

Columns

Columns										
Story	Seismic					Wind				
	Axial	Shear	Torsion	M2	M3	Axial	Shear	Torsion	M2	M3
PHRF	15.0	28.4	44.0	63.3	606.5	27.5	48.8	86.2	76.5	1060.5
RF	22.3	26.2	44.6	70.3	380.8	24.7	43.4	87.4	83.4	683.2
12	54.2	24.5	44.8	75.0	429.1	30.6	40.2	87.5	100.9	749.3
11	90.4	23.3	44.8	183.1	412.8	62.8	40.0	87.1	106.6	722.4
10	126.3	22.2	44.6	189.6	410.4	106.1	39.3	85.8	117.3	721.8
9	160.0	21.1	43.9	200.8	397.9	160.5	38.0	83.5	142.9	705.2
8	191.5	19.9	42.7	207.7	380.7	225.8	36.0	79.8	173.5	680.0
7	223.4	18.3	40.7	206.8	356.8	301.9	33.1	74.5	208.6	641.4
6	259.7	16.1	38.0	212.4	326.0	388.8	29.1	67.2	247.2	588.0
5	304.8	15.7	34.4	218.3	286.8	486.3	24.1	57.8	287.6	516.2
4	361.8	15.1	29.7	205.3	253.9	594.2	23.1	46.0	325.2	428.1
3	431.1	13.0	23.8	170.1	243.5	711.7	25.5	31.4	355.7	431.7
2	536.4	15.8	7.8	313.9	344.0	886.1	26.9	14.2	547.3	568.5

Columns													
Story	Dead					Live				Trib Reduct LL			
	Axial	Shear	Torsion	M2	M3	Axial	Area	Factor	Reduced	Shear	Torsion	M2	M3
PHRF	6.9	6.1	0.0	10.9	133.3	7.7	550.0	1.00	7.7	8.2	0.0	21.7	183.7
RF	31.0	3.7	0.0	19.6	79.7	39.3	1100.0	1.00	39.3	5.3	0.0	14.0	110.6
12	49.8	4.4	0.0	34.4	91.6	50.7	1650.0	0.43	22.0	4.6	0.0	21.2	127.4
11	72.1	3.6	0.0	48.7	106.1	70.5	2200.0	0.41	28.9	3.6	0.0	33.6	119.5
10	94.6	6.4	0.0	62.7	123.1	90.3	2750.0	0.40	36.1	6.2	0.0	45.9	126.6
9	117.4	7.3	0.0	77.3	139.7	110.2	3300.0	0.40	44.1	7.0	0.0	58.1	140.2
8	140.1	8.2	0.0	92.3	155.7	130.1	3850.0	0.40	52.1	7.8	0.0	70.3	153.1
7	163.0	9.2	0.0	107.2	171.3	150.3	4400.0	0.40	60.1	8.5	0.0	82.4	165.4
6	186.0	10.1	0.0	122.0	186.3	170.6	4950.0	0.40	68.2	9.2	0.0	94.3	176.9
5	209.1	10.9	0.0	136.6	200.9	191.1	5500.0	0.40	76.4	9.9	0.0	105.8	187.8
4	232.3	12.3	0.0	151.3	217.3	211.8	6050.0	0.40	84.7	10.5	0.0	116.6	198.2
3	255.9	13.9	0.0	164.5	233.3	232.7	6600.0	0.40	93.1	12.1	0.0	122.4	203.2
2	280.6	15.5	0.0	171.1	168.5	253.0	7150.0	0.40	101.2	13.6	0.0	112.6	129.1

Story	1.4DL			1.2D+1.6L			2 1.2D+1.6W+1.0L			4 0.9D+1.6W		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
PHRF	9.7	8.6	186.7	20.6	20.4	453.9	60.0	93.6	2040.5	50.2	83.6	1816.8
RF	43.3	5.2	111.5	99.9	13.0	272.5	115.9	79.2	1299.3	67.3	72.8	1164.9
12	69.7	6.1	128.3	95.0	12.6	313.9	130.7	74.2	1436.3	93.8	68.2	1281.4
11	100.9	5.1	148.5	132.7	10.1	318.5	215.9	71.9	1402.6	165.4	67.3	1251.2
10	132.5	8.9	172.4	171.4	17.6	350.2	319.5	76.7	1429.1	255.0	68.6	1265.7
9	164.3	10.2	195.5	211.3	20.0	391.9	441.6	76.6	1436.2	362.3	67.4	1254.1
8	196.2	11.5	218.0	251.5	22.3	431.9	581.4	75.2	1428.0	487.3	65.0	1228.2
7	228.2	12.8	239.8	291.8	24.6	470.1	738.8	72.4	1397.2	629.8	61.1	1180.5
6	260.4	14.1	260.8	332.4	26.8	506.6	913.5	67.9	1341.2	789.4	55.7	1108.4
5	292.7	15.3	281.2	373.2	28.9	541.5	1105.4	61.5	1254.7	966.2	48.4	1006.7
4	325.2	17.2	304.2	414.3	31.6	577.9	1314.2	62.3	1144.0	1159.8	48.0	880.5
3	358.3	19.5	326.6	456.0	36.0	605.1	1539.0	69.5	1173.9	1369.1	53.3	900.7
2	392.9	21.6	239.6	498.7	40.3	411.9	1855.7	75.2	1244.1	1670.3	57.0	1063.7

Story	SDS = 0.991 Ω <sub>0</sub> = 2.5 1.2D+1.0E+1.0L (1.2+0.2SDS)D+Ω <sub>0</sub> E+1.0L			5 0.9D+1.0E (0.9-0.2SDS)D+Ω <sub>0</sub> E			7 Columns Maximums		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
PHRF	54.9	87.8	1886.3	42.4	75.4	1609.7	60.0	93.6	170.0
RF	138.4	76.0	1174.0	77.6	68.1	1008.0	138.4	79.2	108.3
12	227.1	72.0	1328.4	170.4	64.3	1137.1	227.1	74.2	119.7
11	355.6	67.0	1299.8	276.5	60.9	1106.4	355.6	71.9	116.9
10	484.2	70.7	1324.6	382.2	60.1	1112.3	484.2	76.7	119.1
9	608.0	70.1	1330.3	482.2	58.0	1092.9	608.0	76.6	119.7
8	726.8	69.0	1322.5	577.2	55.4	1060.9	726.8	75.2	119.0
7	846.5	67.0	1296.8	672.9	52.2	1012.1	846.5	72.4	116.4
6	977.4	63.6	1252.5	779.6	47.4	945.8	977.4	67.9	111.8
5	1130.7	64.3	1185.6	908.6	46.8	857.9	1130.7	64.3	104.6
4	1313.9	65.4	1136.7	1067.4	46.3	787.2	1314.2	65.4	95.3
3	1528.6	64.0	1138.2	1257.2	42.2	772.5	1539.0	69.5	97.8
2	1834.5	74.7	1228.5	1537.9	50.3	980.2	1855.7	75.2	103.7

**Beams**

Beams												
Story	Seismic			Wind			Dead			Live		
	Shear	Torsion	M3	Shear	Torsion	M3	Shear	Torsion	M3	Shear	Torsion	M3
PHRF	7.0	40.0	805.0	12.3	79.3	1406.7	1.6	0.1	177.3	12.1	2.9	616.5
RF	7.6	42.9	858.6	13.4	84.9	1502.3	1.7	0.3	188.1	12.6	0.8	688.9
12	7.4	42.2	841.2	13.0	82.8	1472.6	1.6	0.1	181.0	12.6	1.2	702.2
11	7.5	42.5	844.0	13.1	83.5	1482.3	1.6	0.0	177.5	12.6	1.1	695.2
10	7.3	42.1	828.8	12.9	82.5	1464.9	1.5	0.2	169.7	12.5	1.0	682.8
9	7.1	41.2	804.8	12.7	80.9	1435.0	1.4	0.4	160.1	12.3	0.9	665.7
8	6.8	39.7	768.3	12.2	78.1	1383.1	1.3	0.5	148.0	12.1	0.8	643.4
7	6.4	37.5	719.1	11.5	73.8	1305.7	1.2	0.7	133.7	11.9	0.7	616.1
6	5.8	34.5	655.4	10.6	67.9	1197.8	1.0	0.8	116.9	11.6	0.6	583.7
5	5.1	30.5	575.0	9.3	60.0	1054.5	0.9	1.0	97.8	11.3	0.5	546.2
4	4.2	25.5	474.9	7.7	49.7	871.6	0.7	1.1	76.2	10.9	0.5	503.9
3	3.1	19.0	350.9	5.7	37.8	643.6	0.5	1.3	52.1	10.4	0.5	454.7
2	1.8	12.3	201.3	3.3	21.9	369.1	0.2	1.3	26.7	10.0	0.6	406.4

1		2		4		6		5		7		Beams	
1.4DL		1.2D+1.6L		1.2D+1.6W+1.0L		0.9D+1.6W		1.2D+1.0E+1.0L (1.2+0.2SDS)D+Ω <sub>o</sub> E+1.0L		0.9D+1.0E (0.9-0.2SDS)D+Ω <sub>o</sub> E		Maximums	
Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment
K	in-K	K	in-K	K	in-K	K	in-K	K	in-K	K	in-K	K	ft-K
2.2	248.2	21.2	1199.1	33.6	3080.0	21.1	2410.3	31.8	2876.9	18.7	2136.9	33.6	256.7
2.3	263.3	22.1	1327.8	36.0	3318.2	22.9	2573.0	34.0	3098.3	20.3	2278.5	36.0	276.5
2.2	253.4	22.1	1340.7	35.3	3275.6	22.2	2519.1	33.4	3058.3	19.6	2230.1	35.3	273.0
2.2	248.5	22.0	1325.3	35.4	3279.8	22.4	2531.3	33.4	3053.4	19.8	2234.6	35.4	273.3
2.1	237.6	21.8	1296.2	35.0	3230.3	22.0	2496.5	32.9	2992.0	19.4	2191.0	35.0	269.2
2.0	224.1	21.4	1257.1	34.3	3153.7	21.6	2440.0	32.1	2901.4	18.8	2124.3	34.3	262.8
1.8	207.2	21.0	1207.1	33.2	3034.1	20.7	2346.2	30.9	2771.2	17.9	2024.7	33.2	252.8
1.7	187.1	20.4	1146.2	31.8	2865.7	19.5	2209.5	29.4	2600.7	16.7	1891.5	31.8	238.8
1.5	163.7	19.8	1074.3	29.8	2640.5	17.9	2021.6	27.5	2385.7	15.2	1720.5	29.8	220.0
1.2	136.9	19.0	991.2	27.2	2350.8	15.7	1775.3	25.2	2120.4	13.3	1506.1	27.2	195.9
1.0	106.7	18.2	897.7	24.0	1989.9	12.9	1463.2	22.3	1797.6	11.0	1240.7	24.0	165.8
0.7	72.9	17.3	790.1	20.1	1547.1	9.5	1076.7	18.8	1404.9	8.1	913.9	20.1	128.9
0.3	37.4	16.4	682.3	15.6	1028.9	5.4	614.5	14.9	946.9	4.6	521.9	16.4	85.7

Pier 3,4,5

Pier 3,4,5															
Story	Seismic			Wind			Dead			Live	Trib	Reduct	LL		
	Axial	Shear	M3	Axial	Shear	M3	Axial	Shear	M3				Axial	Area	Factor
PHRF	15.2	29.6	1402.6	26.7	56.5	2513.2	27.1	8.7	256.6	36.4	120.0	1.00	36.4	11.9	337.9
RF	42.4	89.0	4753.1	31.5	61.8	1942.2	143.1	2.9	472.4	132.6	240.0	1.00	132.6	3.6	1227.4
12	93.1	134.7	10824.0	70.8	112.6	4321.7	259.1	2.2	1085.1	228.1	360.0	0.65	147.2	2.6	2499.7
11	154.0	155.9	17648.8	158.8	161.5	10034.5	375.4	1.7	1670.9	324.3	480.0	0.59	192.1	2.0	3723.9
10	218.2	165.3	24316.7	276.9	210.6	18161.9	491.8	2.2	2239.2	420.6	600.0	0.56	233.9	2.0	4952.5
9	296.9	174.0	30511.7	425.1	259.6	28320.2	608.4	3.1	2805.0	517.2	720.0	0.53	273.9	3.0	6200.6
8	380.0	191.4	36347.8	603.1	308.1	40503.9	725.2	4.0	3392.6	614.0	840.0	0.51	312.4	4.1	7471.6
7	469.2	222.3	42351.1	810.8	356.0	54700.0	842.2	5.0	4007.0	711.2	960.0	0.49	350.0	5.4	8768.6
6	568.3	262.3	49355.4	1047.5	402.9	70906.3	959.5	6.1	4642.8	808.8	1080.0	0.48	386.8	6.7	10094.8
5	680.5	304.0	58195.5	1311.6	448.2	89183.3	1076.9	7.2	5303.4	906.6	1200.0	0.47	422.9	8.1	11454.0
4	807.0	340.9	69450.4	1599.9	490.6	109740.7	1194.2	8.2	5994.0	1004.6	1320.0	0.46	458.5	9.3	12847.2
3	946.6	366.9	83486.3	1904.6	528.1	133122.4	1310.7	8.6	6788.5	1102.2	1440.0	0.45	493.4	10.0	14312.4
2	1066.5	378.1	100393.1	2151.9	559.9	159691.5	1410.4	8.2	7404.5	1172.4	1560.0	0.44	515.7	9.2	15457.7

Story	1			2			4			6		
	1.4DL			1.2D+1.6L			1.2D+1.6W+1.0L			0.9D+1.6W		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
	K	K	in-K	K	K	in-K	K	K	in-K	K	K	in-K
PHRF	37.9	12.2	359.2	90.7	29.5	848.5	111.7	112.7	4667.0	67.1	98.2	4252.1
RF	200.4	4.1	661.4	383.9	9.3	2530.8	354.7	106.0	4901.8	179.2	101.5	3532.6
12	362.8	3.1	1519.1	546.5	6.8	5301.6	571.4	185.4	10716.5	346.5	182.2	7891.3
11	525.5	2.4	2339.2	757.8	5.2	7963.3	896.6	262.4	21784.1	591.9	260.0	17558.9
10	688.5	3.1	3134.9	964.5	5.9	10611.0	1267.2	341.7	36698.6	885.7	339.0	31074.3
9	851.7	4.3	3927.0	1168.2	8.5	13286.9	1684.1	422.0	54878.8	1227.7	418.1	47836.7
8	1015.3	5.6	4749.6	1370.1	11.5	16025.6	2147.6	501.9	76348.9	1617.6	496.5	67859.6
7	1179.1	7.1	5609.8	1570.6	14.6	18838.1	2657.9	581.0	101097.0	2055.2	574.1	91126.3
6	1343.3	8.6	6499.9	1770.2	18.0	21723.1	3214.1	658.6	129116.2	2539.4	650.1	117628.5
5	1507.7	10.1	7424.7	1969.0	21.5	24690.4	3813.8	733.9	160511.4	3067.8	723.6	147466.4
4	1671.9	11.4	8391.7	2166.7	24.7	27748.4	4451.4	804.1	195625.2	3634.6	792.3	180979.8
3	1835.0	12.1	9503.9	2362.3	26.3	31046.0	5113.6	865.2	235454.3	4227.0	852.7	219105.4
2	1974.6	11.5	10366.3	2517.7	24.6	33617.7	5651.2	914.9	279849.5	4712.4	903.2	262170.5

Story	5			7			3,4,5		
	1.2D+1.0E+1.0L (1.2+0.2SDS)D+Ω <sub>0</sub> E+1.0L			0.9D+1.0E (0.9-0.2SDS)D+Ω <sub>0</sub> E			Maximums		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
	K	K	in-K	K	K	in-K	K	K	ft-K
PHRF	112.2	98.1	4203.1	57.0	80.1	3686.5	112.2	112.7	388.9
RF	438.7	230.3	13770.6	206.5	224.6	12214.2	438.7	230.3	1147.6
12	742.3	342.3	31076.8	414.6	338.2	27821.4	742.3	342.3	2589.7
11	1101.9	394.0	50182.2	648.4	390.9	45294.7	1101.9	394.0	4181.8
10	1467.1	418.4	68875.0	890.7	414.8	62363.2	1467.1	418.4	5739.6
9	1866.7	442.2	86401.7	1169.2	437.1	78247.7	1866.7	442.2	7200.1
8	2276.3	488.2	103084.5	1458.9	481.2	93250.4	2276.3	501.9	8590.4
7	2700.6	568.0	120249.0	1764.1	559.2	108690.0	2700.6	581.0	10020.7
6	3149.1	671.0	139974.8	2094.1	660.1	126646.7	3214.1	671.0	11664.6
5	3630.0	778.1	164358.0	2457.1	765.1	149210.8	3813.8	778.1	13696.5
4	4145.9	873.0	194854.2	2855.7	858.0	177832.7	4451.4	873.0	16302.1
3	4692.6	939.2	232519.9	3286.4	923.2	213480.0	5113.6	939.2	19621.2
2	5154.1	966.0	276793.3	3656.2	951.0	256179.1	5651.2	966.0	23320.8

**Pier D,E (East&West)**

Pier D,E (East&West)																	
Story	Seismic			Wind			Dead			Live		Trib		Reduct		LL	
	Axial	Shear	M3	Axial	Shear	M3	Axial	Shear	M3	Axial	Area	Factor	Reduced	Shear	M3		
PHRF	12.4	21.8	1833.8	10.1	12.7	1468.7	24.8	22.1	737.1	29.8	400.0	1.00	29.8	31.8	918.2		
RF	64.8	61.4	9437.0	42.7	59.0	6606.8	145.3	27.2	1682.9	128.7	800.0	1.00	128.7	40.6	2150.3		
12	140.0	100.0	21190.7	127.8	107.4	18264.2	265.0	27.0	1164.1	226.1	1200.0	0.47	105.5	40.6	1561.4		
11	228.1	125.8	34606.7	252.4	154.4	35758.2	384.5	27.3	1282.4	323.4	1600.0	0.44	141.5	40.8	1660.7		
10	319.8	142.1	48562.2	416.2	201.0	59170.9	503.9	27.8	1375.9	420.6	2000.0	0.42	175.7	41.2	1736.3		
9	410.6	155.5	62945.3	619.0	247.5	88041.0	623.2	28.5	1460.3	517.7	2400.0	0.40	208.7	41.8	1802.9		
8	512.8	172.3	77923.7	860.3	293.9	122313.8	742.4	29.3	1540.9	614.7	2800.0	0.40	245.9	42.3	1865.0		
7	631.1	196.2	93995.8	1139.7	340.0	161946.3	861.5	30.0	1616.8	711.4	3200.0	0.40	284.6	42.8	1920.0		
6	762.0	224.9	112136.7	1456.2	385.0	206874.2	980.4	30.6	1679.0	808.0	3600.0	0.40	323.2	43.1	1952.5		
5	909.9	253.7	133312.2	1807.7	426.6	257016.4	1099.1	30.9	1695.4	904.3	4000.0	0.40	361.7	43.0	1908.5		
4	1076.3	280.0	157746.6	2189.7	459.8	312062.8	1217.5	30.5	1553.7	1000.0	4400.0	0.40	400.0	41.5	1605.2		
3	1259.4	301.9	184633.6	2591.5	476.6	371007.5	1336.1	27.8	849.5	1095.1	4800.0	0.40	438.1	36.2	1213.5		
2	1444.7	303.4	210854.2	2969.6	458.1	428668.3	1446.1	17.8	1204.8	1177.9	5200.0	0.40	471.2	21.7	2330.5		

Story	1			2			4			6		
	1.4DL			1.2D+1.6L			1.2D+1.6W+1.0L			0.9D+1.6W		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
	K	K	in-K	K	K	in-K	K	K	in-K	K	K	in-K
PHRF	34.7	30.9	1031.9	77.4	77.3	2353.6	75.6	78.5	4152.7	38.4	40.1	3013.4
RF	203.5	38.1	2356.1	380.3	97.6	5460.0	371.4	167.6	14740.6	199.1	118.9	12085.5
12	371.0	37.8	1629.7	486.8	97.4	3895.2	628.0	244.8	32181.1	443.0	196.1	30270.5
11	538.3	38.2	1795.4	687.8	98.0	4196.0	1006.8	320.5	60412.7	749.9	271.5	58367.3
10	705.5	39.0	1926.2	885.8	99.4	4429.1	1446.4	396.3	98060.8	1119.5	346.7	95911.7
9	872.5	40.0	2044.4	1081.8	101.1	4637.0	1946.9	472.0	144420.8	1551.3	421.7	142179.8
8	1039.4	41.0	2157.3	1284.3	102.8	4833.2	2513.2	547.6	199416.2	2044.6	496.6	197088.9
7	1206.1	41.9	2263.5	1489.1	104.4	5012.1	3141.8	622.7	262974.1	2598.8	571.0	260569.1
6	1372.6	42.8	2350.6	1693.6	105.6	5138.8	3829.6	695.7	334966.1	3212.3	643.4	332509.9
5	1538.8	43.3	2373.6	1897.7	105.9	5088.0	4573.0	762.6	415169.2	3881.6	710.4	412752.2
4	1704.5	42.7	2175.2	2101.0	103.0	4432.9	5364.5	813.8	502770.3	4599.2	763.1	500698.9
3	1870.5	39.0	1189.3	2304.1	91.4	2961.0	6187.8	832.2	595844.9	5348.9	787.7	594376.6
2	2024.5	24.9	1686.7	2489.2	56.0	5174.5	6957.8	776.0	689645.6	6052.8	749.0	686953.6

Story	5			7			D, E		
	1.2D+1.0E+1.0L (1.2+0.2SDS)D+Ω <sub>0</sub> E+1.0L			0.9D+1.0E (0.9-0.2SDS)D+Ω <sub>0</sub> E			Maximums		
	Axial	Shear	Moment	Axial	Shear	Moment	Axial	Shear	Moment
	K	K	in-K	K	K	in-K	K	K	ft-K
PHRF	95.3	117.1	6533.3	48.3	70.0	5101.9	95.3	117.1	544.4
RF	493.9	232.0	28095.9	264.0	172.5	24773.6	493.9	232.0	2341.3
12	826.0	328.4	56165.7	536.0	269.0	53793.6	826.0	328.4	4680.5
11	1249.4	393.5	89970.4	840.1	333.7	87416.7	1249.4	393.5	7497.5
10	1679.9	435.5	125065.5	1153.2	374.9	122371.0	1679.9	435.5	10422.1
9	2106.5	470.5	161208.0	1463.8	408.9	158388.1	2106.5	472.0	13434.0
8	2565.9	513.9	198828.9	1803.0	451.3	195890.7	2565.9	547.6	16618.0
7	3066.8	575.0	239170.0	2182.2	511.4	236124.1	3141.8	622.7	21914.5
6	3599.0	648.0	284641.8	2593.1	583.6	281520.0	3829.6	695.7	27913.8
5	4173.3	720.3	337559.4	3046.1	655.8	334470.3	4573.0	762.6	34597.4
4	4793.0	784.0	398144.1	3545.1	721.3	395456.8	5364.5	813.8	41897.5
3	5454.7	829.8	463985.3	4086.2	774.2	462180.2	6187.8	832.2	49653.7
2	6104.9	805.0	531150.5	4626.7	771.0	527981.0	6957.8	805.0	57470.5

Appendix G  
PCA Column Output

Gerald Craig  
Thesis Report

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=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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untitled.col

Page 2  
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General Information:

=====

File Name: untitled.col

Project:

Column:

Code: ACI 318-02

Engineer:

Units: English

Run Option: Investigation

Run Axis: Biaxial

Slenderness: Not considered

Column Type: Structural

Appendix G  
PCA Column Output

Gerald Craig  
Thesis Report

Material Properties:

```

=====
f'c   = 5 ksi                fy   = 60 ksi
Ec    = 4030.51 ksi         Es   = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.8
    
```

Section:

```

=====
Rectangular: Width = 20 in      Depth = 20 in

Gross section area, Ag = 400 in^2
Ix = 13333.3 in^4              Iy = 13333.3 in^4
Xo = 0 in                      Yo = 0 in
    
```

Reinforcement:

```

=====
Rebar Database: ASTM A615
Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
-----
# 3      0.38      0.11 # 4      0.50      0.20 # 5      0.63      0.31
# 6      0.75      0.44 # 7      0.88      0.60 # 8      1.00      0.79
# 9      1.13      1.00 # 10     1.27      1.27 # 11     1.41      1.56
# 14     1.69      2.25 # 18     2.26      4.00
    
```

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular  
 Pattern: All Sides Equal (Cover to transverse reinforcement)  
 Total steel area, As = 8.00 in^2 at 2.00%  
 8 #9 Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

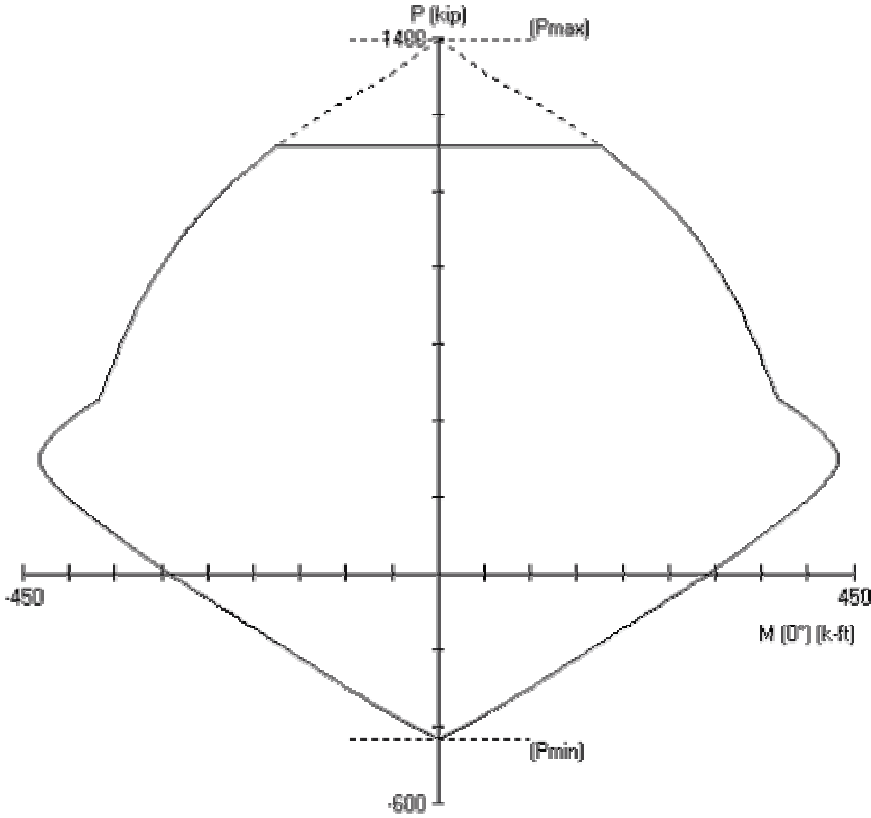
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```

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	1.0	1.0	1.0	215.9	215.9	215.911
2	1856.0	104.0	104.0	-----Pu > Pmax-----#	-----Pu > Pmax-----#	-----#
3	1539.0	98.0	98.0	-----Pu > Pmax-----#	-----Pu > Pmax-----#	-----#
4	1315.0	96.0	96.0	-----Pu > Pmax-----#	-----Pu > Pmax-----#	-----#
5	1106.0	105.0	105.0	186.6	186.6	1.777
6	914.0	112.0	112.0	219.7	219.7	1.961
7	739.0	117.0	117.0	235.0	235.0	2.008
8	582.0	119.0	119.0	239.2	239.2	2.010
9	442.0	120.0	120.0	238.4	238.4	1.987
10	333.0	119.0	119.0	243.5	243.5	2.046
11	248.0	117.0	117.0	246.0	246.0	2.102
12	163.0	120.0	120.0	242.9	242.9	2.024
13	116.0	109.0	109.0	239.6	239.6	2.199
14	60.0	170.0	170.0	234.0	234.0	1.376

#- Column section cannot resist applied loads  
 Pmax = 1268.8 kips



Appendix G  
PCA Column Output

Gerald Craig  
Thesis Report

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=====  
Computer program for the Strength Design of Reinforced Concrete Sections  
=====

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untitled.col

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General Information:  
=====

```
File Name: untitled.col
Project:
Column:                               Engineer:
Code:   ACI 318-02                     Units: English

Run Option: Investigation              Slenderness: Not considered
Run Axis:   Biaxial                    Column Type: Structural
```



Material Properties:

```

=====
f'c   = 8 ksi           fy   = 60 ksi
Ec    = 5098.24 ksi    Es   = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.65
    
```

Section:

```

=====
Rectangular: Width = 20 in           Depth = 20 in

Gross section area, Ag = 400 in^2
Ix = 13333.3 in^4                   Iy = 13333.3 in^4
Xo = 0 in                           Yo = 0 in
    
```

Reinforcement:

```

=====
Rebar Database: ASTM A615
Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
-----
# 3      0.38      0.11 # 4      0.50      0.20 # 5      0.63      0.31
# 6      0.75      0.44 # 7      0.88      0.60 # 8      1.00      0.79
# 9      1.13      1.00 # 10     1.27      1.27 # 11     1.41      1.56
# 14     1.69      2.25 # 18     2.26      4.00
    
```

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular  
 Pattern: All Sides Equal (Cover to transverse reinforcement)  
 Total steel area, As = 8.00 in<sup>2</sup> at 2.00%  
 8 #9 Cover = 1.5 in

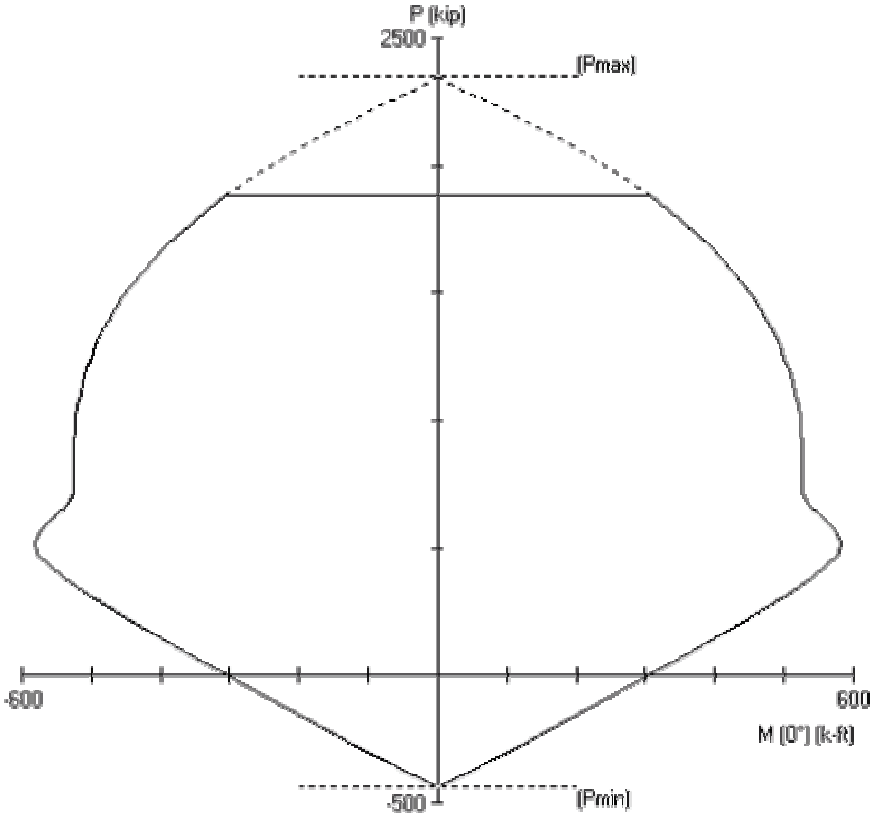
Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)

```

=====

```

No.	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	1.0	1.0	1.0	229.2	229.2	229.180
2	1856.0	104.0	104.0	226.4	226.4	2.177
3	1539.0	98.0	98.0	296.0	296.0	3.020
4	1315.0	96.0	96.0	320.3	320.3	3.336
5	1106.0	105.0	105.0	328.7	328.7	3.131
6	914.0	112.0	112.0	325.3	325.3	2.905
7	739.0	117.0	117.0	314.1	314.1	2.685
8	582.0	119.0	119.0	298.7	298.7	2.510
9	442.0	120.0	120.0	286.3	286.3	2.386
10	333.0	119.0	119.0	283.1	283.1	2.379
11	248.0	117.0	117.0	278.9	278.9	2.383
12	163.0	120.0	120.0	267.8	267.8	2.232
13	116.0	109.0	109.0	261.1	261.1	2.396
14	60.0	170.0	170.0	250.7	250.7	1.474



**Seismic Drifts**

Story	Item	Load	Point	X	Y	Z	DriftX	DriftY	w/ Cd = 5	w/ Cd = 5	
PHRF	Max Drift X	CHU1	81	804	1020	2060	0.00116		0.00579		OK
PHRF	Max Drift Y	CHU1	1814	564	720	2060		0.00006		0.00030	OK
PHRF	Max Drift X	CHU1E	81	804	1020	2060	0.00139		0.00694		OK
PHRF	Max Drift Y	CHU1E	1814	564	720	2060		0.00029		0.00143	OK
PHRF	Max Drift X	CHU2	84	804	360	2060	0.00021		0.00106		OK
PHRF	Max Drift Y	CHU2	1812	1044	720	2060		0.00093		0.00467	OK
PHRF	Max Drift X	CHU2E	84	804	360	2060	0.00048		0.00240		OK
PHRF	Max Drift Y	CHU2E	1814	564	720	2060		0.00106		0.00532	OK
RF	Max Drift X	CHU1	52	553	1355	1944	0.00120		0.00599		OK
RF	Max Drift Y	CHU1	37	-11	349	1944		0.00014		0.00072	OK
RF	Max Drift X	CHU1E	52	553	1355	1944	0.00167		0.00834		OK
RF	Max Drift Y	CHU1E	37	-11	349	1944		0.00078		0.00388	OK
RF	Max Drift X	CHU2	57	1055	-11	1944	0.00045		0.00224		OK
RF	Max Drift Y	CHU2	47	1619	1031	1944		0.00118		0.00590	OK
RF	Max Drift X	CHU2E	57	1055	-11	1944	0.00102		0.00511		OK
RF	Max Drift Y	CHU2E	47	1619	1031	1944		0.00178		0.00890	OK
STORY12	Max Drift X	CHU1	52	553	1355	1768	0.00120		0.00600		OK
STORY12	Max Drift Y	CHU1	37	-11	349	1768		0.00015		0.00073	OK
STORY12	Max Drift X	CHU1E	52	553	1355	1768	0.00167		0.00835		OK
STORY12	Max Drift Y	CHU1E	37	-11	349	1768		0.00078		0.00389	OK
STORY12	Max Drift X	CHU2	57	1055	-11	1768	0.00045		0.00226		OK
STORY12	Max Drift Y	CHU2	47	1619	1031	1768		0.00118		0.00591	OK
STORY12	Max Drift X	CHU2E	57	1055	-11	1768	0.00103		0.00513		OK
STORY12	Max Drift Y	CHU2E	47	1619	1031	1768		0.00178		0.00892	OK
STORY11	Max Drift X	CHU1	52	553	1355	1608	0.00119		0.00594		OK
STORY11	Max Drift Y	CHU1	36	-11	1031	1608		0.00014		0.00071	OK
STORY11	Max Drift X	CHU1E	52	553	1355	1608	0.00166		0.00828		OK
STORY11	Max Drift Y	CHU1E	37	-11	349	1608		0.00077		0.00386	OK
STORY11	Max Drift X	CHU2	57	1055	-11	1608	0.00045		0.00225		OK
STORY11	Max Drift Y	CHU2	47	1619	1031	1608		0.00117		0.00587	OK
STORY11	Max Drift X	CHU2E	57	1055	-11	1608	0.00102		0.00510		OK
STORY11	Max Drift Y	CHU2E	47	1619	1031	1608		0.00177		0.00886	OK
STORY10	Max Drift X	CHU1	52	553	1355	1448	0.00116		0.00580		OK
STORY10	Max Drift Y	CHU1	37	-11	349	1448		0.00014		0.00069	OK
STORY10	Max Drift X	CHU1E	52	553	1355	1448	0.00162		0.00811		OK
STORY10	Max Drift Y	CHU1E	37	-11	349	1448		0.00076		0.00379	OK
STORY10	Max Drift X	CHU2	57	1055	-11	1448	0.00044		0.00221		OK
STORY10	Max Drift Y	CHU2	47	1619	1031	1448		0.00115		0.00574	OK
STORY10	Max Drift X	CHU2E	57	1055	-11	1448	0.00100		0.00502		OK
STORY10	Max Drift Y	CHU2E	47	1619	1031	1448		0.00174		0.00870	OK
STORY9	Max Drift X	CHU1	52	553	1355	1288	0.00112		0.00558		OK
STORY9	Max Drift Y	CHU1	37	-11	349	1288		0.00013		0.00065	OK
STORY9	Max Drift X	CHU1E	52	553	1355	1288	0.00157		0.00783		OK
STORY9	Max Drift Y	CHU1E	37	-11	349	1288		0.00074		0.00368	OK
STORY9	Max Drift X	CHU2	2520	804	0	1288	0.00042		0.00210		OK
STORY9	Max Drift Y	CHU2	47	1619	1031	1288		0.00111		0.00553	OK
STORY9	Max Drift X	CHU2E	2520	804	0	1288	0.00096		0.00481		OK
STORY9	Max Drift Y	CHU2E	47	1619	1031	1288		0.00168		0.00841	OK
STORY8	Max Drift X	CHU1	52	553	1355	1128	0.00105		0.00526		OK
STORY8	Max Drift Y	CHU1	37	-11	349	1128		0.00012		0.00060	OK
STORY8	Max Drift X	CHU1E	52	553	1355	1128	0.00148		0.00742		OK
STORY8	Max Drift Y	CHU1E	37	-11	349	1128		0.00070		0.00351	OK
STORY8	Max Drift X	CHU2	42	1385	-11	1128	0.00040		0.00202		OK
STORY8	Max Drift Y	CHU2	47	1619	1031	1128		0.00104		0.00522	OK
STORY8	Max Drift X	CHU2E	42	1385	-11	1128	0.00093		0.00466		OK
STORY8	Max Drift Y	CHU2E	47	1619	1031	1128		0.00160		0.00799	OK
STORY7	Max Drift X	CHU1	52	553	1355	968	0.00097		0.00486		OK

STORY7	Max Drift Y	CHU1	37	-11	349	968		0.00011		0.00055	OK
STORY7	Max Drift X	CHU1E	52	553	1355	968	0.00138		0.00689		OK
STORY7	Max Drift Y	CHU1E	37	-11	349	968		0.00066		0.00329	OK
STORY7	Max Drift X	CHU2	42	1385	-11	968	0.00037		0.00187		OK
STORY7	Max Drift Y	CHU2	47	1619	1031	968		0.00096		0.00482	OK
STORY7	Max Drift X	CHU2E	42	1385	-11	968	0.00087		0.00435		OK
STORY7	Max Drift Y	CHU2E	47	1619	1031	968		0.00148		0.00742	OK
STORY6	Max Drift X	CHU1	52	553	1355	808	0.00087		0.00435		OK
STORY6	Max Drift Y	CHU1	37	-11	349	808		0.00010		0.00050	OK
STORY6	Max Drift X	CHU1E	52	553	1355	808	0.00124		0.00620		OK
STORY6	Max Drift Y	CHU1E	37	-11	349	808		0.00060		0.00299	OK
STORY6	Max Drift X	CHU2	42	1385	-11	808	0.00034		0.00168		OK
STORY6	Max Drift Y	CHU2	47	1619	1031	808		0.00086		0.00430	OK
STORY6	Max Drift X	CHU2E	42	1385	-11	808	0.00079		0.00394		OK
STORY6	Max Drift Y	CHU2E	47	1619	1031	808		0.00133		0.00667	OK
STORY5	Max Drift X	CHU1	52	553	1355	648	0.00075		0.00373		OK
STORY5	Max Drift Y	CHU1	37	-11	349	648		0.00009		0.00044	OK
STORY5	Max Drift X	CHU1E	52	553	1355	648	0.00107		0.00534		OK
STORY5	Max Drift Y	CHU1E	37	-11	349	648		0.00052		0.00259	OK
STORY5	Max Drift X	CHU2	42	1385	-11	648	0.00029		0.00145		OK
STORY5	Max Drift Y	CHU2	47	1619	1031	648		0.00073		0.00367	OK
STORY5	Max Drift X	CHU2E	42	1385	-11	648	0.00068		0.00340		OK
STORY5	Max Drift Y	CHU2E	47	1619	1031	648		0.00114		0.00572	OK
STORY4	Max Drift X	CHU1	52	553	1355	488	0.00059		0.00297		OK
STORY4	Max Drift Y	CHU1	37	-11	349	488		0.00007		0.00036	OK
STORY4	Max Drift X	CHU1E	52	553	1355	488	0.00085		0.00426		OK
STORY4	Max Drift Y	CHU1E	37	-11	349	488		0.00042		0.00209	OK
STORY4	Max Drift X	CHU2	42	1385	-11	488	0.00023		0.00116		OK
STORY4	Max Drift Y	CHU2	47	1619	1031	488		0.00058		0.00290	OK
STORY4	Max Drift X	CHU2E	42	1385	-11	488	0.00055		0.00273		OK
STORY4	Max Drift Y	CHU2E	47	1619	1031	488		0.00091		0.00456	OK
STORY3	Max Drift X	CHU1	52	553	1355	328	0.00041		0.00204		OK
STORY3	Max Drift Y	CHU1	37	-11	349	328		0.00005		0.00026	OK
STORY3	Max Drift X	CHU1E	52	553	1355	328	0.00059		0.00293		OK
STORY3	Max Drift Y	CHU1E	37	-11	349	328		0.00029		0.00146	OK
STORY3	Max Drift X	CHU2	42	1385	-11	328	0.00016		0.00081		OK
STORY3	Max Drift Y	CHU2	47	1619	1031	328		0.00040		0.00200	OK
STORY3	Max Drift X	CHU2E	42	1385	-11	328	0.00038		0.00190		OK
STORY3	Max Drift Y	CHU2E	47	1619	1031	328		0.00063		0.00315	OK
STORY2	Max Drift X	CHU1	2517	804	1344	168	0.00017		0.00087		OK
STORY2	Max Drift Y	CHU1	2519	0	690	168		0.00002		0.00012	OK
STORY2	Max Drift X	CHU1E	2517	804	1344	168	0.00025		0.00126		OK
STORY2	Max Drift Y	CHU1E	2519	0	690	168		0.00013		0.00064	OK
STORY2	Max Drift X	CHU2	2520	804	0	168	0.00008		0.00038		OK
STORY2	Max Drift Y	CHU2	2518	1608	690	168		0.00018		0.00091	OK
STORY2	Max Drift X	CHU2E	2520	804	0	168	0.00017		0.00086		OK
STORY2	Max Drift Y	CHU2E	2518	1608	690	168		0.00029		0.00143	OK

