

Digital Canal

Project :
Location : Dubuque, IA
Subject : Foundation Design

File :
Date : 11/1/02
Eng. : CRA

Reinforced Concrete Properties

f'c : 3000.00 lb/in²
 Ec : 3122.00 kip/in²
 Density : 150.00 lb/ft³
 Min Cover : 3.00 in
 fy : 60000.00 lb/in²

Undercapacity Factors

Bending : 0.9000
 Shear : 0.8500

Soil Properties

Modulus of Subgrade Reaction
 Ks : 140.00 kip/ft³

Section Dimensions

Width(1) (ft)	Width(2) (ft)	Thickness (in)	Length (ft)
8.17	8.17	20.50	19.75

Column Properties

Width (in)	Length (in)	Xo (ft)
12.00	12.00	0.50
12.00	12.00	15.50

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Point Loads

Case	Po (kip)	Mo (kip-ft)	Xo (ft)
Live Load	-186.00	0.00	0.50
Live Load	-307.00	0.00	15.50

Load Combinations

1) COMBINATION 1 = 1.00*Selfweight+1.00*Live Load

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Joint Information

Joint No	X (ft)	Y (ft)	Constraints			Springs		
			X Dir. (ft)	Y Dir. (ft)	Z Dir. (rad)	Kx (kip/ft)	Ky (kip/ft)	Kz (kip-ft/Rad)
1	0.00	0.00	-	-	-	0.00	1,143.80	0.00
2	1.00	0.00	-	-	-	0.00	1,143.80	0.00
3	2.00	0.00	-	-	-	0.00	1,143.80	0.00
4	3.00	0.00	-	-	-	0.00	1,143.80	0.00
5	4.00	0.00	-	-	-	0.00	1,143.80	0.00
6	5.00	0.00	-	-	-	0.00	1,143.80	0.00
7	6.00	0.00	-	-	-	0.00	1,143.80	0.00
8	7.00	0.00	-	-	-	0.00	1,143.80	0.00
9	8.00	0.00	-	-	-	0.00	1,143.80	0.00
10	9.00	0.00	-	-	-	0.00	1,143.80	0.00
11	10.00	0.00	-	-	-	0.00	1,143.80	0.00
12	11.00	0.00	0	-	-	0.00	1,143.80	0.00
13	12.00	0.00	-	-	-	0.00	1,143.80	0.00
14	13.00	0.00	-	-	-	0.00	1,143.80	0.00
15	14.00	0.00	-	-	-	0.00	1,143.80	0.00
16	15.00	0.00	-	-	-	0.00	1,143.80	0.00
17	16.00	0.00	-	-	-	0.00	1,143.80	0.00
18	17.00	0.00	-	-	-	0.00	1,143.80	0.00
19	18.00	0.00	-	-	-	0.00	1,143.80	0.00
20	19.00	0.00	-	-	-	0.00	1,000.83	0.00
21	19.75	0.00	-	-	-	0.00	857.85	0.00

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Member Information

Member	Start	End	Length (ft)	Width (ft)	Thickness (ft)	Inertia (ft ⁴)	Proj. Area (ft ²)
1	1	2	1.00	8.17	1.46	2.11	8.17
2	2	3	1.00	8.17	1.46	2.11	8.17
3	3	4	1.00	8.17	1.46	2.11	8.17
4	4	5	1.00	8.17	1.46	2.11	8.17
5	5	6	1.00	8.17	1.46	2.11	8.17
6	6	7	1.00	8.17	1.46	2.11	8.17
7	7	8	1.00	8.17	1.46	2.11	8.17
8	8	9	1.00	8.17	1.46	2.11	8.17
9	9	10	1.00	8.17	1.46	2.11	8.17
10	10	11	1.00	8.17	1.46	2.11	8.17
11	11	12	1.00	8.17	1.46	2.11	8.17
12	12	13	1.00	8.17	1.46	2.11	8.17
13	13	14	1.00	8.17	1.46	2.11	8.17
14	14	15	1.00	8.17	1.46	2.11	8.17
15	15	16	1.00	8.17	1.46	2.11	8.17
16	16	17	1.00	8.17	1.46	2.11	8.17
17	17	18	1.00	8.17	1.46	2.11	8.17
18	18	19	1.00	8.17	1.46	2.11	8.17
19	19	20	1.00	8.17	1.46	2.11	8.17
20	20	21	0.75	8.17	1.46	2.11	6.13

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Joint Displacements

COMBINATION 1

Joint	X (ft)	X-Trans (ft)	Y-Trans (ft)	Z-Rot (rad)
1	0.0000	0.0000	-0.0293	0.0026
2	1.0000	0.0000	-0.0267	0.0025
3	2.0000	0.0000	-0.0242	0.0024
4	3.0000	0.0000	-0.0219	0.0022
5	4.0000	0.0000	-0.0199	0.0019
6	5.0000	0.0000	-0.0182	0.0015
7	6.0000	0.0000	-0.0170	0.0010
8	7.0000	0.0000	-0.0162	0.0006
9	8.0000	0.0000	-0.0158	0.0002
10	9.0000	0.0000	-0.0159	-0.0003
11	10.0000	0.0000	-0.0163	-0.0006
12	11.0000	0.0000	-0.0171	-0.0009
13	12.0000	0.0000	-0.0182	-0.0012
14	13.0000	0.0000	-0.0194	-0.0013
15	14.0000	0.0000	-0.0207	-0.0013
16	15.0000	0.0000	-0.0220	-0.0012
17	16.0000	0.0000	-0.0230	-0.0009
18	17.0000	0.0000	-0.0238	-0.0007
19	18.0000	0.0000	-0.0244	-0.0006
20	19.0000	0.0000	-0.0250	-0.0005
21	19.7500	0.0000	-0.0254	-0.0005

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Reactions

COMBINATION 1

Joint	X-Force (kip)	Y-Force (kip)	Z-Moment (kip-ft)
1	0.00	33.50	0.00
2	0.00	30.58	0.00
3	0.00	27.72	0.00
4	0.00	25.09	0.00
5	0.00	22.77	0.00
6	0.00	20.87	0.00
7	0.00	19.44	0.00
8	0.00	18.50	0.00
9	0.00	18.07	0.00
10	0.00	18.13	0.00
11	0.00	18.65	0.00
12	0.00	19.56	0.00
13	0.00	20.78	0.00
14	0.00	22.21	0.00
15	0.00	23.72	0.00
16	0.00	25.15	0.00
17	0.00	26.33	0.00
18	0.00	27.22	0.00
19	0.00	27.93	0.00
20	0.00	25.00	0.00
21	0.00	21.77	0.00

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Soil Pressures

COMBINATION 1

Joint	Y-Force (kip)	Pj. Area (ft ²)	Pressure (kip/ft ²)
1	33.50	8.17	4.10
2	30.58	8.17	3.74
3	27.72	8.17	3.39
4	25.09	8.17	3.07
5	22.77	8.17	2.79
6	20.87	8.17	2.55
7	19.44	8.17	2.38
8	18.50	8.17	2.26
9	18.07	8.17	2.21
10	18.13	8.17	2.22
11	18.65	8.17	2.28
12	19.56	8.17	2.39
13	20.78	8.17	2.54
14	22.21	8.17	2.72
15	23.72	8.17	2.90
16	25.15	8.17	3.08
17	26.33	8.17	3.22
18	27.22	8.17	3.33
19	27.93	8.17	3.42
20	25.00	7.15	3.50
21	21.77	6.13	3.55

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Member End-Forces

Member	Node	COMBINATION 1			
		X (ft)	Fx (kip)	Fy (kip)	Mz (kip-ft)
1	1	0.00	0.00	33.50	0.00
	2	1.00	0.00	152.50	-59.50
2	2	1.00	0.00	-121.93	59.50
	3	2.00	0.00	121.93	-181.43
3	3	2.00	0.00	-94.20	181.43
	4	3.00	0.00	94.20	-275.63
4	4	3.00	0.00	-69.12	275.63
	5	4.00	0.00	69.12	-344.75
5	5	4.00	0.00	-46.34	344.75
	6	5.00	0.00	46.34	-391.09
6	6	5.00	0.00	-25.47	391.09
	7	6.00	0.00	25.47	-416.56
7	7	6.00	0.00	-6.03	416.56
	8	7.00	0.00	6.03	-422.58
8	8	7.00	0.00	12.48	422.58
	9	8.00	0.00	-12.48	-410.11
9	9	8.00	0.00	30.55	410.11
	10	9.00	0.00	-30.55	-379.56
10	10	9.00	0.00	48.68	379.56
	11	10.00	0.00	-48.68	-330.88
11	11	10.00	0.00	67.33	330.88
	12	11.00	0.00	-67.33	-263.54
12	12	11.00	0.00	86.89	263.54
	13	12.00	0.00	-86.89	-176.66
13	13	12.00	0.00	107.67	176.66
	14	13.00	0.00	-107.67	-68.99
14	14	13.00	0.00	129.88	68.99
	15	14.00	0.00	-129.88	60.89
15	15	14.00	0.00	153.60	-60.89
	16	15.00	0.00	-153.60	214.48
16	16	15.00	0.00	178.75	-214.48
	17	16.00	0.00	128.25	239.73
17	17	16.00	0.00	-101.92	-239.73
	18	17.00	0.00	101.92	137.81
0.	18	17.00	0.00	-74.71	-137.81
	19	18.00	0.00	74.71	63.10
19	19	18.00	0.00	-46.77	-63.10
	20	19.00	0.00	46.77	16.33
20	20	19.00	0.00	-21.77	-16.33
	21	19.75	0.00	21.77	0.00

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Top Longitudinal Steel

Distance (ft)	Bar	Qty	TOP SIDE		Aprv. (in ²)	Ratio	Status
			Spc (in)	Arqd. (in ²)			
0.00	#4	15	6.57	2.98	3.00	1.01	Pass
1.00	#4	15	6.57	2.98	3.00	1.01	Pass
2.00	#4	15	6.57	2.98	3.00	1.01	Pass
3.00	#4	19	5.11	3.73	3.80	1.02	Pass
4.00	#4	24	4.00	4.70	4.80	1.02	Pass
5.00	#4	27	3.54	5.35	5.40	1.01	Pass
6.00	#4	29	3.29	5.72	5.80	1.01	Pass
7.00	#4	30	3.17	5.80	6.00	1.03	Pass
8.00	#4	29	3.29	5.63	5.80	1.03	Pass
9.00	#4	26	3.68	5.19	5.20	1.00	Pass
10.00	#4	23	4.18	4.50	4.60	1.02	Pass
11.00	#4	18	5.41	3.56	3.60	1.01	Pass
12.00	#4	15	6.57	2.98	3.00	1.01	Pass
13.00	#4	15	6.57	2.98	3.00	1.01	Pass
14.00	#4	15	6.57	2.98	3.00	1.01	Pass
15.00	#4	15	6.57	2.98	3.00	1.01	Pass
16.00	#4	15	6.57	2.98	3.00	1.01	Pass
17.00	#4	15	6.57	2.98	3.00	1.01	Pass
18.00	#4	15	6.57	2.98	3.00	1.01	Pass
19.00	#4	15	6.57	2.98	3.00	1.01	Pass
19.75	#4	15	6.57	2.98	3.00	1.01	Pass

STATUS

Pass : Section will carry the loads.
 Fail/O.R. : Over reinforced section. Sudden failure will occur.
 Fail/U.R. : Under reinforced section. Not enough steel provided.

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Bottom Longitudinal Steel

BOTTOM SIDE							
Distance	Bar	Qty	Spc	Arqd.	Aprv.	Ratio	Status
(ft)			(in)	(in ²)	(in ²)		
0.00	#4	15	6.57	2.98	3.00	1.01	Pass
1.00	#4	15	6.57	2.98	3.00	1.01	Pass
2.00	#4	15	6.57	2.98	3.00	1.01	Pass
3.00	#4	15	6.57	2.98	3.00	1.01	Pass
4.00	#4	15	6.57	2.98	3.00	1.01	Pass
5.00	#4	15	6.57	2.98	3.00	1.01	Pass
6.00	#4	15	6.57	2.98	3.00	1.01	Pass
7.00	#4	15	6.57	2.98	3.00	1.01	Pass
8.00	#4	15	6.57	2.98	3.00	1.01	Pass
9.00	#4	15	6.57	2.98	3.00	1.01	Pass
10.00	#4	15	6.57	2.98	3.00	1.01	Pass
11.00	#4	15	6.57	2.98	3.00	1.01	Pass
12.00	#4	15	6.57	2.98	3.00	1.01	Pass
13.00	#4	15	6.57	2.98	3.00	1.01	Pass
14.00	#4	15	6.57	2.98	3.00	1.01	Pass
15.00	#4	15	6.57	2.98	3.00	1.01	Pass
16.00	#4	17	5.75	3.23	3.40	1.05	Pass
17.00	#4	15	6.57	2.98	3.00	1.01	Pass
18.00	#4	15	6.57	2.98	3.00	1.01	Pass
19.00	#4	15	6.57	2.98	3.00	1.01	Pass
19.75	#4	15	6.57	2.98	3.00	1.01	Pass

STATUS

Pass : Under reinforced section. Not enc

Fail/O.R. : Over reinforced section. Sudden failure will occur.

Fail/U.R. : Under reinforced section. Not enough steel provided.

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Punching Shear Capacity

Distance (ft)	phi	bo (in)	d (in)	Area (ft ²)	qo (kip/ft ²)	Psoil (Kip)	Pcol (Kip)	phi*Vn (kip)	Vu (kip)	Ratio	Status
0.50	0.85	69.38	16.69	4.05	3.92	15.89	186.00	215.59	170.11	1.27	Pass
15.50	0.85	114.75	16.69	5.72	3.15	18.01	307.00	356.60	288.99	1.23	Pass

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Beam Action Shear Capacity

Distance (ft)	phi	bw (in)	d (in)	phi*Vn (kip)	Vu (kip)	Ratio	Status
2.39	0.85	98.04	16.69	152.34	94.20	1.62	Pass
13.61	0.85	98.04	16.69	152.34	129.88	1.17	Pass
17.39	0.85	98.04	16.69	152.34	74.71	2.04	Pass