

cColumn v10

A Concrete Column Design and Investigation Program
Copyright 2023, Computations & Graphics, Inc.
All rights reserved.

DISCLAIMER: COMPUTATIONS & GRAPHICS, INC. (CGI) HAS TAKEN EVERY EFFORT TO MAKE THE SOFTWARE RELIABLE AND ACCURATE. HOWEVER, IT IS THE END USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE ACCURACY AND RELIABILITY OF THE SOFTWARE. NO EXPRESS OR IMPLIED WARRANTY IS PROVIDED BY CGI OR ITS DEVELOPERS ON THE ACCURACY OR RELIABILITY OF THE SOFTWARE. IN NO EVENT WILL CGI OR ITS SUPPLIERS BE LIABLE TO YOU FOR ANY DAMAGES, CLAIMS OR COSTS WHATSOEVER OR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL DAMAGES, OR ANY LOST PROFITS OR LOST SAVINGS, EVEN IF CGI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS, DAMAGES, CLAIMS OR COSTS

Table of Contents

General Info	3
Units	3
Rebar Database	3
Model Settings	3
Capacity Check Summary	3
Section 1: RectC1	4
Section Figure	4
Section Information	4
Section Boundary	4
Section Rebars	4
P-Mx (Positive) Control Points	5
P-Mx (Negative) Control Points	5
P-My (Positive) Control Points	5
P-My (Negative) Control Points	5
Mx-My @ Pu = 0 kip	5
P-Mx and P-My Diagram	7
Mx-My Diagram	8

General Info

Model Name	
Engineer	
Notes	
Date & Time	10/29/2023 15:24
File Name	C:\CGIncl\cColumn10\RcVerifications\Example003.rcs

Units

Dimension	in
Length	ft
Force	kip
Moment	kip-in
Modulus	kip/in ²

Rebar Database

Bar #	Diameter in	Area in ²	Bar #	Diameter in	Area in ²	Bar #	Diameter in	Area in ²
#3	0.37500	0.1100	#4	0.50000	0.2000	#5	0.62500	0.3100
#6	0.75000	0.4400	#7	0.87500	0.6000	#8	1.00000	0.7900
#9	1.12800	1.0000	#10	1.27000	1.2700	#11	1.41000	1.5600
#14	1.69300	2.2500	#18	2.25700	4.0000			

Model Settings

Code	ACI 318-14
Strength Reduction	Auto
Neutral Axis Steps for Accuracy	250
Biaxial Angle Steps	4
Axial Force Steps for Display	20
Diagram Aspect Ratio	0.250
Exclude Concrete Displaced by Bars	Yes
Consider X-Axis Slenderness	No
Consider X-Axis Mmin	No
Unbraced Length Lux	0.0 ft
Unbraced Length Factor Kx	1.00
Consider Y-Axis Slenderness	No
Consider Y-Axis Mmin	No
Unbraced Length Luy	0.0 ft
Unbraced Length Factor Ky	1.00
EI for Column Critical Load Pc	$EI = (0.2E_c * I_g + E_s * I_{se}) / (1 + \text{Beta}_d)$
Minimum Bar Spacing	1.500 in
Minimum Reinforcement Ratio	1.00%
Maximum Reinforcement Ratio	8.00%
Bar Selection Method	Based on area of steel
Minimum Unity Ratio	0.80
Maximum Unity Ratio	1.00
Unity Method	Use maximum of axial and moment demand/capacity ratios
Section Input Mode	Advanced

Capacity Check Summary

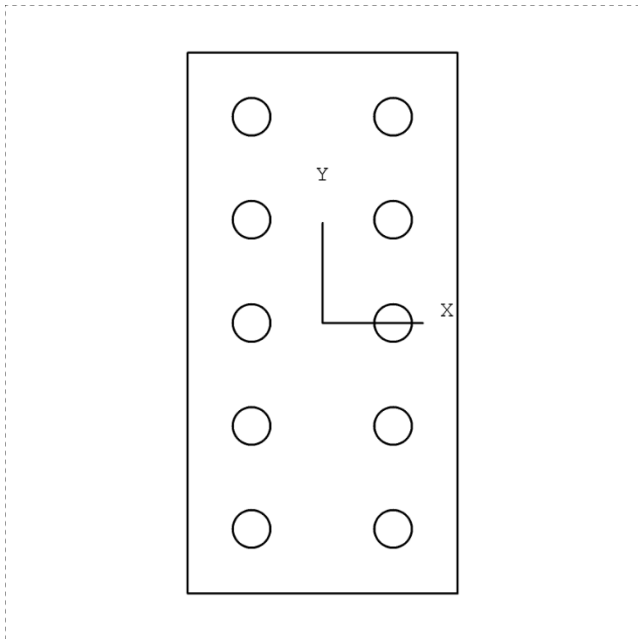
Section #	As in ²	Ag in ²	Rho %	Load #	Pu kip	Mcx kip-in	Mcy kip-in	Ratio
1	22.5000	288.0000	7.813	NA	0.0	0.0	0.0	0.000

* Mcx and Mcy denote the magnified Mx and My moments of the critical load respectively

* Ratio (i.e. unity ratio) less than 1.0 means the section is adequate to resist the loads. Ratio greater than 1.0 means the section is NOT adequate to resist the loads.

Section 1: RectC1

Section Figure



Section Information

Section Name	RectC1
Section Type	Rectangular (C)
b x h	12 x 24 in
Cover to Bar Center	2.8465 in
fc	6.00e+00 kip/in ²
fy	6.00e+01 kip/in ²
Confinement	Tied
Bars	10 # 14
Total Steel Area (As)	22.5000 in ²
Total Section Area (Ag)	288.0000 in ²
Rho	7.813 %
Moment of Inertia of Section Ix	13824.0000 in ⁴
Moment of Inertia of Section Iy	3456.0000 in ⁴
Centroid-X (X0)	0.0000 in
Centroid-Y (Y0)	0.0000 in
Clear Spacing between Bars	2.8838 in
Moment of Inertia of Reinforcement Ise-X	942.5988 in ⁴
Moment of Inertia of Reinforcement Ise-Y	223.7527 in ⁴
Critical Load #	NA
Pu	0.0 kip
Critical Moment Mcx (magnified)	0.0 kip-in
Critical Moment Mcy (magnified)	0.0 kip-in
Unity Ratio	0.000

Section Boundary

Point #	X in	Y in	Point #	X in	Y in	Point #	X in	Y in
1	-6.0000	-12.0000	2	6.0000	-12.0000	3	6.0000	12.0000
4	-6.0000	12.0000						

Section Rebars

Area in ²	X in	Y in	Area in ²	X in	Y in	Area in ²	X in	Y in
-------------------------	---------	---------	-------------------------	---------	---------	-------------------------	---------	---------

2.2500	-3.1535	-9.1535	2.2500	-3.1535	-4.5768	2.2500	-3.1535	0.0000
2.2500	-3.1535	4.5768	2.2500	-3.1535	9.1535	2.2500	3.1535	-9.1535
2.2500	3.1535	-4.5768	2.2500	3.1535	0.0000	2.2500	3.1535	4.5768
2.2500	3.1535	9.1535						

P-Mx (Positive) Control Points

Point Name	Neutral axis depth in	phi * Pn kip	phi * Mnx kip-in	phi * Mny kip-in	max strain	phi
Pmax	27.3089	1406.1	2723.7	0.0	-0.00068	0.650
fs = 0.0	21.1535	1092.2	4472.6	0.0	0.00000	0.650
fs = 0.25 Fy	18.0427	880.9	5211.6	0.0	0.00052	0.650
fs = 0.5 Fy	15.7295	708.2	5745.9	0.0	0.00103	0.650
Balanced	12.5194	375.4	6588.2	0.0	0.00207	0.650
Tension Controlled	7.9326	-111.1	8276.4	0.0	0.00500	0.900
Pure bending	8.6460	-0.0	8124.6	-0.0	0.00434	0.844
Pure Tension	0.0000	-1215.0	0.0	-0.0	0.20000	0.900

P-Mx (Negative) Control Points

Point Name	Neutral axis depth in	phi * Pn kip	phi * Mnx kip-in	phi * Mny kip-in	max strain	phi
Pmax	27.3089	1406.1	-2723.7	-0.0	-0.00068	0.650
fs = 0.0	21.1535	1092.2	-4472.6	-0.0	0.00000	0.650
fs = 0.25 Fy	18.0427	880.9	-5211.6	-0.0	0.00052	0.650
fs = 0.5 Fy	15.7295	708.2	-5745.9	-0.0	0.00103	0.650
Balanced	12.5194	375.4	-6588.2	-0.0	0.00207	0.650
Tension Controlled	7.9326	-111.1	-8276.4	-0.0	0.00500	0.900
Pure bending	8.6460	-0.0	-8124.6	-0.0	0.00434	0.844
Pure Tension	0.0000	-1215.0	0.0	-0.0	0.20000	0.900

P-My (Positive) Control Points

Point Name	Neutral axis depth in	phi * Pn kip	phi * Mnx kip-in	phi * Mny kip-in	max strain	phi
Pmax	13.8476	1406.1	-0.0	1370.5	-0.00102	0.650
fs = 0.0	9.1535	947.2	-0.0	2667.0	0.00000	0.650
fs = 0.25 Fy	7.8074	723.1	-0.0	2934.3	0.00052	0.650
fs = 0.5 Fy	6.8064	519.6	-0.0	3141.6	0.00103	0.650
Balanced	5.4174	149.1	-0.0	3500.9	0.00207	0.650
Tension Controlled	3.4326	-173.5	-0.0	3726.6	0.00500	0.900
Pure bending	4.3281	-0.0	-0.0	3599.3	0.00334	0.759
Pure Tension	0.0000	-1215.0	0.0	-0.0	0.20000	0.900

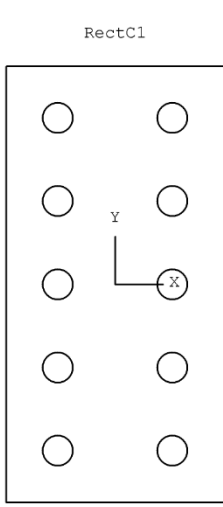
P-My (Negative) Control Points

Point Name	Neutral axis depth in	phi * Pn kip	phi * Mnx kip-in	phi * Mny kip-in	max strain	phi
Pmax	13.8476	1406.1	0.0	-1370.5	-0.00102	0.650
fs = 0.0	9.1535	947.2	0.0	-2667.0	0.00000	0.650
fs = 0.25 Fy	7.8074	723.1	0.0	-2934.3	0.00052	0.650
fs = 0.5 Fy	6.8064	519.6	0.0	-3141.6	0.00103	0.650
Balanced	5.4174	149.1	0.0	-3500.9	0.00207	0.650
Tension Controlled	3.4326	-173.5	0.0	-3726.6	0.00500	0.900
Pure bending	4.3281	-0.0	0.0	-3599.3	0.00334	0.759
Pure Tension	0.0000	-1215.0	0.0	-0.0	0.20000	0.900

Mx-My @ Pu = 0 kip

phi * Pn kip	phi * Mnx kip-in	phi * Mny kip-in	Neutral axis depth in	Max strain	Angle deg
0.0	8124.6	-0.0	8.6460	0.00434	0.00

0.0	-0.0	3599.3	4.3281	0.00334	90.00
0.0	-8124.6	-0.0	8.6460	0.00434	180.00
0.0	0.0	-3599.3	4.3281	0.00334	270.00



Section 1 of 1

Code: ACI 318-14
 Strength reduction: Auto
 Neutral axis steps: 250
 Biaxial angle steps: 4
 Axial capacity steps: 20
 Excl. displ'd concrete: Yes

b x h: 12 x 24 in
 fc: 6.00 kip/in²
 fy: 60.00 kip/in²
 Cover (t.c): 2.8465 in
 Bars: 10 # 14
 Confinement: Tied
 Ag: 288.00 in²
 As: 22.50 in²
 Roh: 7.81%
 Ix: 13824 in⁴
 Iy: 3456 in⁴
 X0: 0.00 in
 Y0: 0.00 in
 Clear spacing: 2.88 in

Control Points (kip, kip-in)

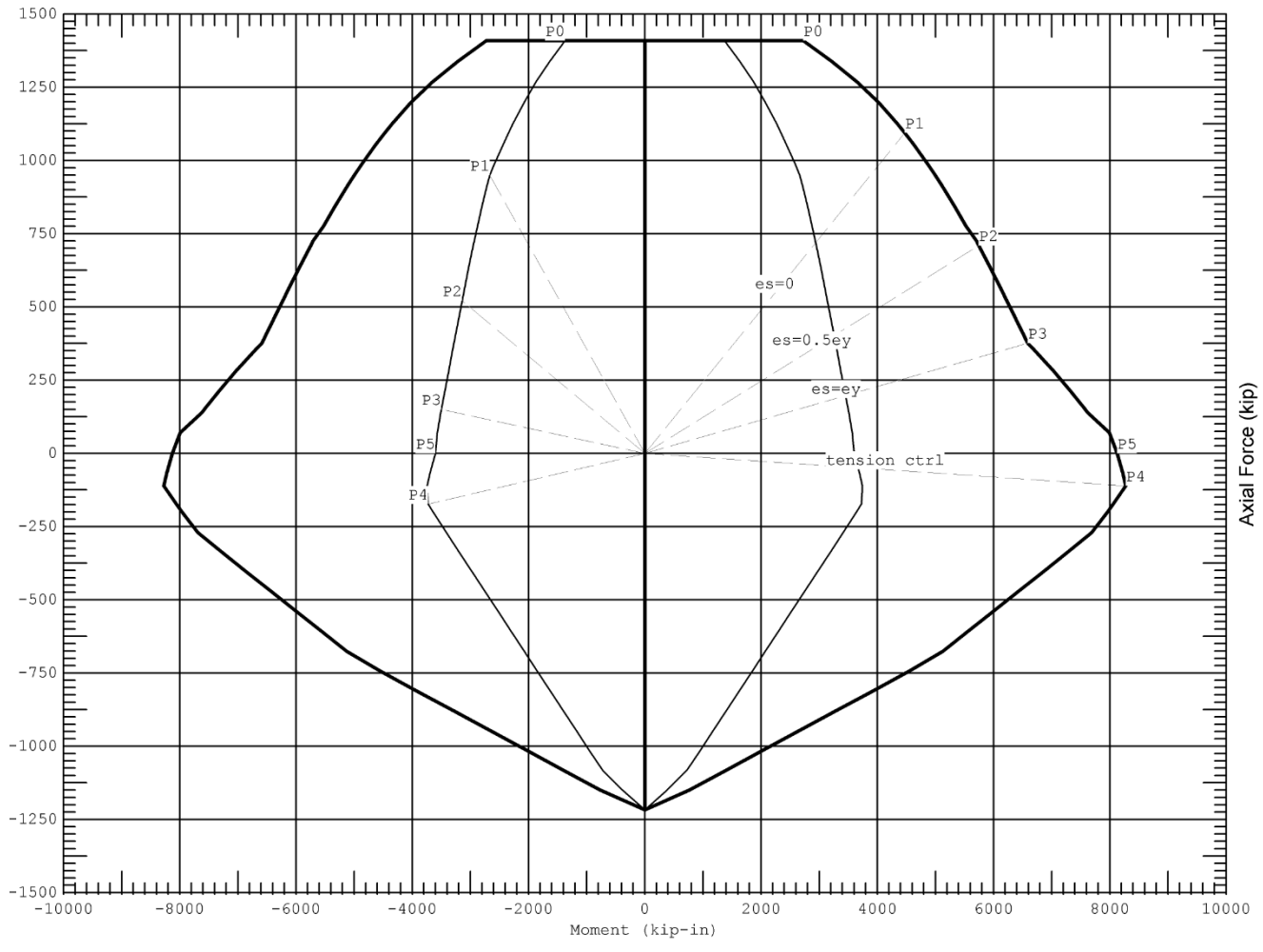
PT	P	Mx(+)	max es

P0	1406.11	2723.66	-0.00068
P1	1092.21	4472.61	0.00000
P2	708.22	5745.94	0.00103
P3	375.36	6588.22	0.00207
P4	-111.09	8276.36	0.00500
P5	-0.00	8124.62	0.00434
Pmin	-1215.00	0.00	0.20000

PT	P	My(-)	max es

P0	1406.11	-1370.46	-0.00102
P1	947.25	-2667.04	0.00000
P2	519.60	-3141.60	0.00103
P3	149.12	-3500.90	0.00207
P4	-173.50	-3726.57	0.00500
P5	-0.00	-3599.28	0.00334
Pmin	-1215.00	-0.00	0.20000

P-Mx and P-My Interaction Diagram



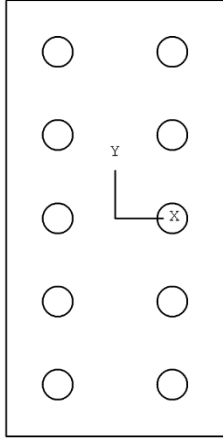
Project/Job:

Engineer:

Date & Time: 10/29/2023 15:24

cColumn v10
(C) Computations & Graphics, Inc.

RectC1



Section 1 of 1

Code: ACI 318-14
Strength reduction: Auto
Neutral axis steps: 250
Biaxial angle steps: 4
Axial capacity steps: 20
Excl. displ'd concrete: Yes

b x h: 12 x 24 in
fc: 6.00 kip/in²
fy: 60.00 kip/in²
Cover (t.c): 2.8465 in
Bars: 10 # 14
Confinement: Tied
Ag: 288.00 in²
As: 22.50 in²
Roh: 7.81%
Ix: 13824 in⁴
Iy: 3456 in⁴
X0: 0.00 in
Y0: 0.00 in
Clear spacing: 2.88 in

Control Points (kip, kip-in)

Angle	P	Mx	My
0	0.00	8124.62	-0.00
90	0.00	-0.00	3599.28
180	0.00	-8124.62	-0.00
270	0.00	0.00	-3599.28

Mx-My Interaction Diagram

