

Mat or Raft Foundation Analysis

Organization:
 Project Name: **15 ft Water Tank Foundation**
 Job #:
 Design by:
 Date: **1/10/2019**

Mat Geometry

Shape	Round	Inertia, I	5.5339 ft ⁴
Strip Length, L	34.00 ft	Beta	0.140
Strip Width, B	34.00 ft	Beta*L	4.772
Strip Thickness, T	1.25 ft	Min. Thickness for Criteria	
Concrete Str, Fc	2.5 ksi	"Semi-Rigid"	2.183 ft
Concrete Modulus, E	2850.00 ksi	"Rigid"	13.859 ft
Subgrade Modulus, k	60.00 pci	Estimated Effective Strip Width for Slab or Mat:	
Allow. Bearing Cap, qa	2.50 ksf	Lr	5.067 ft
		%B	100.00 %
Mat is flexible		B(est.)	10.134 ft

Mat Loadings

Full Uniform, w 0.94 kips/ft

Distributed Loads

	b, ft	wb, kips/ft	e, ft
#1	0.0000	0.00	0.0000
#2	0.0000	0.00	0.0000
#3	0.0000	0.00	0.0000
#4	0.0000	0.00	0.0000
#5	0.0000	0.00	0.0000
#6	0.0000	0.00	0.0000

Point Loads

	a, ft	P, kips
#1	0.7500	20.00
#2	32.7500	20.00
#3	0.0000	0.00
#4	0.0000	0.00
#5	0.0000	0.00
#6	0.0000	0.00
#7	0.0000	0.00
#8	0.0000	0.00
#9	0.0000	0.00
#10	0.0000	0.00
#11	0.0000	0.00
#12	0.0000	0.00

Moments

	c, ft	M, ft-kips
#1	0.0000	0.00
#2	0.0000	0.00
#3	0.0000	0.00
#4	0.0000	0.00

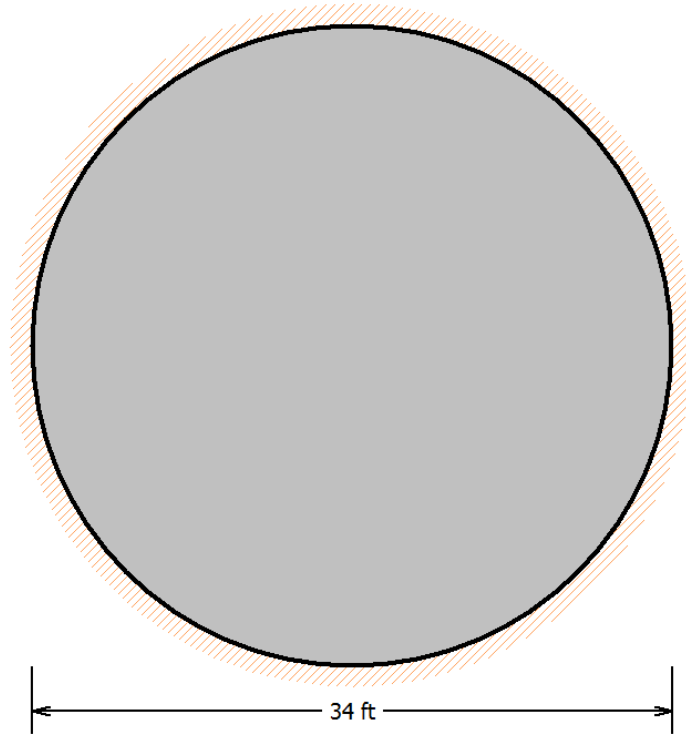
Results

Max. Shears	14.54 k	@	32.750 ft	User Designated Points				
	-16.36 k	@	0.750 ft					
Max. Moments	3.51 ft-k	@	32.750 ft		x1	x2	x3	x4
	-36.39 ft-k	@	6.460 ft	Distance, ft	0.0000	12.0000	30.0000	34.0000
Max. Deflection	-0.02054 in	@	0.000 ft	Shear, k	0.00	2.46	5.58	0.00
Max. Soil Press.	0.177 ksf	@	0.000 ft	Moment, ft-k	0.00	-25.54	-23.20	0.00
Min. Soil Press.	0.011 ksf	@	16.660 ft	Deflection, in	-0.02054	-0.00246	-0.01177	-0.01927
Brg. Area	100.00 %			Pressure, ksf	0.177	0.021	0.102	0.166

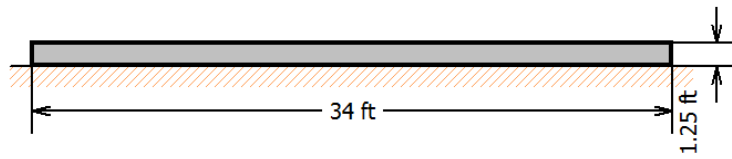
Reinforcement Summary

15.00 in Mat with 31 #5 bars @ 13.45 in on center spacing top bars
 and 31 #5 bars @ 13.38 in on center spacing bottom bars

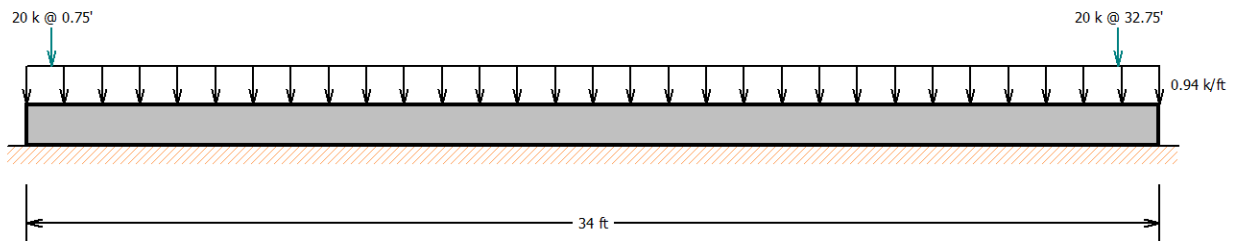
Plan



Cross Section



Loading



Reinforcement

Steel Yield Str, F_y	60.0 ksi	Shear Load Factor	1.6
Concrete Str, F_c	2.5 ksi	Moment Load Factor	1.6
Rebar Sizes	US		

Negative Moment

Top Clear Cover	2.00 in
Top Bar Size	#5
Req. Area of Top Steel	1.02 in ²
Min # Bars for Top	4
Override # of Bars	31
Top Bar Spacing	13.45 in
Eff. Depth of Top Bars	12.69 in
Area of Top Steel	9.51 in ²
Percent Top Steel	0.18 %
Allow. Neg. Moment	511.5 k-ft

Utilization: 11.38%

Max. Factored Moments

Negative	-58.22 k-ft
Positive	5.61 k-ft

Positive Moment

Bottom Clear Cover	3.00 in
Bottom Bar Size	#5
Req. Area of Bot. Steel	0.11 in ²
Min # Bars for Bottom	2
Override # of Bars	31
Bottom Bar Spacing	13.38 in
Eff. Depth of Bot. Bars	11.69 in
Area of Bottom Steel	9.51 in ²
Percent Bottom Steel	0.20 %
Allow. Pos. Moment	468.7 k-ft

Utilization: 1.20%

Shear Check

Max. Factored Shear	26.2 kips
Allowable Shear	357.6 kips

Utilization: 7.32%

Reinforcement

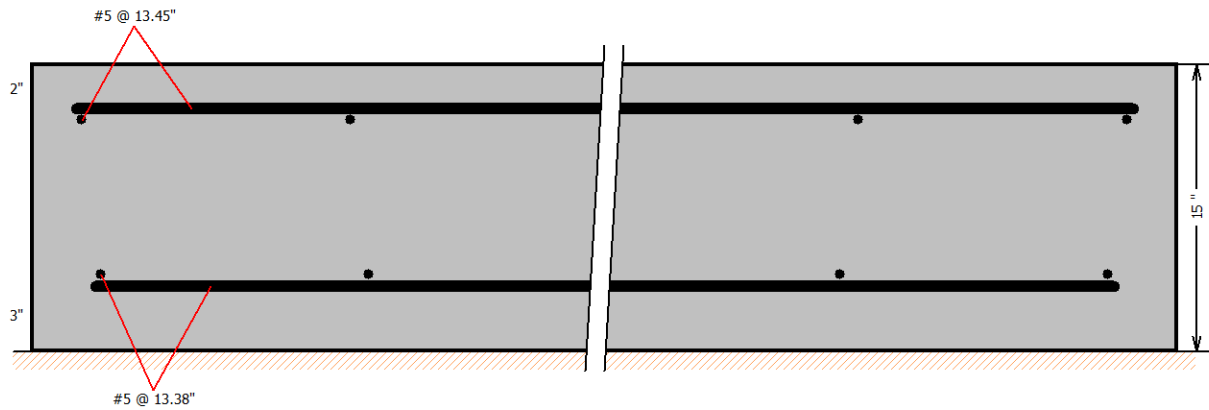
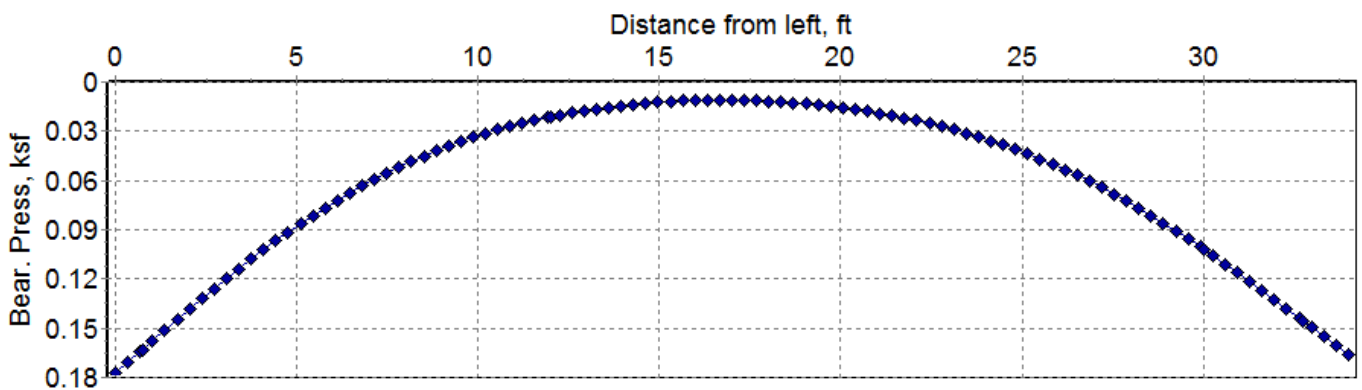
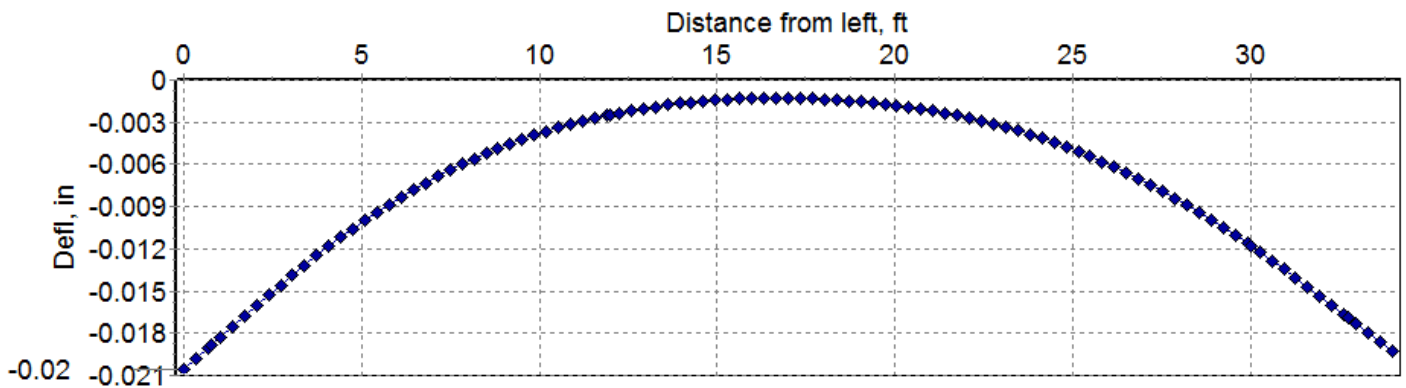
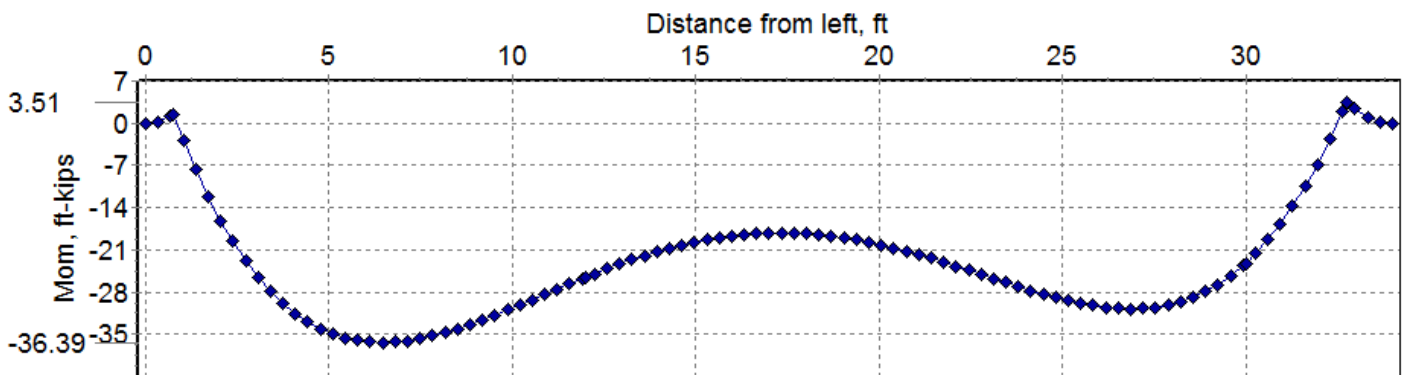
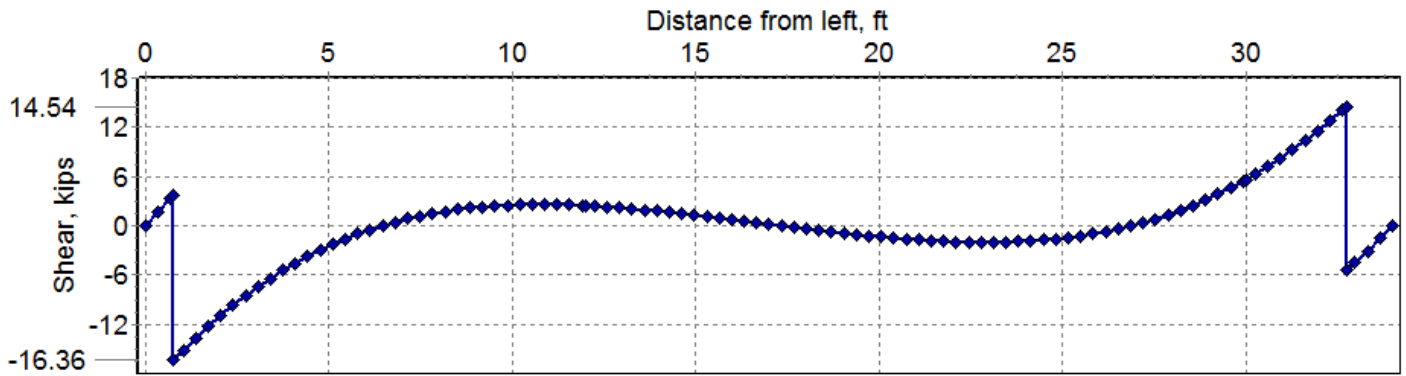


Table of Results - Nodes 1 to 50

Node #	Dist. from left ft	Shear, kips	Moment, ft-kips	Slope, deg	Deflection, in	Soil Press, ksf
1	0.0000	0.000	0.00	0.00	-0.02	0.177
2	0.3400	1.694	0.29	0.00	-0.02	0.171
3	0.6800	3.313	1.14	0.00	-0.02	0.164
4	1.0200	-15.143	-2.87	0.00	-0.02	0.158
5	1.3600	-13.676	-7.76	0.00	-0.02	0.151
6	1.7000	-12.283	-12.17	0.00	-0.02	0.145
7	2.0400	-10.965	-16.12	0.00	-0.02	0.138
8	2.3800	-9.721	-19.64	0.00	-0.02	0.132
9	2.7200	-8.549	-22.74	0.00	-0.01	0.126
10	3.0600	-7.449	-25.46	0.00	-0.01	0.120
11	3.4000	-6.419	-27.82	0.00	-0.01	0.114
12	3.7400	-5.457	-29.83	0.00	-0.01	0.108
13	4.0800	-4.561	-31.53	0.00	-0.01	0.102
14	4.4200	-3.730	-32.94	0.00	-0.01	0.097
15	4.7600	-2.962	-34.08	0.00	-0.01	0.091
16	5.1000	-2.254	-34.96	0.00	-0.01	0.086
17	5.4400	-1.605	-35.62	0.00	-0.01	0.081
18	5.7800	-1.012	-36.06	0.00	-0.01	0.077
19	6.1200	-0.474	-36.31	0.00	-0.01	0.072
20	6.4600	0.013	-36.39	0.00	-0.01	0.068
21	6.8000	0.450	-36.31	0.00	-0.01	0.063
22	7.1400	0.839	-36.09	0.00	-0.01	0.059
23	7.4800	1.183	-35.74	0.00	-0.01	0.056
24	7.8200	1.484	-35.29	0.00	-0.01	0.052
25	8.1600	1.744	-34.74	0.00	-0.01	0.048
26	8.5000	1.965	-34.11	0.00	-0.01	0.045
27	8.8400	2.150	-33.41	0.00	0.00	0.042
28	9.1800	2.299	-32.65	0.00	0.00	0.039
29	9.5200	2.416	-31.85	0.00	0.00	0.036
30	9.8600	2.503	-31.01	0.00	0.00	0.034
31	10.2000	2.560	-30.15	0.00	0.00	0.031
32	10.5400	2.591	-29.27	0.00	0.00	0.029
33	10.8800	2.597	-28.39	0.00	0.00	0.027
34	11.2200	2.579	-27.51	0.00	0.00	0.025
35	11.5600	2.540	-26.64	0.00	0.00	0.023
36	11.9000	2.481	-25.78	0.00	0.00	0.022
37	12.2400	2.403	-24.95	0.00	0.00	0.020
38	12.5800	2.308	-24.15	0.00	0.00	0.019
39	12.9200	2.199	-23.38	0.00	0.00	0.018
40	13.2600	2.075	-22.66	0.00	0.00	0.016
41	13.6000	1.939	-21.97	0.00	0.00	0.015
42	13.9400	1.791	-21.34	0.00	0.00	0.014
43	14.2800	1.634	-20.76	0.00	0.00	0.014
44	14.6200	1.469	-20.23	0.00	0.00	0.013
45	14.9600	1.296	-19.76	0.00	0.00	0.012
46	15.3000	1.117	-19.35	0.00	0.00	0.012
47	15.6400	0.933	-19.00	0.00	0.00	0.012
48	15.9800	0.746	-18.72	0.00	0.00	0.011
49	16.3200	0.556	-18.49	0.00	0.00	0.011
50	16.6600	0.365	-18.34	0.00	0.00	0.011

Table of Results - Nodes 51 to 101

Node #	Dist. from left ft	Shear, kips	Moment, ft-kips	Slope, deg	Deflection, in	Soil Press, ksf
51	17.0000	0.173	-18.25	0.00	0.00	0.011
52	17.3400	-0.018	-18.22	0.00	0.00	0.011
53	17.6800	-0.207	-18.26	0.00	0.00	0.011
54	18.0200	-0.392	-18.36	0.00	0.00	0.012
55	18.3600	-0.574	-18.52	0.00	0.00	0.012
56	18.7000	-0.750	-18.75	0.00	0.00	0.013
57	19.0400	-0.920	-19.03	0.00	0.00	0.013
58	19.3800	-1.082	-19.37	0.00	0.00	0.014
59	19.7200	-1.235	-19.77	0.00	0.00	0.015
60	20.0600	-1.379	-20.21	0.00	0.00	0.016
61	20.4000	-1.511	-20.70	0.00	0.00	0.017
62	20.7400	-1.631	-21.24	0.00	0.00	0.018
63	21.0800	-1.737	-21.81	0.00	0.00	0.019
64	21.4200	-1.828	-22.42	0.00	0.00	0.020
65	21.7600	-1.902	-23.05	0.00	0.00	0.022
66	22.1000	-1.959	-23.71	0.00	0.00	0.024
67	22.4400	-1.997	-24.38	0.00	0.00	0.025
68	22.7800	-2.014	-25.06	0.00	0.00	0.027
69	23.1200	-2.009	-25.75	0.00	0.00	0.029
70	23.4600	-1.980	-26.43	0.00	0.00	0.031
71	23.8000	-1.926	-27.09	0.00	0.00	0.033
72	24.1400	-1.845	-27.73	0.00	0.00	0.036
73	24.4800	-1.735	-28.34	0.00	0.00	0.038
74	24.8200	-1.595	-28.91	0.00	0.00	0.041
75	25.1600	-1.423	-29.42	0.00	-0.01	0.044
76	25.5000	-1.217	-29.87	0.00	-0.01	0.047
77	25.8400	-0.975	-30.25	0.00	-0.01	0.050
78	26.1800	-0.696	-30.53	0.00	-0.01	0.053
79	26.5200	-0.377	-30.72	0.00	-0.01	0.057
80	26.8600	-0.018	-30.79	0.00	-0.01	0.061
81	27.2000	0.385	-30.72	0.00	-0.01	0.064
82	27.5400	0.833	-30.52	0.00	-0.01	0.068
83	27.8800	1.327	-30.15	0.00	-0.01	0.073
84	28.2200	1.871	-29.61	0.00	-0.01	0.077
85	28.5600	2.464	-28.87	0.00	-0.01	0.081
86	28.9000	3.111	-27.93	0.00	-0.01	0.086
87	29.2400	3.811	-26.75	0.00	-0.01	0.091
88	29.5800	4.567	-25.33	0.00	-0.01	0.095
89	29.9200	5.380	-23.64	0.00	-0.01	0.101
90	30.2600	6.252	-21.67	0.00	-0.01	0.106
91	30.6000	7.184	-19.38	0.00	-0.01	0.111
92	30.9400	8.177	-16.77	0.00	-0.01	0.116
93	31.2800	9.233	-13.82	0.00	-0.01	0.122
94	31.6200	10.352	-10.49	0.00	-0.01	0.127
95	31.9600	11.536	-6.77	0.00	-0.02	0.133
96	32.3000	12.784	-2.64	0.00	-0.02	0.138
97	32.6400	14.098	1.93	0.00	-0.02	0.144
98	32.9800	-4.524	2.36	0.00	-0.02	0.150
99	33.3200	-3.081	1.06	0.00	-0.02	0.155
100	33.6600	-1.573	0.27	0.00	-0.02	0.161
101	34.0000	0.000	0.00	0.00	-0.02	0.166



References:

1. Design and Performance of Mat Foundations, ACI SP-152, E. J. Ulrich, 1995
2. Foundation Analysis & Design, 5th Ed., J.E. Bowles, 1996
3. Elastic Analysis of Raft Foundations, J.A. Hemsley, 1999
4. Design Applications of Raft Foundations, J.A. Hemsley, 2000
5. Roark's Formulas for Stress & Strain, 8th Ed., Young, Budynas & Sadegh, 2011
6. ACI 318-14, American Concrete Institute, 2014
7. SoilStructure Mat or Raft Foundation Software v1.0.0 by SoilStructure.com