0.376	15.79
	9th	48	10	11.75	4.303	2,426.89
	9th	24	3	1.75	0.376	15.79
	10th	48	10	12.75	4.303	2,633.44
	10th	26	3	1.75	0.376	17.11
				Subtotal (LBS)		313,470
				Waste Factor (5%)		1.05
				Total (LBS)		**329,143**
				Total (TON)		**165**

Appendix E

General Conditions Estimate

Table 1: General Conditions Estimate

General Conditions Estimate					
Activity	**Qty.**	**Unit**	**Rate**	**Cost**	**Total Cost**
Supervision					
Senior Project Manager	131	WK	$2,100	$275,100	
Assistant Project Manager	131	WK	$1,850	$242,350	
Senior Project Engineer	393	WK	$1,125	$442,125	
Project Engineer	262	WK	$865	$226,630	
MEP Coordinator	131	WK	$1,300	$170,300	
Superintendent	131	WK	$2,100	$275,100	
Assistant Superintendent	70	WK	$1,600	$112,000	
Field Engineer	131	WK	$1,300	$170,300	
Instumant Man	131	WK	$865	$113,315	
Rodman	131	WK	$865	$113,315	
Safety Manager		LS	$10,000	$10,000	
Office Manager	131	WK	$750	$98,250	
Supervision Subtotal					**$2,248,785**
Temporary Facilities					
Jobsite Office	24	MO	$2,500	$60,000	
Telephone/Fax	30	MO	$850	$25,500	
Cell Phone Usage	30	MO	$85	$2,550	
Temporary Toilets	30	MO	$625	$18,750	
Office Equipment	30	MO	$1,000	$30,000	
Office Supplies	30	MO	$610	$18,300	
Field Office Set-Up	1	LS	$9,200	$9,200	
Sales Tax (Materials)	5.75%			$9,447	
Temporary Facilities Subtotal					**$173,747**
Temporary Utilities					
Electric	30	MO	$1,950	$58,500	
Water	1	LS	$5,600	$4,600	
Ethernet	30	MO	$435	$13,050	
Sales Tax (Materials)	5.75%			$4,379	
Temporary Utilities Subtotal					**$80,529**

Equipment Rental					
Storage Trailer	30	MO	$110	$3,300	
Surveying Instruments	1	LS	$7,450	$7,450	
Sales Tax (Materials)	5.75%			$618	
Equipment Rental Subtotal					**$11,368**
General Costs					
Fees for Public Parking	240	WK	$100	$24,000	
Photographs	30	MO	$150	$4,500	
Small Tools	30	MO	$360	$10,800	
Permits				$25,000	
Blue Prints	30	MO	$340	$10,200	
Temporary Fencing	450	LF	$22	$9,900	
Drug Testing	1	LS	$300	$300	
Construction Sign	30	MO	$27	$810	
Temporary Building Enclosures	1	LF	$17,500	$17,500	
Temporary Waterproofing	1	LF	$3,750	$3,750	
Performance Bond		LS	$18,530	$18,530	
Builder's Risk Insurance			$25,000	$25,000	
Jersey Barriers	30	WK	$60	$1,800	
Fire Extinguishers	1	LS	$5,400	$5,400	
Security	30	MO	$1,350	$40,500	
Trash Disposal	30	MO	$7,500	$225,000	
First Aid Kits & Supplies	1	EA	$175	$175	
Protection & Life Saving Equipment	30	MO	$1,375	$41,250	
Potable Water	30	MO	$95	$2,850	
Miscellaneous Items	30	MO	$275	$8,250	
Sales Tax (Materials)	5.75%			$27,342	
General Costs Subtotal					**$478,857**
Location Factor	98.00%				**$59,866**
COMPLETE TOTAL					**$3,053,152**

Appendix F

CIP Concrete Structural Hand Calculations

A

LOADING:
LIVE = 100PSF
DEAD = 10PSF (Before Concrete)

$W_u = 1.2(10) + 1.6(100) = 172\ PSF$

MATERIAL:
$f'_c = 4000\ PSI$
$f_y = 60KSI$

MINIMUM SLAB THICKNESS:

- ASSUME COLUMNS ARE 24" X 24"

$l_n = 10' - 2' = 8'$

- FROM ACI 318-08 TABLE 9.5 $h \geq l_n/28$

$h \geq (8' \times 12)/28 = 3.43" \Rightarrow \boxed{h = 5"}$ ∴ fire protection min. 4.5"

SLAB CONTRIBUTION TO DEAD LOAD:

- SLAB WEIGHT = $150PCF \times \frac{5"}{12"} = 62.5PSF$

- $W_{SLAB} = 1.2(62.5PSF) = \boxed{75\ PSF}$

TOTAL LOAD:

- $W_u = 172\ PSF + 75\ PSF = 247\ PSF$

MOMENT VALUES USING ACI COEFFICIENTS:

- AT INTERIOR SUPPORTS: $-M = \left(\frac{1}{10}\right) W_u l_n^2 = \left(\frac{1}{10}\right)(247)(8)^2 = 1.58K\text{-}ft$
- AT MID SPAN: $+M = \left(\frac{1}{16}\right) W_u l_n^2 = \left(\frac{1}{16}\right)(247)(8)^2 = 0.988K\text{-}ft$
- UNFACTORED: $M_u = \frac{(100 + 62.5 + 10)(8)^2}{8} = 1.38\ K\text{-}ft$

Reference CIP Concrete Structure Hand Calculations

B

REQUIRED REINFORCEMENT:

- $\rho_{max} = 0.85\beta(f'_c/f_y)\left[\frac{\varepsilon_s}{\varepsilon_s+\varepsilon_t}\right]$
- $\rho_{max} = 0.85(0.85)\left(\frac{4}{60}\right)\left[\frac{0.003}{0.003+0.004}\right] = 0.0206$

EFFECTIVE DEPTH:

- $kd^2 = 20(M_u)$

$(12")\,d^2 = 20(1.38)$

$d = 1.52"$ ——— 3.75 See prev. Thick.

AREA OF STEEL REQUIRED PER FOOT IN TOP OF SLAB:

- $A_s = \frac{M_u}{4d} = \frac{1.38}{4(1.52")} = 0.23\ in^2$

USE #6 @ 12" ($A_s = 0.44\ in^2$)

AREA OF STEEL REQUIRED PER FOOT @ MIDSPAN:

- $A_s = \frac{M_u}{4d} = \frac{0.988}{4(1.52")} = 0.1625\ in^2$

USE #6 @ 12" ($A_s = 0.44\ in^2$)

MINIMUM STEEL FOR SHRINKAGE & TEMPERATURE:

- $A_{s\,min} = .0018(12")(5") = 0.108\ in^2$
- $A_{s\,min} = 0.108 < A_s = 0.44\ in^2$ ∴ OK

USE #6 @ 12"

Reference CIP Concrete Structure Hand Calculations

C

CHECK SHEAR

- SHEAR IN END MEMBERS @ FIRST INTERIOR SUPPORT

$V_u = \frac{1.15 w_u l_n}{2} = \frac{1.15(.247)(8')}{2} = 1.14^K$

- SHEAR AT OTHER SUPPORT

$V_u = \frac{w_u l_n}{2} = \frac{(247)(8')}{2} = 0.988$

- ALLOWABLE SHEAR

$\phi V_n = 0.75(2)\sqrt{f'c}\, bd = 0.75(2)\sqrt{4000}(12)(1.52) = 1.73^K$

$V_u < \phi V_n \therefore$ OK

CHECK DEFLECTION

$\Delta = \frac{5wl^4}{384EI} = \frac{5(.247\ KSF)(37')(10')^4 1728\ in^3/ft^3}{384(3605\ KSI)(17280\ in^4)} = 0.033"$

$I = \frac{(10' \times 12"/ft)(12")^3}{12} = 17280\ in^4$ $\quad E = 57000\sqrt{4000} = 3605\ KSI$

$\Delta_{max} = \frac{l}{240} = \frac{10 \times 12}{240} = 0.5"$ $\quad \boxed{\Delta < \Delta_{max} \therefore OK}$

GIRDER DESIGN #1

LOADING:

DEAD = 62.5PSF + 10PSF = 72.5PSF + GIRDER WT
LIVE = 100PSF
* NO LIVE LOAD REDUCTION TO BE CONSERVATIVE

Slab $w_u = 1.2(72.9) + 1.6(100) = 247$ PSF

Bm $w_u = \frac{(24"\times 19"/12)(150PCF)}{10'}(1.2) = 57$ PSF

Total $w_u = 304$ PSF or 0.304 KSF

Reference CIP Concrete Structure Hand Calculations

D

MAXIMUM MOMENT DETERMINATION

- M_{max} @ ENDS $= \frac{wl^2}{12} = \frac{(0.304\ KSF)(10')(37')^2}{12} = 346.8$ K-ft
- M_{max} @ MID $= \frac{wl^2}{24} = \frac{(0.304\ KSF)(10')(37')^2}{24} = 173.4$ K-ft

$M_{max} = 346.8$ K-ft

GIRDER SIZE

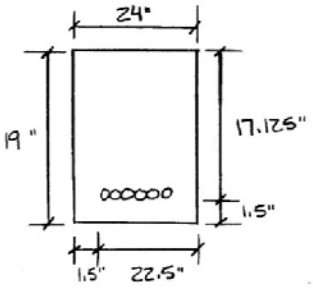
$bd^2 = 20M_u$
$(24")d^2 = 20(346.8)$
$d = 17"$ try #6's

$h = d + 1.5 + .75/2 = 15.32 + 1.5 + .375$
$h = 18.875"$
$h = 19"$

$d = 19" - 1.5 - .375 = 17.125"$

$A_s = \frac{M_u}{4d} = \frac{346.8}{4(17.125)} = 5.06\ in^2$

TRY (12) #6's, $A_s = 5.28\ in^2$



ASSUME $f_s > f_y$

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(5.28)(60)}{0.85(4)(24")} = 3.88"$

$c = a/\beta_1 = 3.88"/0.85 = 4.56"$

CHECK $f_s > f_y$

$f_s = \frac{\varepsilon_u}{c}(d-c) = \frac{0.003}{4.56}(17.125 - 4.56) = 0.0082 > 0.005$ ∴ OK

$\phi M_n = \phi A_s f_y (d - a/2) = 0.9(5.28)(60)(17.125 - 3.88/2) = 4329.5$ K-in

$\frac{4329.5\ K\text{-in}}{12"} = 360.8$ K-ft

$\phi M_n = 360.8$ K-ft > 346.8 K-ft

Reference CIP Concrete Structure Hand Calculations

E

CHECK SHEAR

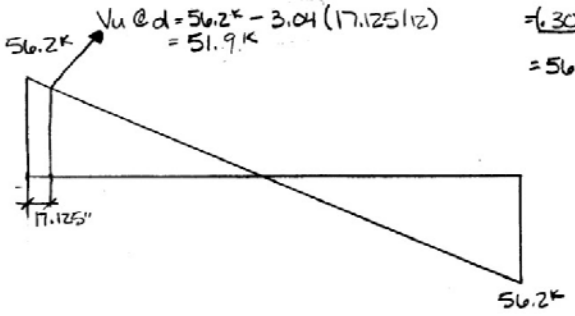
$V_n = V_c + V_s$ $\quad \phi V_n \geq V_u$

• SHEAR STRENGTH OF CONCRETE BM W/O STIRRUPS

$V_c = 2\lambda\sqrt{f'c}\, b_w \cdot d = 2\sqrt{4000}(24)(17.125) = 52^K$

$\phi V_n = 0.5\phi V_c = 0.5(0.75)(52^K) = 19.5^K$

• DETERMINE SHEAR STRENGTH REQUIRED BY REINFORCING



$= \frac{(.304)(10') \times 37'}{2}$
$= 56.2^K$

$V_s = \frac{V_u}{\phi} - V_c = \frac{51.9^K}{0.75} - 52^K = 17.2^K$

$V_s \leq 8\sqrt{f'c}\, b_w d = 8\sqrt{4000}(24)(17.125)/1000 = 208^K$

$17.2^K < 208^K$ ∴ OK

DETERMINE MAXIMUM SPACING OF SHEAR REINFORCING

• IF $V_s \leq 4\sqrt{f'c}\, b_w d = 104^K$ THEN $S_{max} = \min\begin{cases} d/2 = 17.125/2 = 8.5" \\ 24" \end{cases}$

$V_s = 7.53^K < 979.04^K$ ELSE $S_{max} = \begin{cases} d/4 \\ 12" \end{cases}$

$\boxed{S = 8"}$

Reference CIP Concrete Structure Hand Calculations

F

DETERMINE MINIMUM SHEAR REINFORCEMENT

- $A_{v\min} = \max\begin{cases} 0.75\sqrt{f'_c}\, b_w s / f_{yt} = 0.75\sqrt{4000}(24)(8)/60000 = 0.152\ in^2 \\ 50 b_w s / f_{yt} = 50(24)(8)/60000 = 0.16\ in^2 \end{cases}$

$A_{v\min} = 0.16 in^2$

Use # 3 STIRRUPS @ 8" AS MINIMUM SHEAR REINFORCEMENT
(2 LEGS = $2(0.11 in^2) = 0.22 in^2 > 0.16 in^2$ ∴ OK)

DESIGN SHEAR REINFOREMENT

$V_s = A_v f_{yt} d / S$
$S = A_v f_{yt} d / V_s = (0.22 in^2)(60)(17.125)/17.2^k = 13.1$ "

Use (2) #3 @ 13.1" AT MEMBER ENDS, STARTING 2" FROM FACE OF SUPPORT

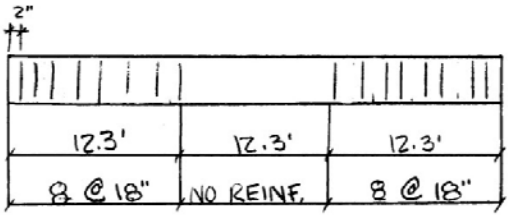
FIND WHERE (2) #3 @24" WORK

$\phi V_n = \phi V_c + \phi V_s = 0.75\left(52^k + \frac{0.22(60)(17.125)}{24}\right) = 55.3^k$

DIST. WHERE $V_u = 55.3^k$

$x = \frac{(56.2 - 55.3)(12\ in/ft)}{3.04} = 3.55" \Rightarrow$ NO REINF.

ACI 11.4.6 (min # of Bars)
STIRRUPS: (2)# 3 STIRRUPS: 1 @ 2" ; 8 @18"



Reference CIP Concrete Structure Hand Calculations

G

GIRDER DESIGN #2

LOADING: DEAD = 10PSF + 47.5PSF (Girder)

$w_u = 1.2(57.5) = 69$ PSF or 0.069 KSF

MAXIMUM MOMENT DETERMINATION

- M_{max} @ END $= \frac{wl^2}{12} = \frac{(0.069\ KSF)(20')^2}{12} = 2.3^{K\text{-}ft}$
- M_{max} @ MID $= \frac{wl^2}{24} = \frac{(0.069\ KSF)(20')^2}{24} = 1.15^{K\text{-}ft}$
- M_{max} @ END & MID $= \frac{Pl}{8} = \frac{(56.2^K)(20')}{8} = 140.5^{K\text{-}ft}$

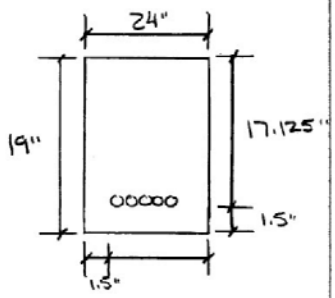
M_{max} @ END $= 142.8^{K\text{-}ft}$ M_{max} @ MID $= 141.65^{K\text{-}ft}$

GIRDER SIZE

$h = 19"$

$d = 17.125"$

$A_s = \frac{M_u}{4d} = \frac{142.8}{4(17.125")} = 2.08\ in^2$



TRY (5) #6's, $A_s = 2.2\ in^2$

Assume $f_s > f_y$

$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(2.2)(60)}{0.85(4)(24")} = 1.62"$

$c = a/\beta_1 = 1.62"/0.85 = 1.91"$

CHECK $f_s > f_y$

$f_s = \frac{\varepsilon_u (d-c)}{c} = \frac{0.003(17.125 - 1.91)}{1.91} = 0.0238 > 0.005$ ∴ OK

$\phi M_n = \phi A_s f_y (d - a/2) = 0.9(2.2)(60)(17.125 - 1.62/2) = 1762^{K\text{-}in}$

$\frac{1762^{K\text{-}in}}{12"} = 146.8^{K\text{-}ft}$

$\phi M_n = 146.8\ K\text{-}ft > 142.8\ K\text{-}ft.$

H

CHECK SHEAR

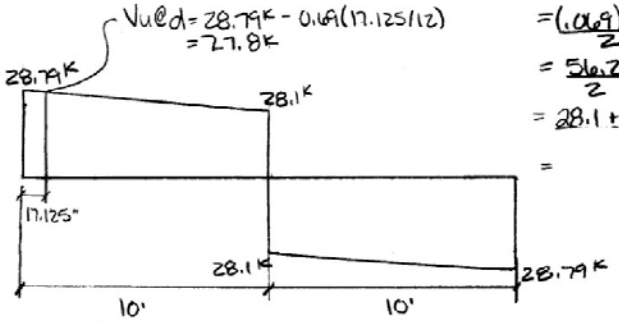
$V_n = V_c + V_s$ $\qquad \phi V_n \geq V_u$

- SHEAR STRENGTH OF CONCRETE BW W/O STIRRUPS

$V_c = 2\lambda\sqrt{f'c}\, b_w d = 2\sqrt{4000}(24)(17.0625) = 52^K$

$\phi V_n = 0.5\phi V_c = 0.5(0.75)(52) = 19.5^K$

- DETERMINE SHEAR STRENGTH REQUIRED BY REINFORCING



$= \frac{(.069)(20')}{2} = 0.69$

$= \frac{56.2}{2} = 28.1$

$= 28.1 + 0.69 = 28.79^K$

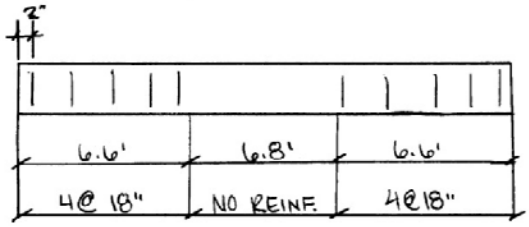
$=$

$V_s = \frac{V_u}{\phi} - V_c = \frac{27.8^K}{0.75} - 52^K = -14.9^K$

ACI 11.4.6

∴ Neg value thus, minimum reinforcement is needed

(2) #3: 1 @ 2"; 4 @ 18"



Reference CIP Concrete Structure Hand Calculations

I

COLUMN DESIGN – PCACOLUMN CLEAR COVER = 1.5"

Wu = 0.247 KSF

- 10th FLOOR – 24" x 24" - (8) #10

  37'/2 = 18.5' TArea = (18.5')(20') = 370 PSF
  Mu = 346.8 K-ft. Load = (370)(.247) = 91.39K

- 9th FLOOR - 24" x 24" – (8) #10
  Wu = ((24/12)(24/12))/18.5' (150)(1.2) = 39 PSF
  LOAD = (.039)(12.75) = .50 K
  TOTAL = 2(91.39) + .50K = 183.28K

- 8th FLOOR - 24" x 24" – (8) #10
  LOAD = (039)(11.75) = 0.46
  TOTAL = 3(91.39) + .50 + .46 = 275.13K

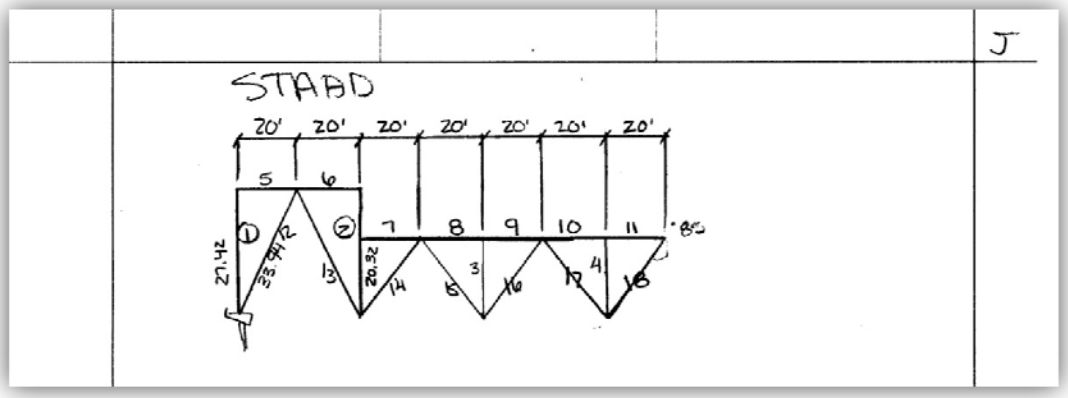
- 7th FLOOR - 24" x 24" – (8) #10
  LOAD = (.039)(11.75) = 0.46
  TOTAL = 4(91.39) + .50 + 2(.46) = 366.98K

- 6th FLOOR - 24" x 24" – (8) #10
  TOTAL = 5(91.39) + .50 + 3(.46) = 458.83K

- 5th FLOOR - 24" x 24" – (8) #10
  TOTAL = 6(91.39) + .50 + 4(.46) = 550.68K

- RAMP –
  Assumed 12" x 12" to acquire Loads on column.
  TOTAL = 7(91.39) + .50 + 5(.46) = 642.53K

Reference CIP Concrete Structure Hand Calculations



Reference CIP Concrete Structure Hand Calculations

Appendix G

CIP Concrete Structural STAAD Pro 2006 Calculations

Reactions

Node	L/C	Horizontal FX (kip)	Vertical FY (kip)	Horizontal FZ (kip)	Moment MX (kip*in)	MY (kip*in)	MZ (kip*in)
1	1:POINT LOAD	215.469	963.795	0.000	0.000	0.000	0.000
3	1:POINT LOAD	-26.774	1.18E 3	0.000	0.000	0.000	0.000
5	1:POINT LOAD	-266.389	1.18E 3	0.000	0.000	0.000	0.000
7	1:POINT LOAD	77.694	1.82E 3	0.000	0.000	0.000	0.000

Beam End Forces

Sign convention is as the action of the joint on the beam.

Beam	Node	L/C	Axial Fx (kip)	Shear Fy (kip)	Shear Fz (kip)	Torsion Mx (kip*in)	Bending My (kip*in)	Bending Mz (kip*in)
1	1	1:POINT LOAD	642.530	0.000	0.000	0.000	0.000	0.000
	15	1:POINT LOAD	-642.530	0.000	0.000	0.000	0.000	0.000
2	3	1:POINT LOAD	642.530	0.000	0.000	0.000	0.000	0.000
	17	1:POINT LOAD	-642.530	0.000	0.000	0.000	0.000	0.000
3	5	1:POINT LOAD	642.530	0.000	0.000	0.000	0.000	0.000
	11	1:POINT LOAD	-642.530	0.000	0.000	0.000	0.000	0.000
4	7	1:POINT LOAD	642.530	0.000	0.000	0.000	0.000	0.000
	13	1:POINT LOAD	-642.530	0.000	0.000	0.000	0.000	0.000
5	15	1:POINT LOAD	0.000	0.000	0.000	0.000	0.000	0.000
	16	1:POINT LOAD	-0.000	0.000	0.000	0.000	0.000	0.000

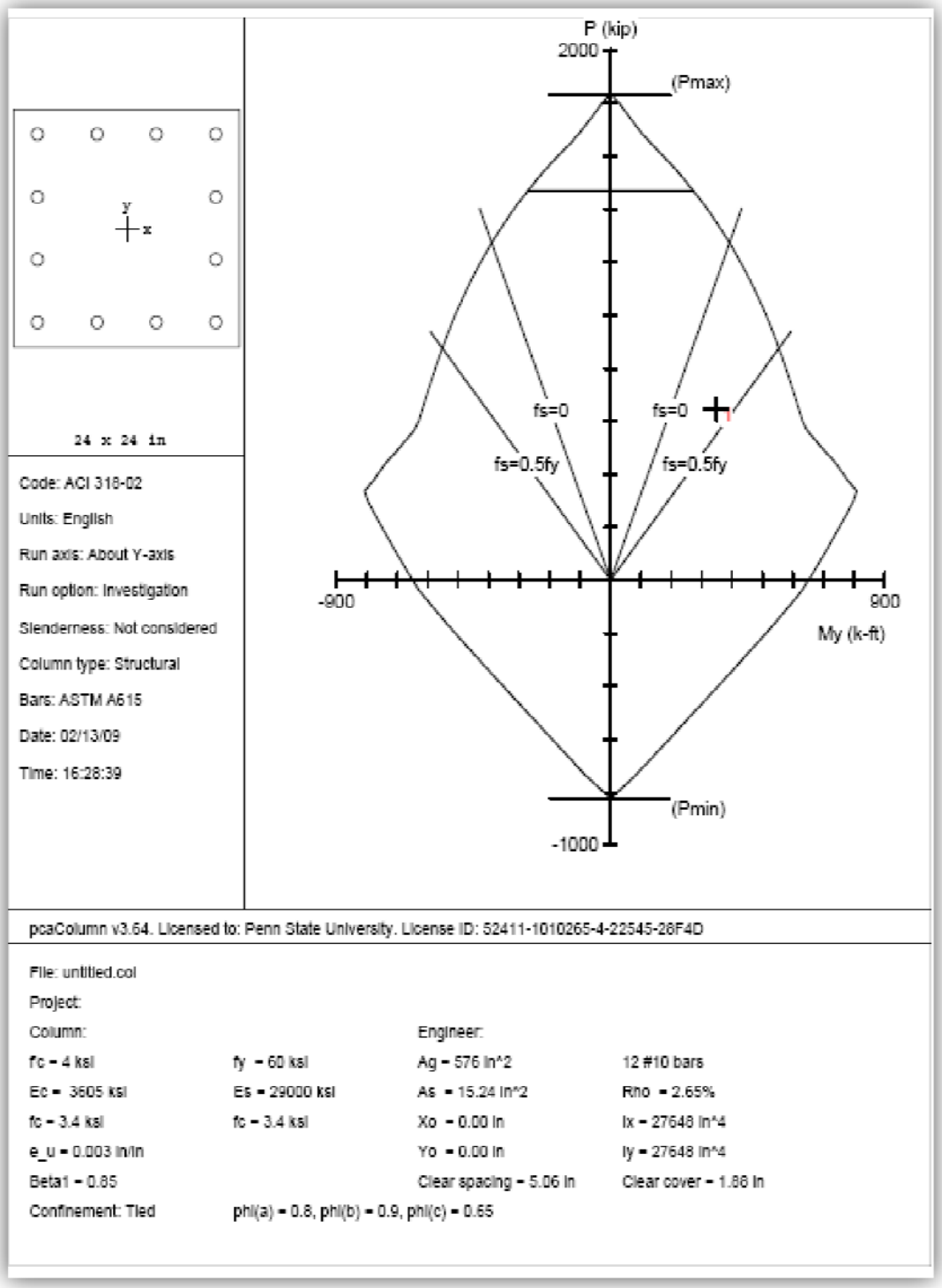
Beam End Forces Cont...

Beam	Node	L/C	Axial Fx (kip)	Shear Fy (kip)	Shear Fz (kip)	Torsion Mx (kip*in)	Bending My (kip*in)	Bending Mz (kip*in)
6	16	1:POINT LOAD	0.000	0.000	0.000	0.000	0.000	0.000
	17	1:POINT LOAD	0.000	0.000	0.000	0.000	0.000	0.000
7	9	1:POINT LOAD	-0.000	0.000	0.000	0.000	0.000	0.000
	10	1:POINT LOAD	0.000	0.000	0.000	0.000	0.000	0.000
8	10	1:POINT LOAD	-171.455	0.000	0.000	0.000	0.000	0.000
	11	1:POINT LOAD	171.455	0.000	0.000	0.000	0.000	0.000
9	11	1:POINT LOAD	-171.455	0.000	0.000	0.000	0.000	0.000
	12	1:POINT LOAD	171.455	0.000	0.000	0.000	0.000	0.000
10	12	1:POINT LOAD	-432.580	0.000	0.000	0.000	0.000	0.000
	13	1:POINT LOAD	432.580	0.000	0.000	0.000	0.000	0.000
11	13	1:POINT LOAD	-432.580	0.000	0.000	0.000	0.000	0.000
	14	1:POINT LOAD	432.580	0.000	0.000	0.000	0.000	0.000
12	1	1:POINT LOAD	386.831	0.000	0.000	0.000	0.000	0.000
	16	1:POINT LOAD	-386.831	0.000	0.000	0.000	0.000	0.000
13	3	1:POINT LOAD	386.831	0.000	0.000	0.000	0.000	0.000
	16	1:POINT LOAD	-386.831	0.000	0.000	0.000	0.000	0.000
14	3	1:POINT LOAD	285.579	0.000	0.000	0.000	0.000	0.000
	10	1:POINT LOAD	-285.579	0.000	0.000	0.000	0.000	0.000
15	5	1:POINT LOAD	543.217	0.000	0.000	0.000	0.000	0.000
	10	1:POINT LOAD	-543.217	0.000	0.000	0.000	0.000	0.000
16	5	1:POINT LOAD	157.410	0.000	0.000	0.000	0.000	0.000
	12	1:POINT LOAD	-157.410	0.000	0.000	0.000	0.000	0.000
17	7	1:POINT LOAD	598.417	0.000	0.000	0.000	0.000	0.000
	12	1:POINT LOAD	-598.417	0.000	0.000	0.000	0.000	0.000
18	7	1:POINT LOAD	816.212	0.000	0.000	0.000	0.000	0.000
	14	1:POINT LOAD	-816.212	0.000	0.000	0.000	0.000	0.000

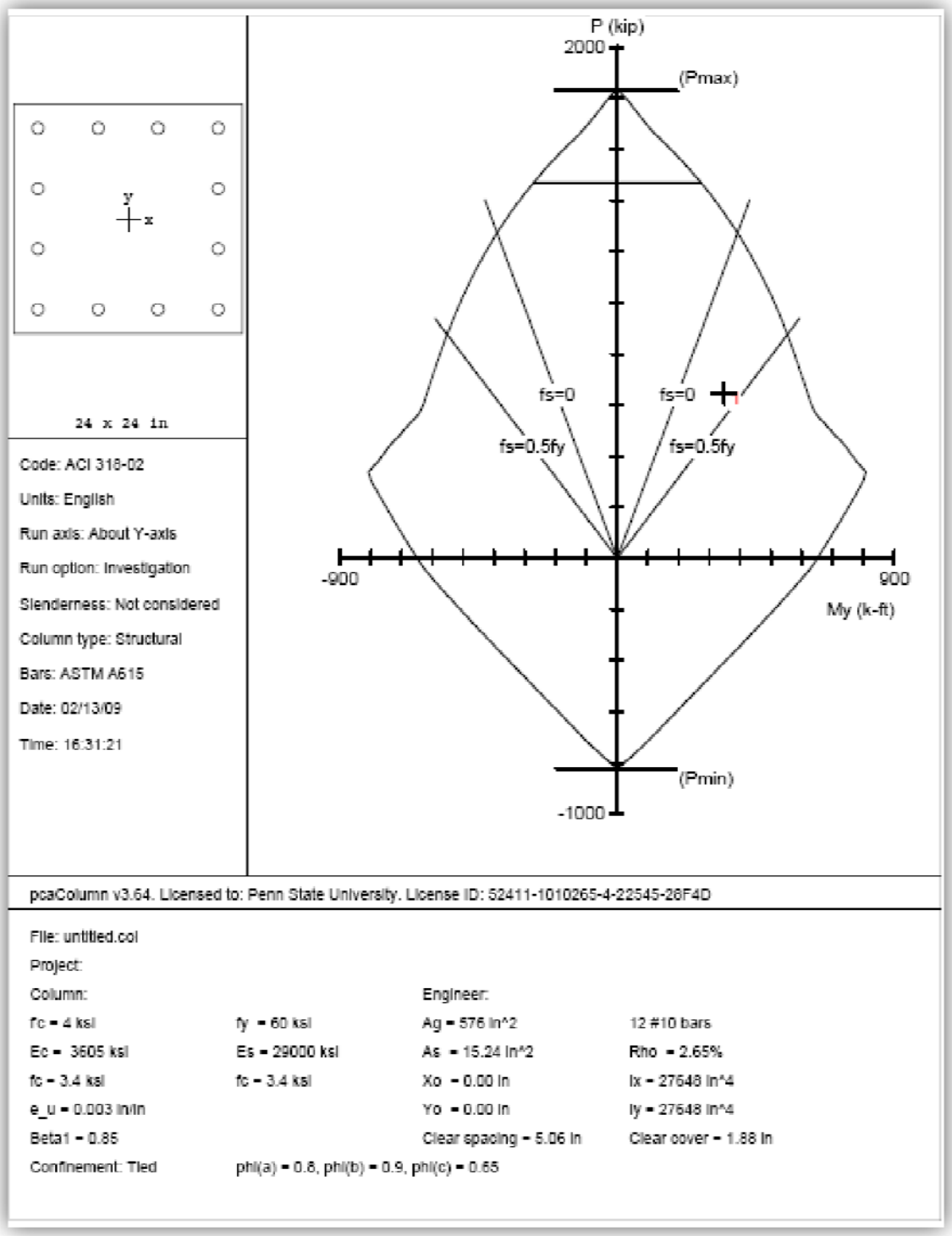
Reference CIP Concrete Structure STAAD Pro 2006 Calculations

Appendix H

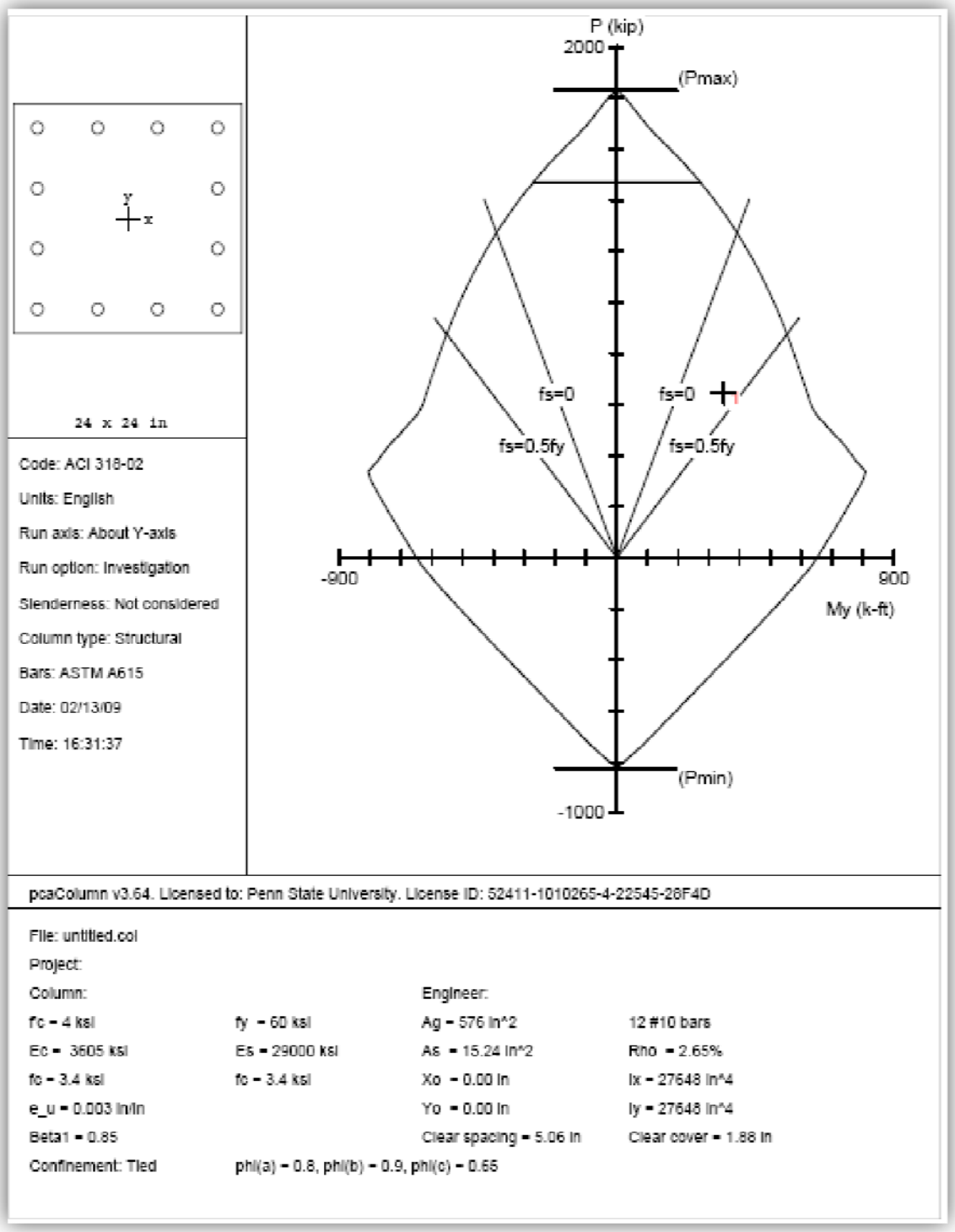
CIP Concrete Structural PCAColumn Calculations



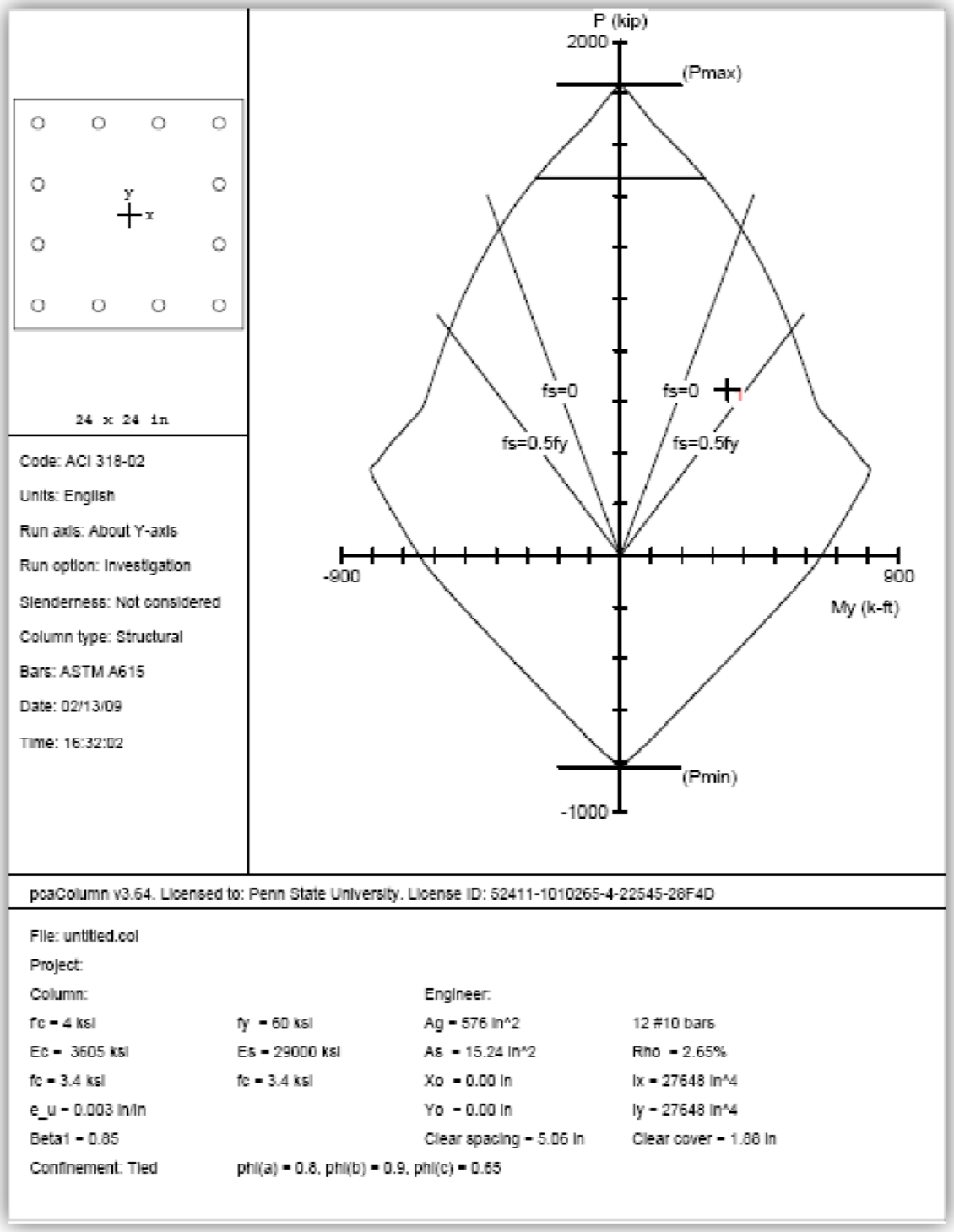
Reference CIP Concrete Structural PCAColumn Calculations – Column #1



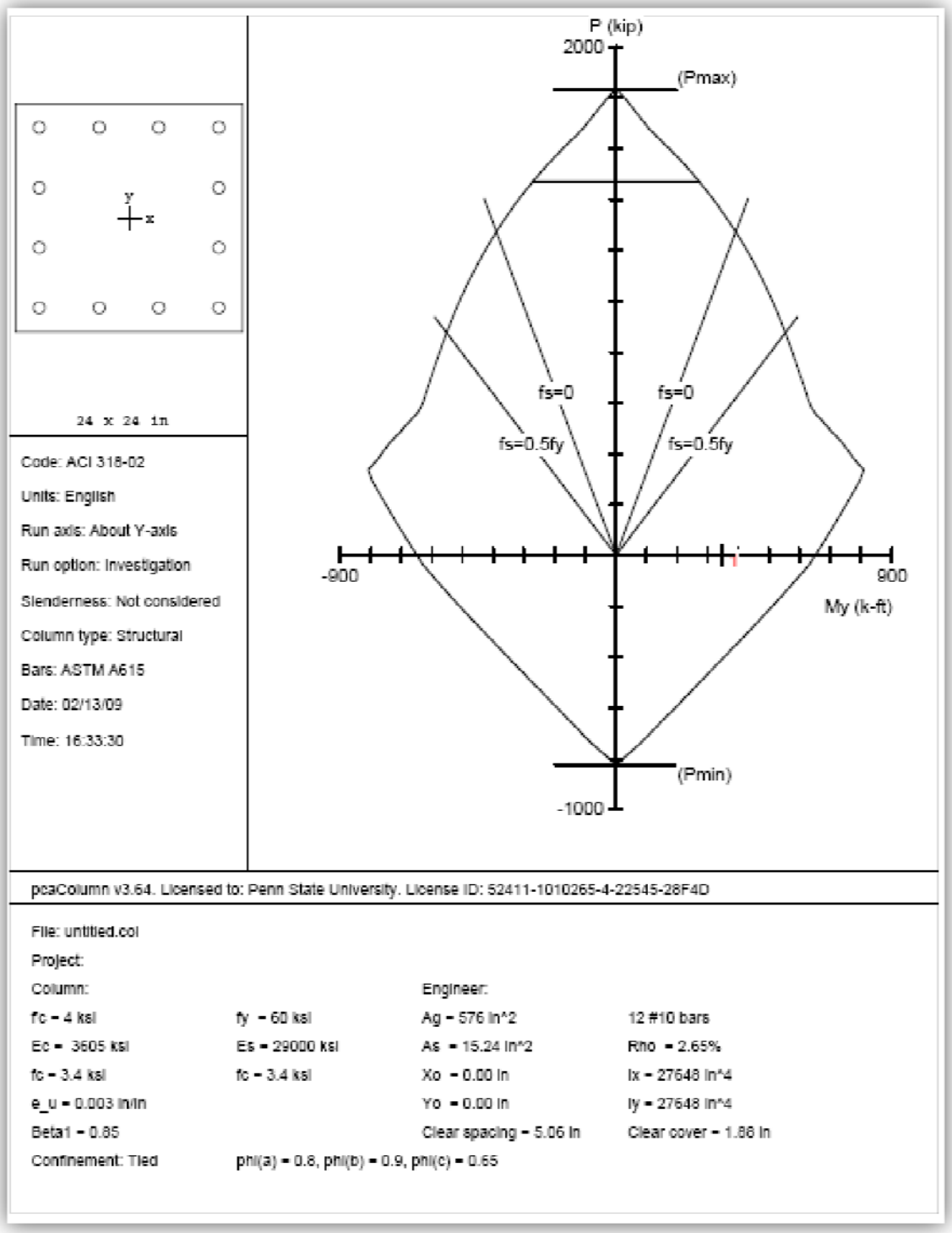
Reference CIP Concrete Structural PCAColumn Calculations – Column #2



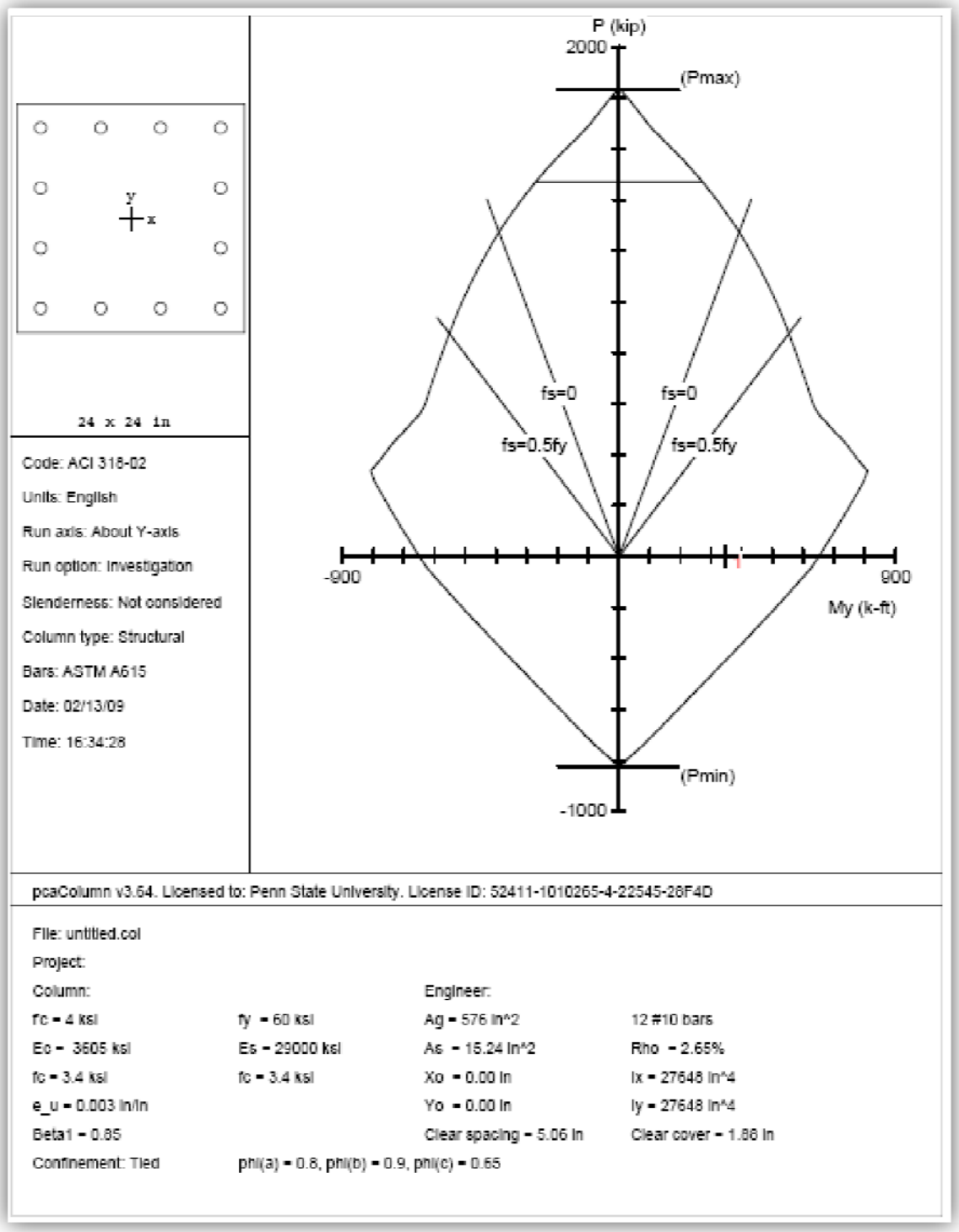
Reference CIP Concrete Structural PCAColumn Calculations – Column #3



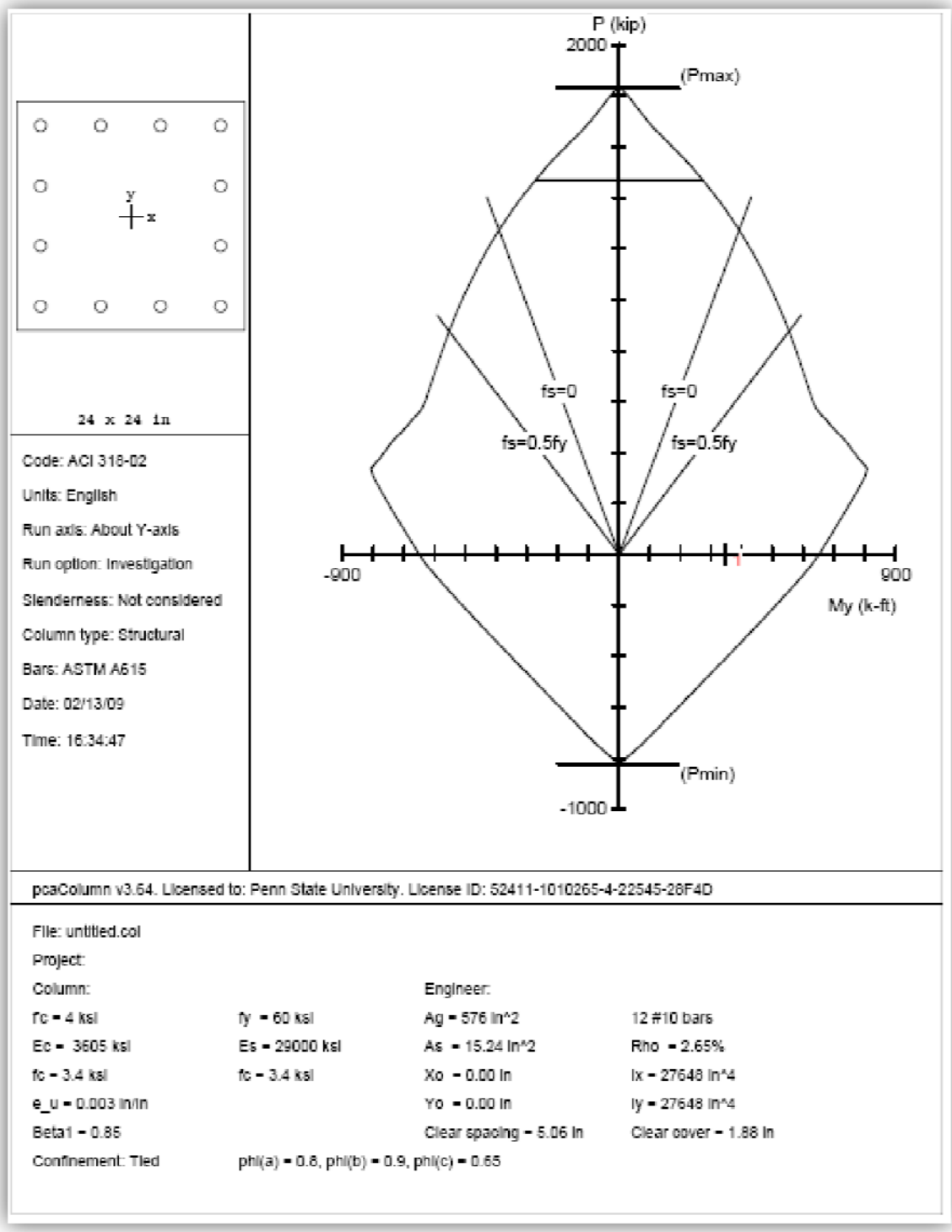
Reference CIP Concrete Structural PCAColumn Calculations – Column #4



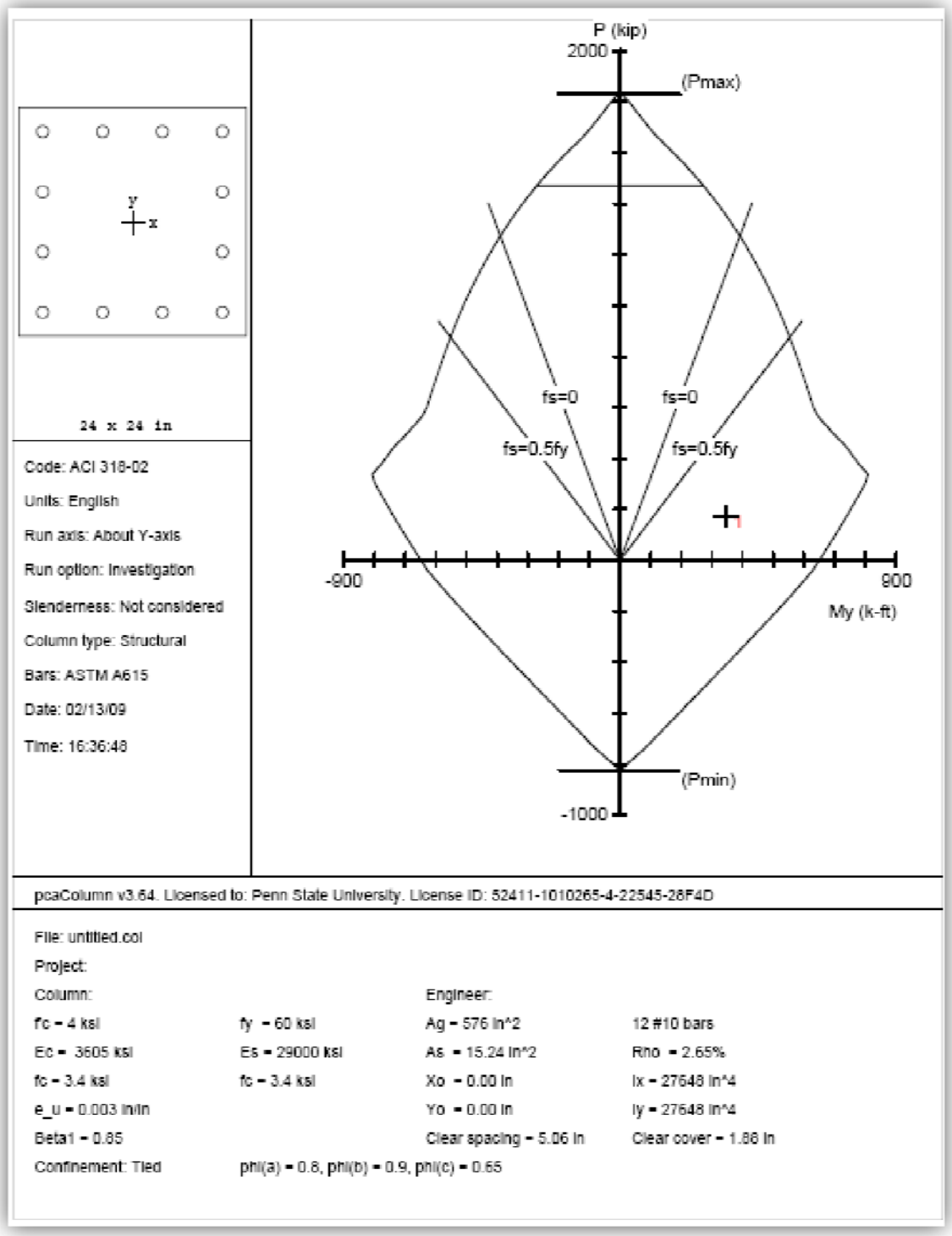
Reference CIP Concrete Structural PCAColumn Calculations – Column #5



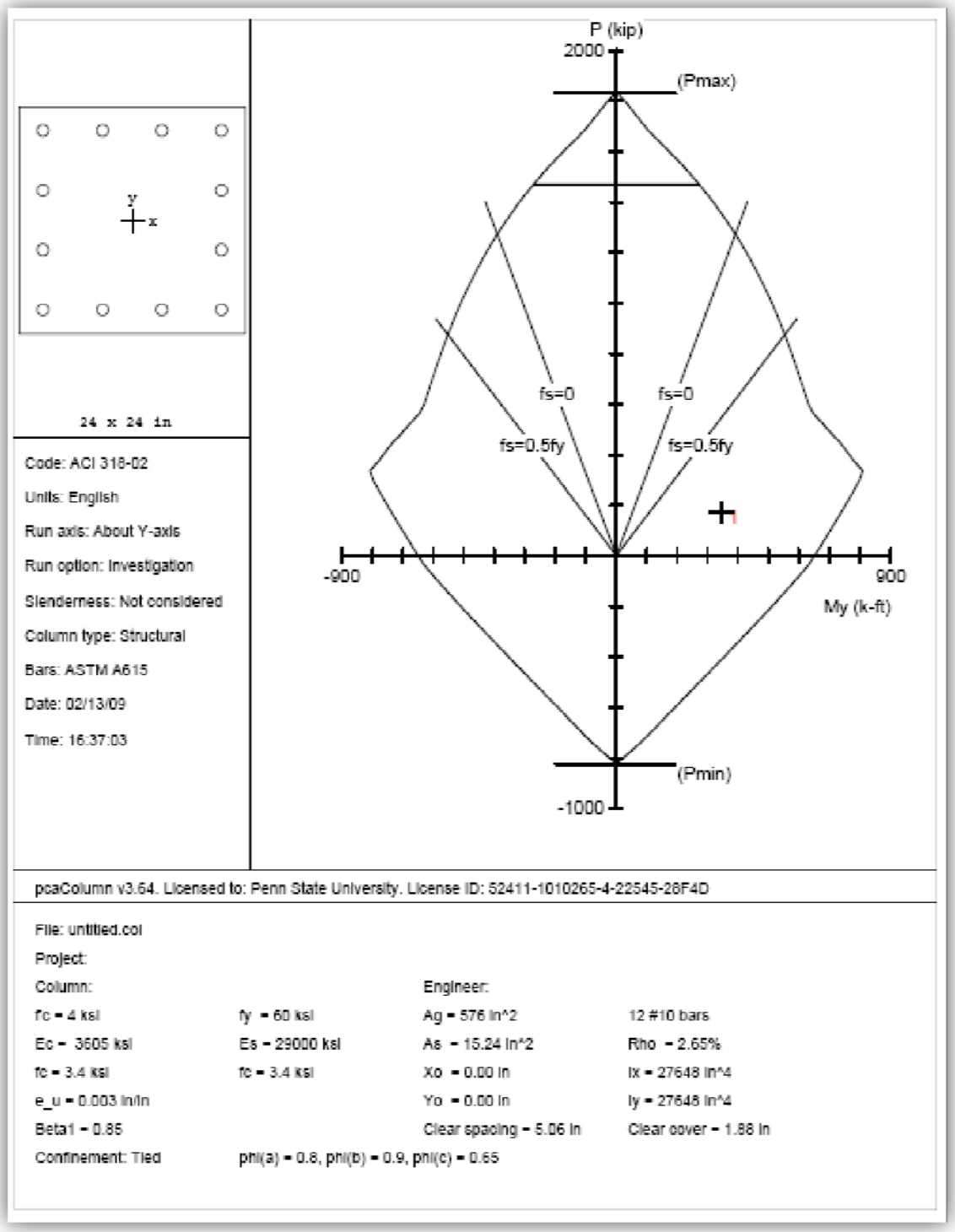
Reference CIP Concrete Structural PCAColumn Calculations – Column #6



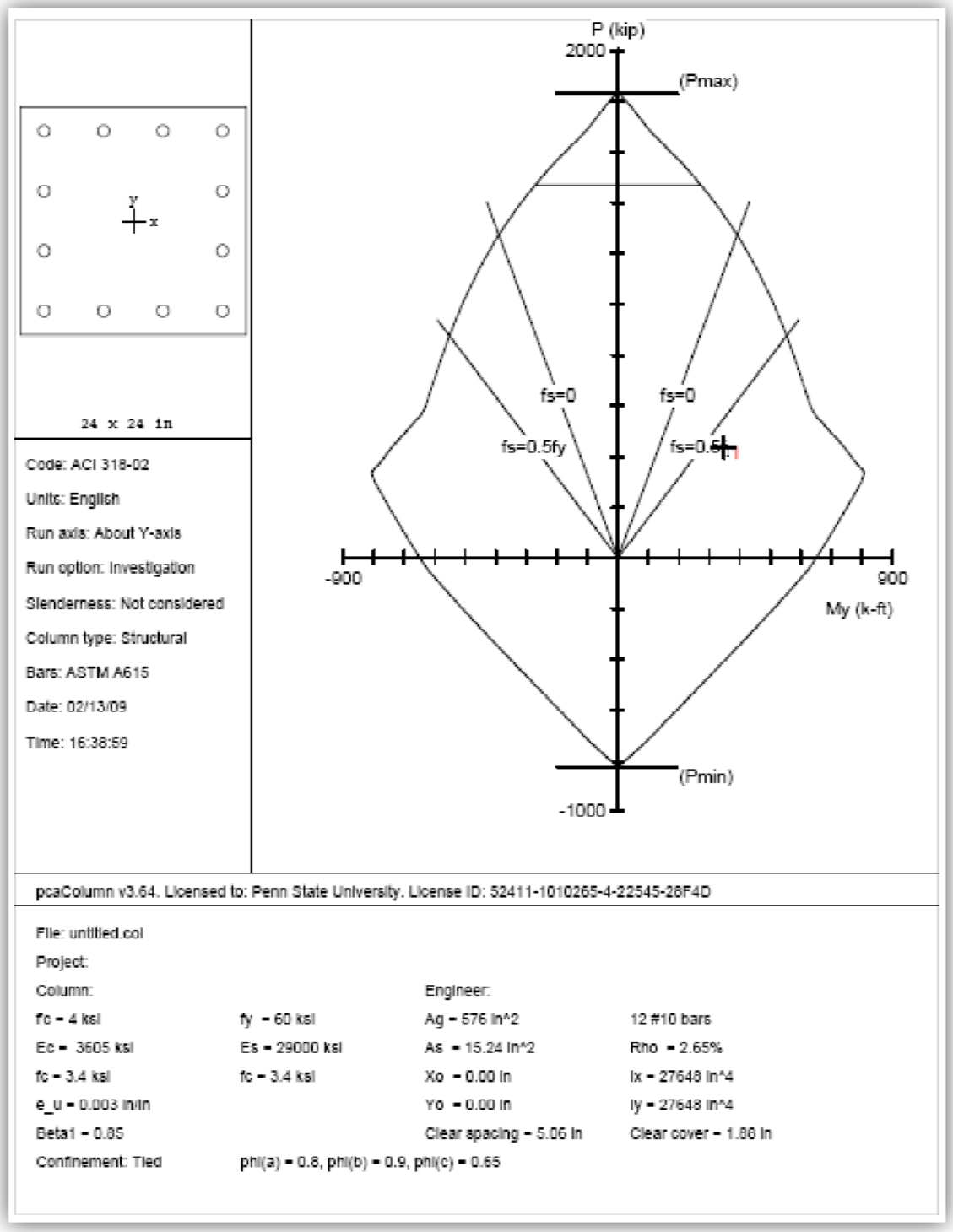
Reference CIP Concrete Structural PCAColumn Calculations – Column #7



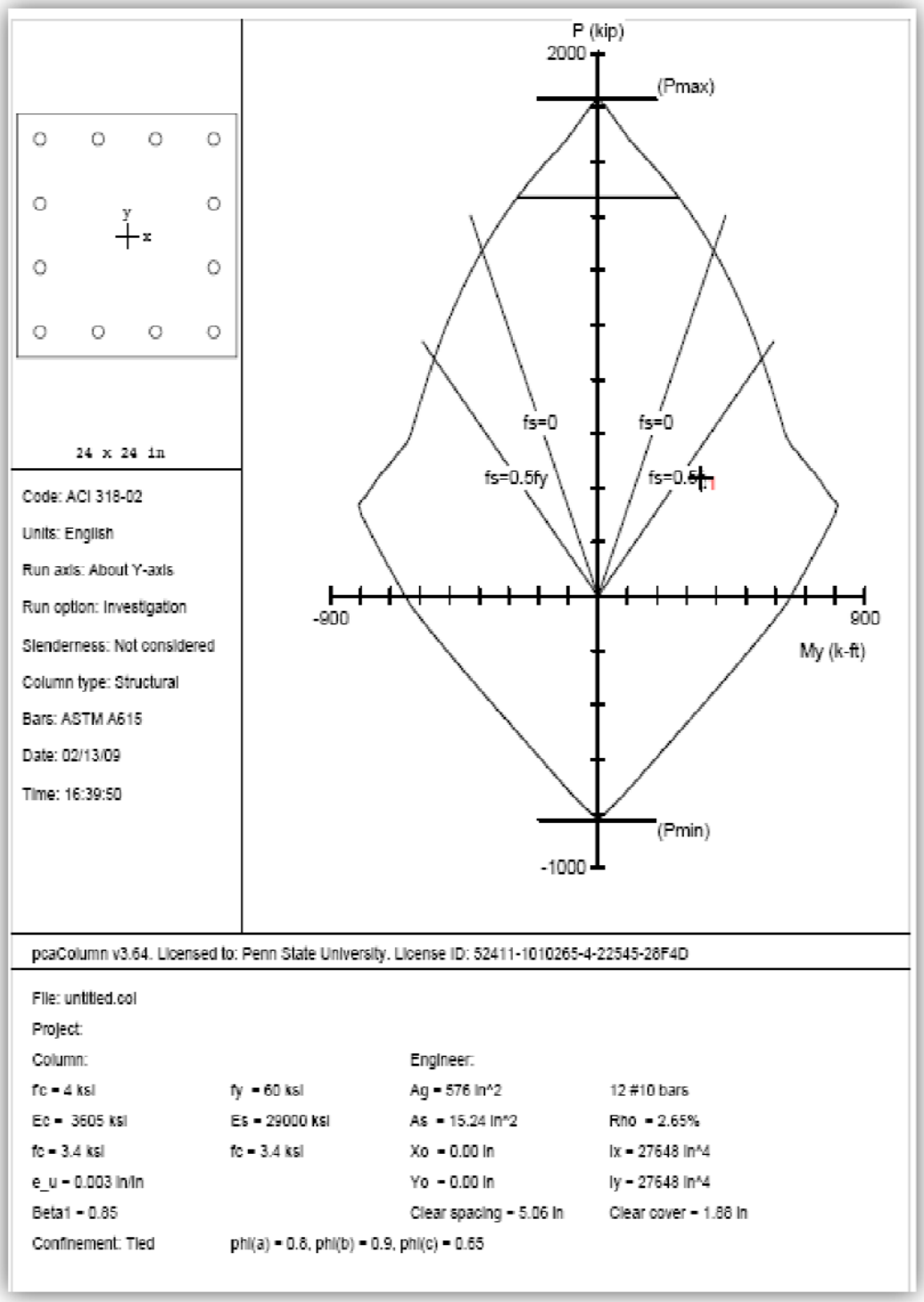
Reference CIP Concrete Structural PCAColumn Calculations – Column #8



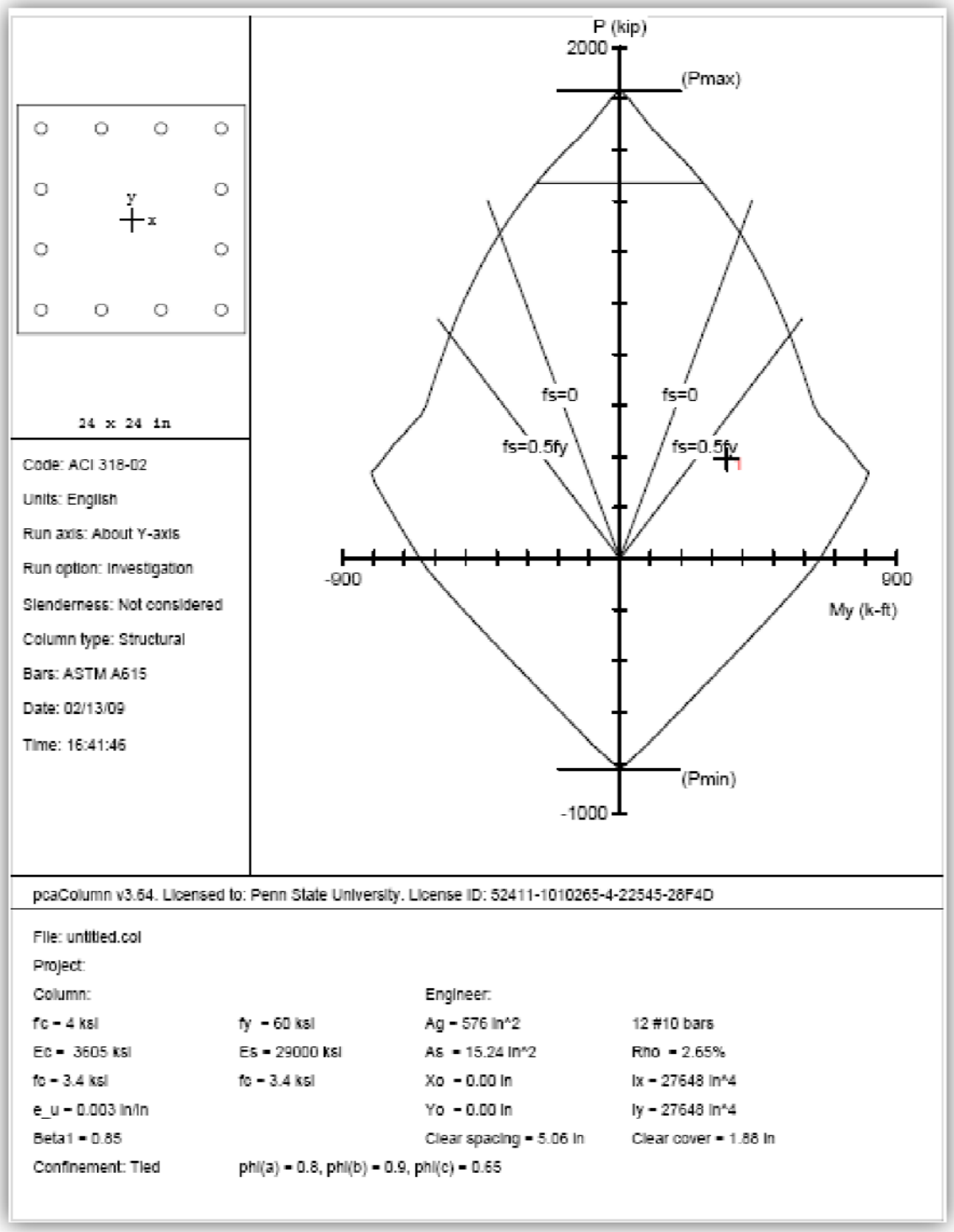
Reference CIP Concrete Structural PCAColumn Calculations – Column #9



Reference CIP Concrete Structural PCAColumn Calculations – Column #10



Reference CIP Concrete Structural PCAColumn Calculations – Column #11



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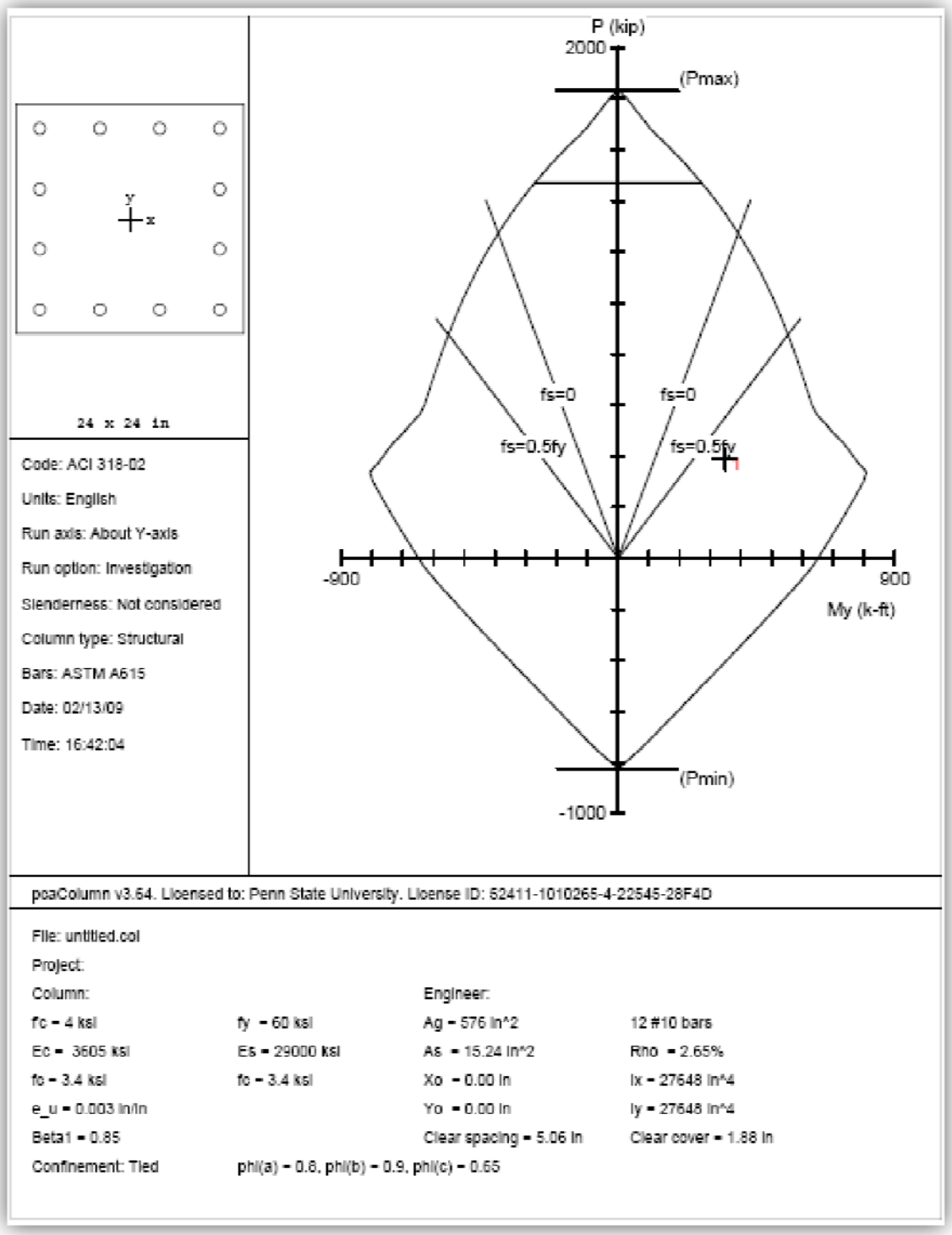
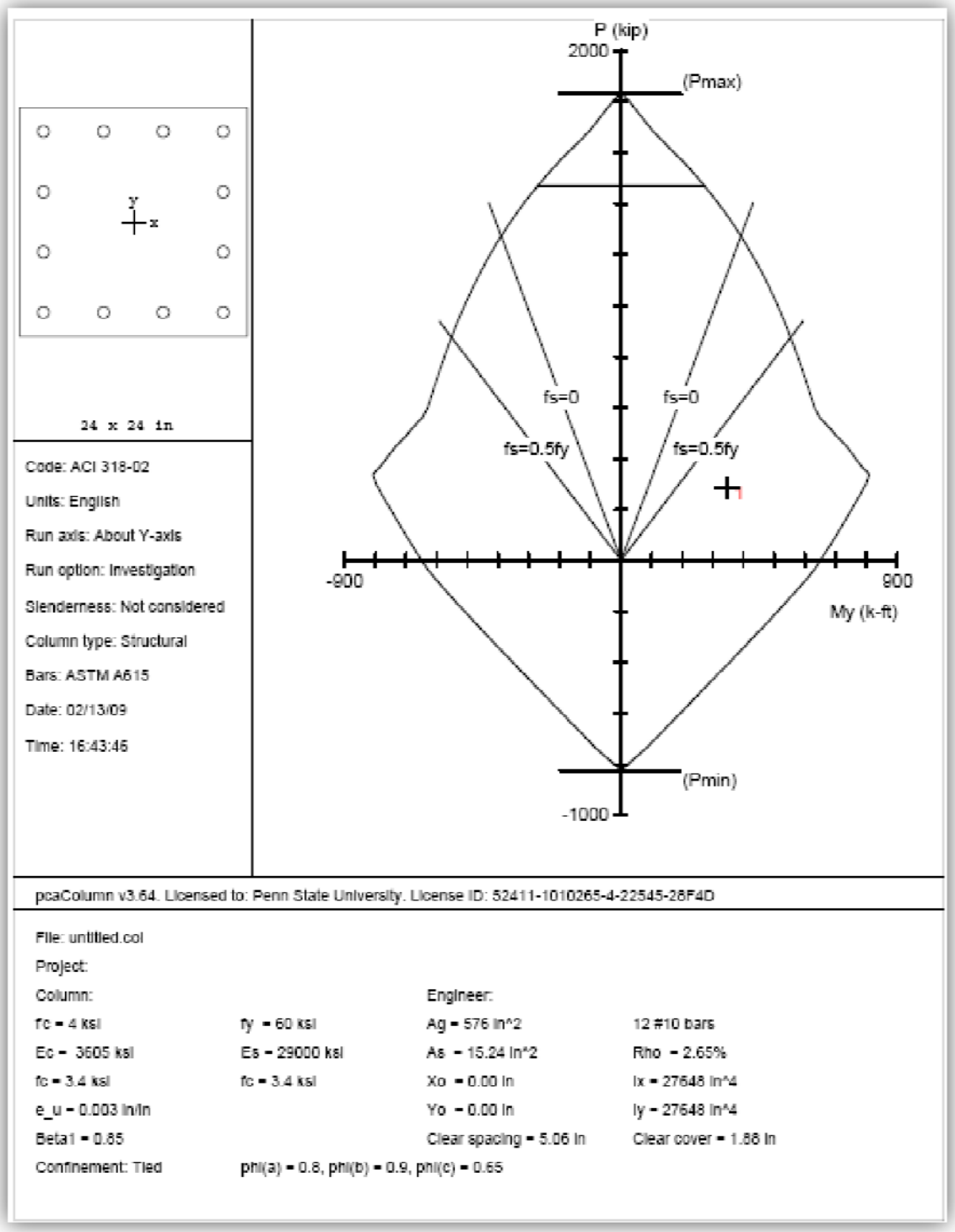
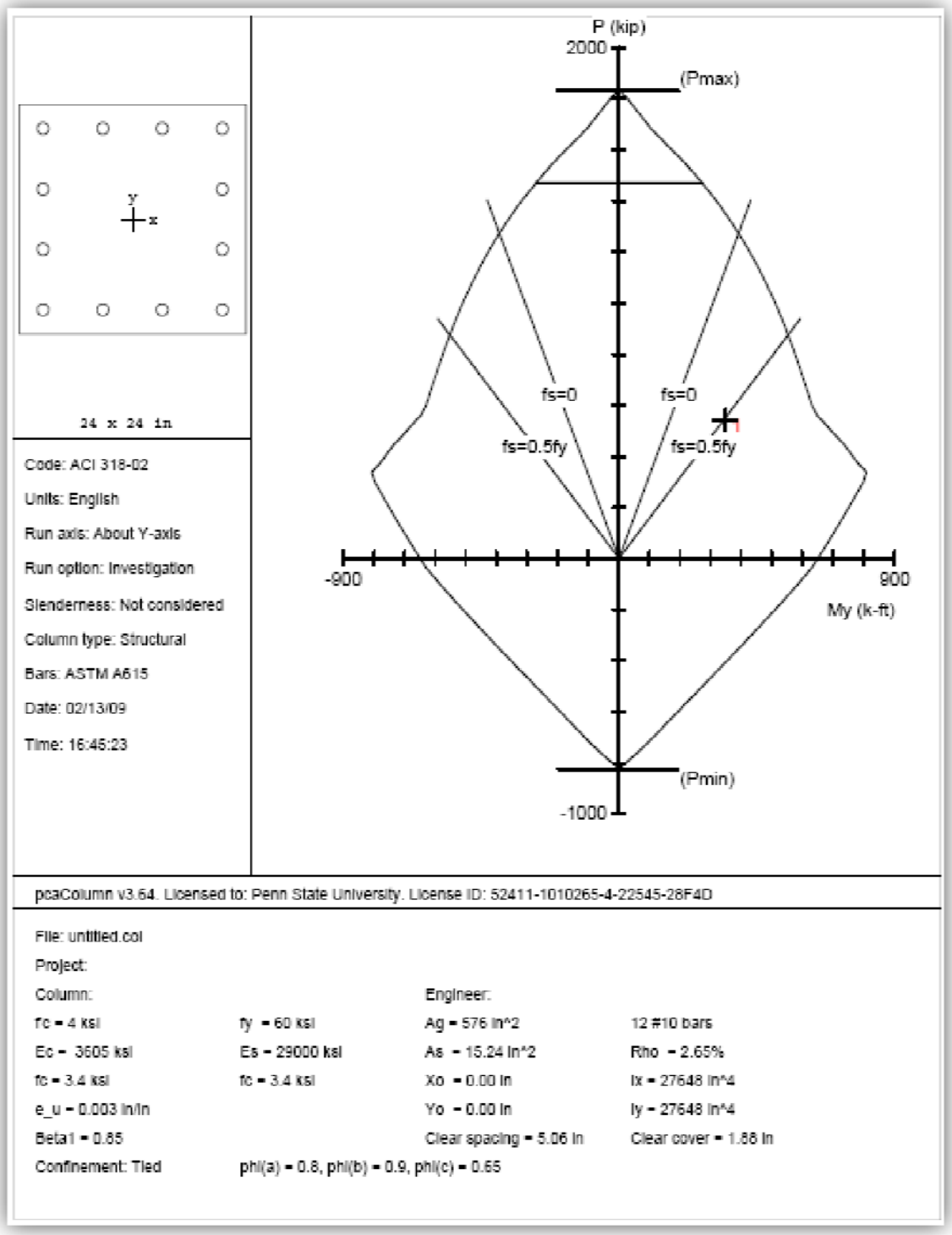


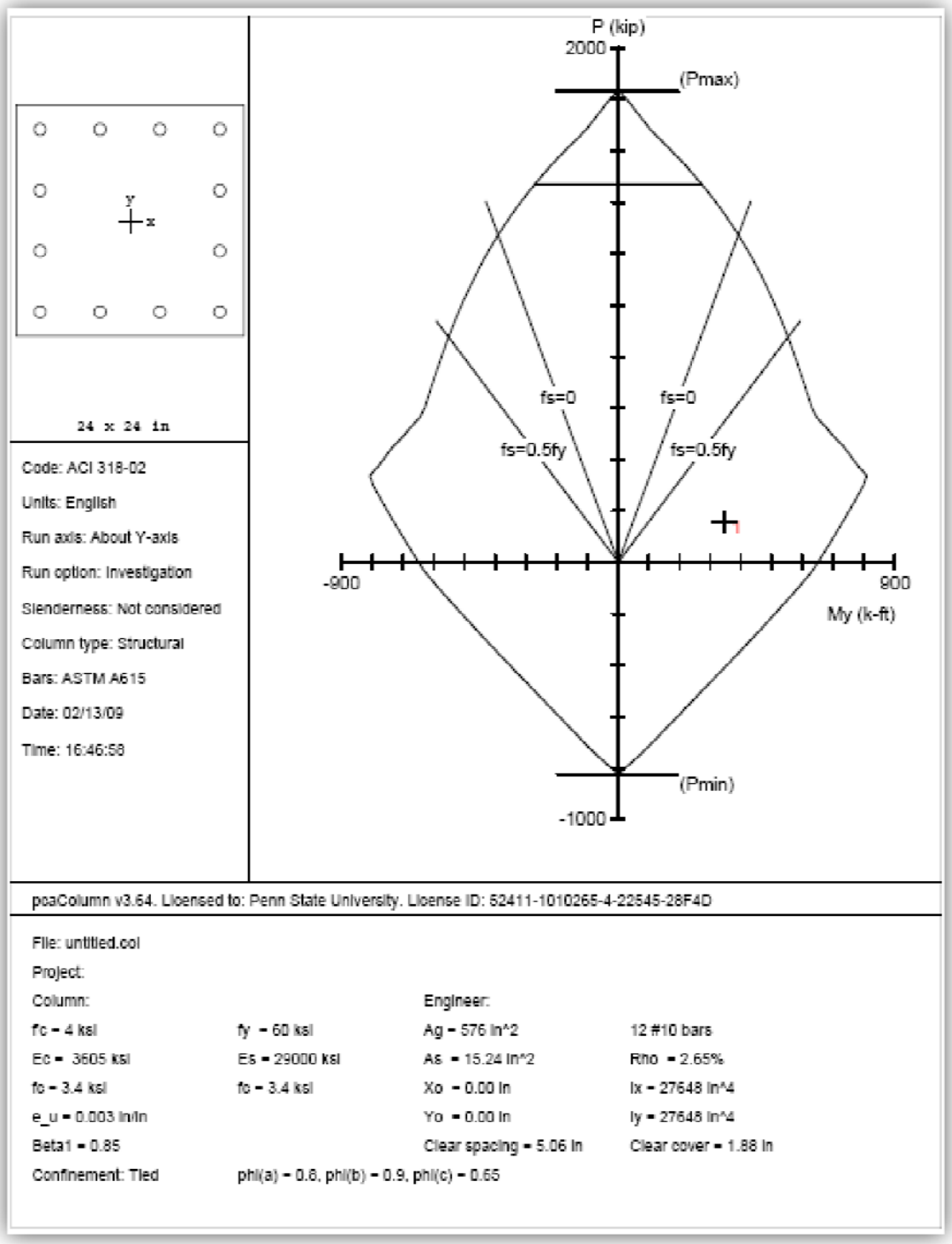
Reference CIP Concrete Structural PCAColumn Calculations – Column #13



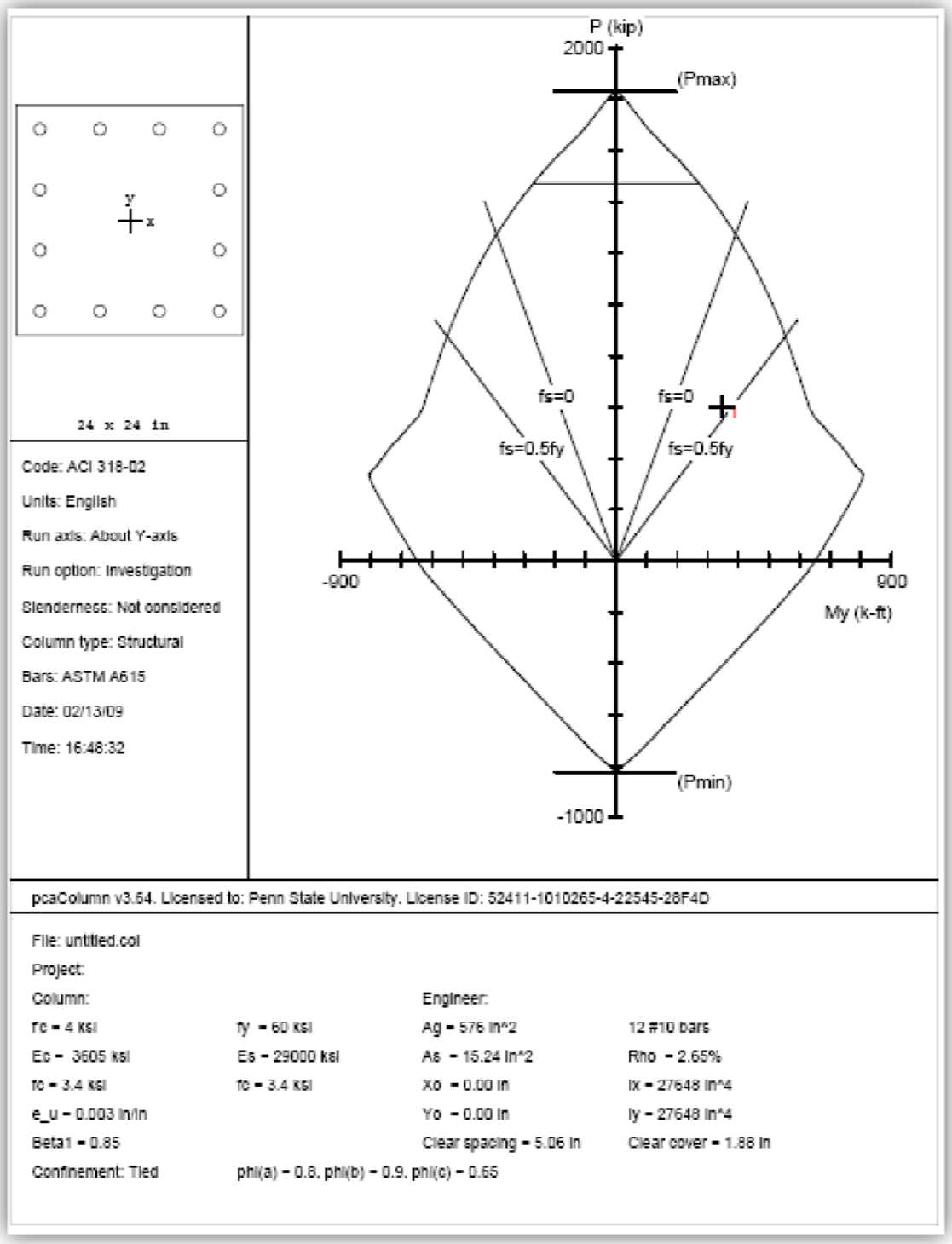
Reference CIP Concrete Structural PCAColumn Calculations – Column #14



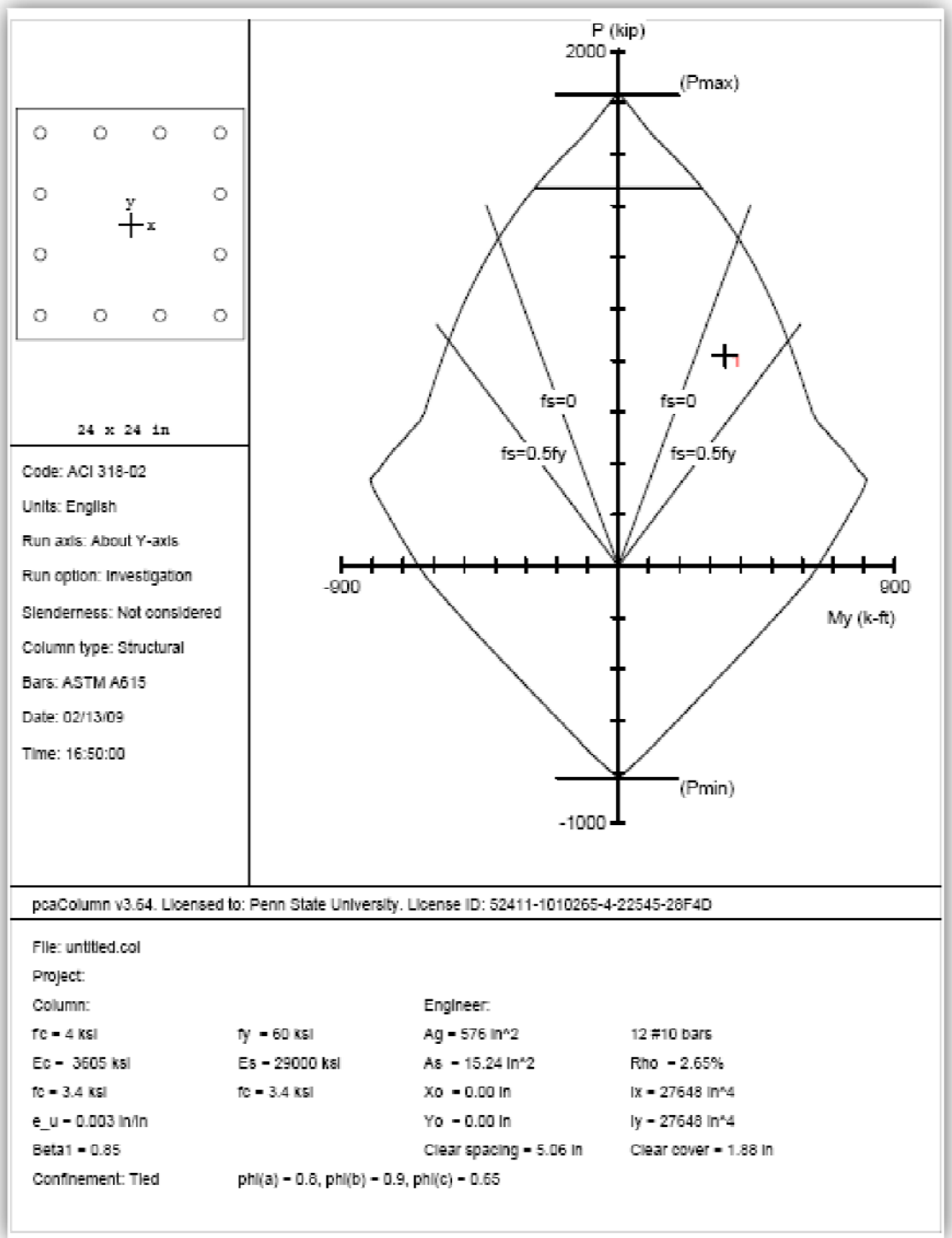
Reference CIP Concrete Structural PCAColumn Calculations – Column #15



Reference CIP Concrete Structural PCAColumn Calculations – Column #16



Reference CIP Concrete Structural PCAColumn Calculations – Column #17



Reference CIP Concrete Structural PCAColumn Calculations – Column #18

Appendix I

Matrix Schedule Duration Calculations

Table 1: Slab Duration Calculations

Mat Slab/ P3 Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	18362	SF	290	3	870	3
Reinforce	550	TON	2.3	8	18.4	4
Place	12717	CY	130	10	1300	1
Finish	68673	SF	900	5	4500	2

Elevated Slab P2 - Ground Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	74862	SF	544	6	3264	3
Reinforce	402	TON	2.3	6	13.8	4
Place	1908	CY	130	2	260	1
Finish	68673	SF	900	5	4500	2

Elevated Slab 2nd - 3rd Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	55480	SF	560	6	3360	2
Reinforce	25	TON	2.3	1	2.3	1
Place	1876	CY	130	2	260	1
Finish	50629	SF	900	4	3600	2

Elevated Slab 4th - 7th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	51516	SF	560	6	3360	2
Reinforce	25	TON	2.3	2	4.6	1
Place	1736	CY	130	2	260	1
Finish	46855	SF	900	4	3600	2

Elevated Slab 8th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	42812	SF	560	6	3360	2
Reinforce	25	TON	2.3	2	4.6	1
Place	1435	CY	130	2	260	1
Finish	38733	SF	900	4	3600	2

Elevated Slab 9th & 10th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	28971	SF	560	6	3360	2
Reinforce	25	TON	2.3	3	6.9	1
Place	986	CY	130	2	260	1
Finish	26611	SF	900	4	3600	2

Elevated Slab Roof						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	26960	SF	560	6	3360	2
Reinforce	25	TON	2.3	3	6.9	1
Place	920	CY	130	2	260	1
Finish	24842	SF	900	4	3600	2

Table 2: Column Duration Calculations

Mat Slab/ P3 Level - Ground Columns						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	10643	SF	238	3	714	2
Reinforce	42	TON	2.2	2	4.4	1
Place	362	CY	70	1	70	1

Columns 2nd - 3rd Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	9110	SF	238	3	714	2
Reinforce	40	TON	2.2	2	4.4	1
Place	305	CY	70	1	70	1

Columns 4th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	8518	SF	238	3	714	2
Reinforce	38	TON	2.2	2	4.4	1
Place	283	CY	70	1	70	1

Columns 5th - 7th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	8008	SF	238	3	714	2
Reinforce	36	TON	2.2	2	4.4	1
Place	264	CY	70	1	70	1

Columns 8th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	5836	SF	238	2	476	2
Reinforce	26	TON	2.2	2	4.4	1
Place	216	CY	70	1	70	1

Columns 9th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	4620	SF	238	2	476	2
Reinforce	22	TON	2.2	2	4.4	1
Place	171	CY	70	1	70	1

Columns 10th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	4057	SF	238	2	476	2
Reinforce	21	TON	2.2	2	4.4	1
Place	150	CY	70	1	70	1

Table 2: Column Duration Calculations

Mat Slab/ P3 Level - Ground Walls						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	10791	SF	395	2	790	2
Reinforce	13	TON	2.3	1	2.3	1
Place	193	CY	95	1	95	0.5

Walls 2nd Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	10610	SF	395	2	790	2
Reinforce	12	TON	2.3	1	2.3	1
Place	190	CY	95	1	95	0.5

Walls 3rd - 4th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	10191	SF	395	2	790	2
Reinforce	11	TON	2.3	1	2.3	1
Place	183	CY	95	1	95	0.5

Walls 5th - 10th Level						
Activity	**Total**	**Units**	**Daily Output**	**# of Crews**	**Total Daily Output**	**Duration Per Section**
Forms	10836	SF	395	2	790	2
Reinforce	10	TON	2.3	1	2.3	1
Place	194	CY	95	1	95	0.5