

Mat or Raft Foundation Analysis

Organization:
 Project Name: **5m Water Tank Foundation**
 Job #:
 Design by:
 Date: **1/10/2019**

Mat Geometry

Shape	Round	Inertia, I	0.01125 m ⁴
Strip Length, L	5.000 m	Beta	0.441
Strip Width, B	5.000 m	Beta*L	2.205
Strip Thickness, T	0.300 m	Min. Thickness for Criteria	
Concrete Str, Fc	25.0 MPa	"Semi-Rigid"	0.187 m
Concrete Modulus, E	23500.00 MPa	"Rigid"	1.188 m
Subgrade Modulus, k	8000.00 KN/m ²	Estimated Effective Strip Width for Slab or Mat:	
Allow. Bearing Cap, qa	80.00 KPa	Lr	1.613 m
		%B	100.00 %
		B(est.)	3.225 m

Mat is semi-rigid

Mat Loadings

Full Uniform, w 5.00 KN/m

Distributed Loads

	b, m	wb, KN/m	e, m
#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, m	P, KN
#1	0.2500	90.00
#2	4.7500	90.00
#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, m	M, KN-m
#1	0.0000	0.00
#2	0.0000	0.00
#3	0.0000	0.00
#4	0.0000	0.00

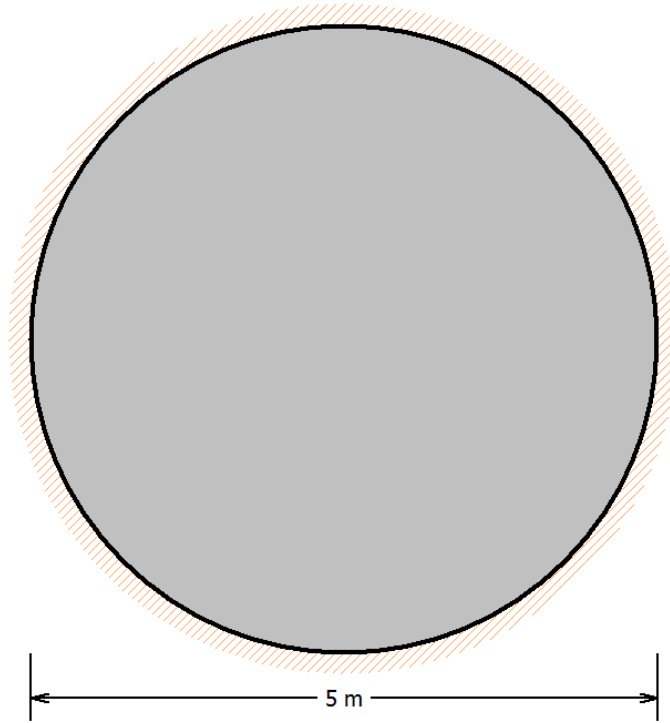
Results

Max. Shears	77.04 KN @ 4.750 m	User Designated Points				
	-77.04 KN @ 0.250 m					
Max. Moments	1.64 KN-m @ 0.250 m		x1	x2	x3	x4
	-74.47 KN-m @ 2.500 m	Distance, m	0.0000	1.0000	3.0000	5.0000
Max. Deflection	-1.47475 @ 5.000 m	Shear, KN	0.00	-44.49	13.04	0.00
Max. Soil Press.	11.798 KP @ 5.000 m	Moment, KN-m	0.00	-43.35	-71.24	0.00
Min. Soil Press.	6.121 KPa @ 2.500 m	Deflection, mm	-1.47475	-1.06089	-0.80003	-1.47475
Brg. Area	100.00 %	Pressure, KPa	11.798	8.487	6.400	11.798

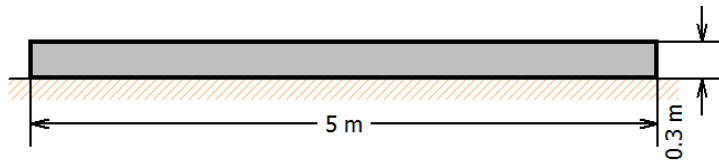
Reinforcement Summary

300.00 mm Mat with 15 14M bars @ 349.00 mm on center spacing top bars
 and 15 14M bars @ 345.43 mm on center spacing bottom bars

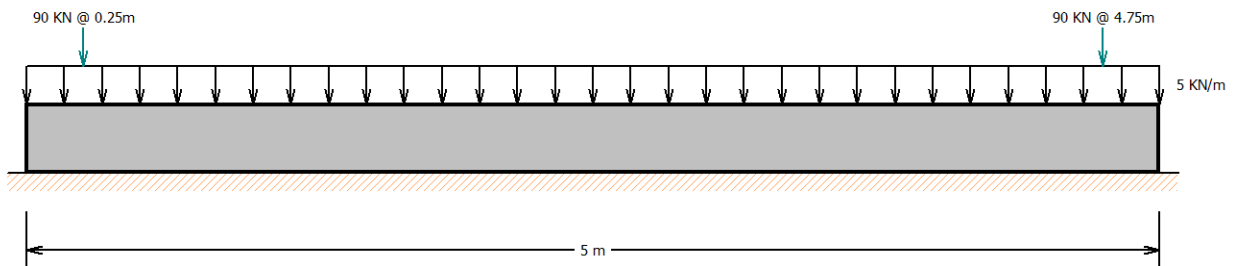
Plan



Cross Section



Loading



Reinforcement

Steel Yield Str, F_y	400.0 MPa	Shear Load Factor	1.6
Concrete Str, F_c	25.0 MPa	Moment Load Factor	1.6
Rebar Sizes	European		

Negative Moment

Top Clear Cover	50.00 mm
Top Bar Size	14M
Req. Area of Top Steel	1.36 mm ²
Min # Bars for Top	2
Override # of Bars	15
Top Bar Spacing	349.00 mm
Eff. Depth of Top Bars	243.00 mm
Area of Top Steel	2310.00 mm ²
Percent Top Steel	0.19 %
Allow. Neg. Moment	201.9 KN-m

Utilization: 59.01%

Positive Moment

Bottom Clear Cover	75.00 mm
Bottom Bar Size	14M
Req. Area of Bot. Steel	0.03 mm ²
Min # Bars for Bottom	2
Override # of Bars	15
Bottom Bar Spacing	345.43 mm
Eff. Depth of Bot. Bars	218.00 mm
Area of Bottom Steel	2310.00 mm ²
Percent Bottom Steel	0.21 %
Allow. Pos. Moment	181.1 KN-m

Utilization: 1.45%

Max. Factored Moments

Negative	-119.16 KN-m
Positive	2.63 KN-m

Shear Check

Max. Factored Shear	123.3 KN
Allowable Shear	258.5 KN

Utilization: 47.68%

Reinforcement

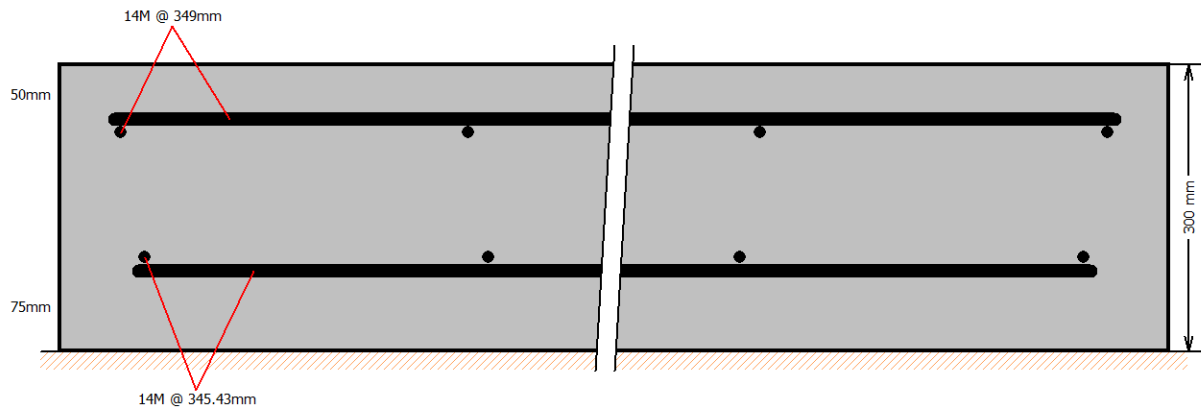
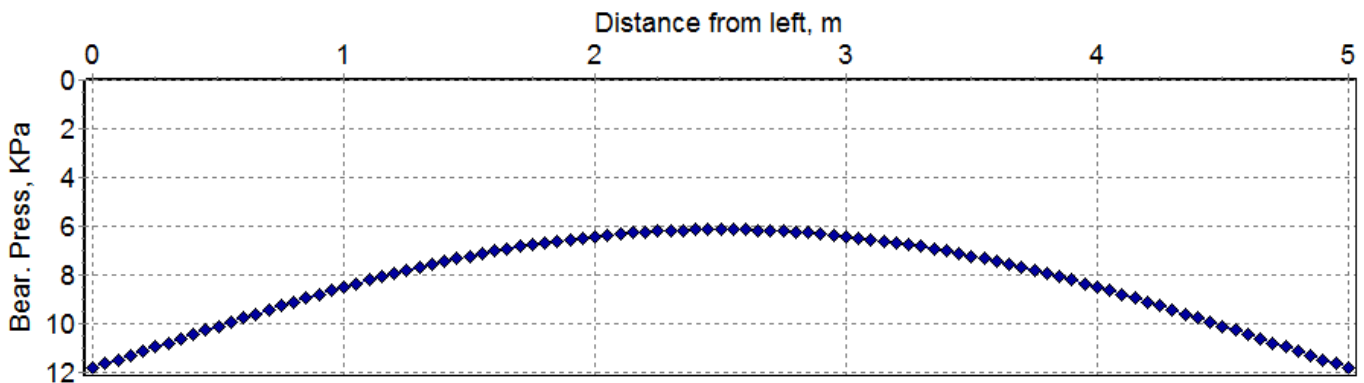
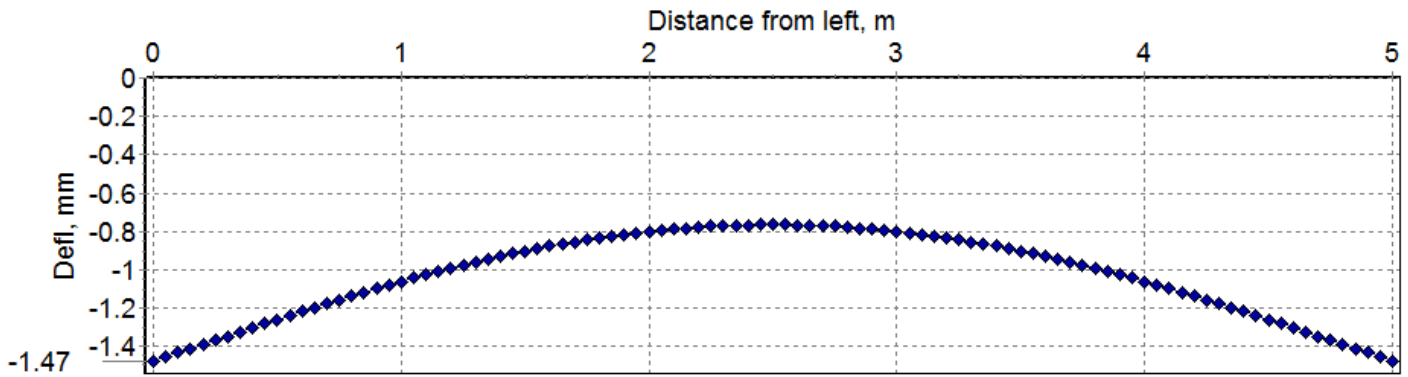
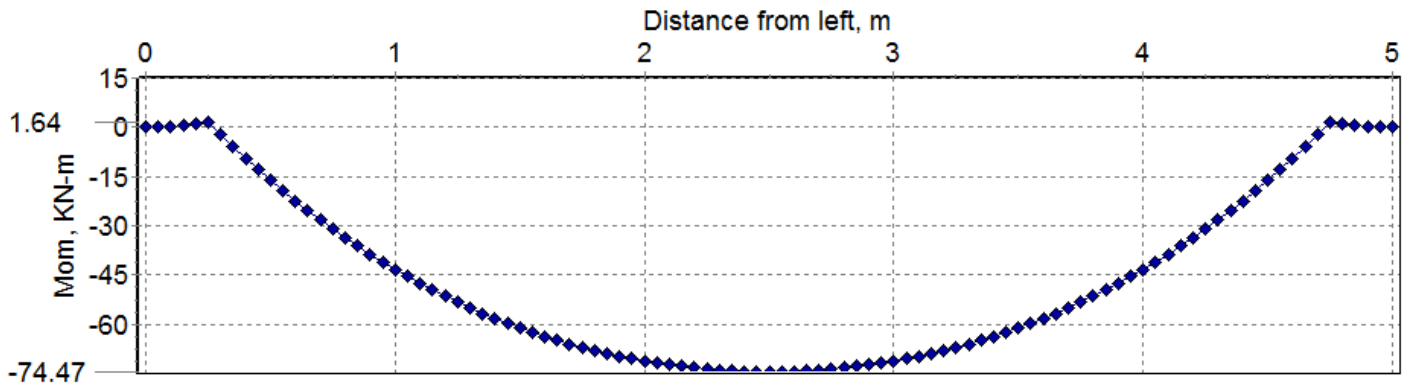
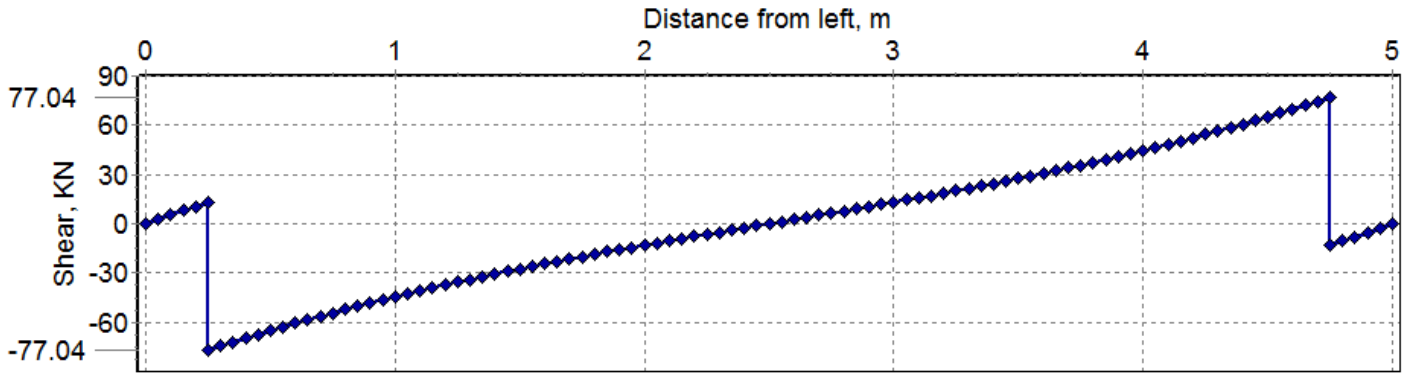


Table of Results - Nodes 1 to 50

Node #	Dist. from left m	Shear, KN	Moment, KN-m	Slope, deg	Deflection, mm	Soil Press, KPa
1	0.0000	0.000	0.00	0.00	-1.47	11.798
2	0.0500	2.678	0.07	0.00	-1.45	11.626
3	0.1000	5.313	0.27	0.00	-1.43	11.454
4	0.1500	7.905	0.60	0.00	-1.41	11.282
5	0.2000	10.454	1.06	0.00	-1.39	11.110
6	0.2500	12.960	1.64	0.00	-1.37	10.938
7	0.3000	-74.577	-2.15	0.00	-1.35	10.766
8	0.3500	-72.157	-5.82	0.00	-1.32	10.594
9	0.4000	-69.780	-9.36	0.00	-1.30	10.422
10	0.4500	-67.446	-12.79	0.00	-1.28	10.251
11	0.5000	-65.154	-16.11	0.00	-1.26	10.082
12	0.5500	-62.905	-19.31	0.00	-1.24	9.913
13	0.6000	-60.697	-22.40	0.00	-1.22	9.746
14	0.6500	-58.532	-25.38	0.00	-1.20	9.580
15	0.7000	-56.407	-28.25	0.00	-1.18	9.417
16	0.7500	-54.323	-31.02	0.00	-1.16	9.255
17	0.8000	-52.279	-33.69	0.00	-1.14	9.096
18	0.8500	-50.275	-36.25	0.00	-1.12	8.940
19	0.9000	-48.309	-38.72	0.00	-1.10	8.786
20	0.9500	-46.382	-41.08	0.00	-1.08	8.635
21	1.0000	-44.492	-43.35	0.00	-1.06	8.487
22	1.0500	-42.638	-45.53	0.00	-1.04	8.343
23	1.1000	-40.820	-47.62	0.00	-1.03	8.202
24	1.1500	-39.037	-49.62	0.00	-1.01	8.064
25	1.2000	-37.288	-51.52	0.00	-0.99	7.930
26	1.2500	-35.571	-53.34	0.00	-0.98	7.801
27	1.3000	-33.887	-55.08	0.00	-0.96	7.675
28	1.3500	-32.234	-56.73	0.00	-0.94	7.553
29	1.4000	-30.610	-58.30	0.00	-0.93	7.436
30	1.4500	-29.015	-59.80	0.00	-0.92	7.323
31	1.5000	-27.448	-61.21	0.00	-0.90	7.215
32	1.5500	-25.908	-62.54	0.00	-0.89	7.111
33	1.6000	-24.392	-63.80	0.00	-0.88	7.012
34	1.6500	-22.901	-64.98	0.00	-0.86	6.918
35	1.7000	-21.433	-66.09	0.00	-0.85	6.828
36	1.7500	-19.987	-67.12	0.00	-0.84	6.744
37	1.8000	-18.561	-68.09	0.00	-0.83	6.665
38	1.8500	-17.154	-68.98	0.00	-0.82	6.591
39	1.9000	-15.765	-69.80	0.00	-0.82	6.522
40	1.9500	-14.392	-70.56	0.00	-0.81	6.458
41	2.0000	-13.035	-71.24	0.00	-0.80	6.400
42	2.0500	-11.692	-71.86	0.00	-0.79	6.347
43	2.1000	-10.361	-72.41	0.00	-0.79	6.300
44	2.1500	-9.041	-72.90	0.00	-0.78	6.258
45	2.2000	-7.732	-73.32	0.00	-0.78	6.222
46	2.2500	-6.430	-73.67	0.00	-0.77	6.191
47	2.3000	-5.136	-73.96	0.00	-0.77	6.166
48	2.3500	-3.847	-74.18	0.00	-0.77	6.146
49	2.4000	-2.562	-74.34	0.00	-0.77	6.132
50	2.4500	-1.280	-74.44	0.00	-0.77	6.123

Table of Results - Nodes 51 to 101

Node #	Dist. from left m	Shear, KN	Moment, KN-m	Slope, deg	Deflection, mm	Soil Press, KPa
51	2.5000	0.000	-74.47	0.00	-0.77	6.121
52	2.5500	1.280	-74.44	0.00	-0.77	6.123
53	2.6000	2.562	-74.34	0.00	-0.77	6.132
54	2.6500	3.847	-74.18	0.00	-0.77	6.146
55	2.7000	5.136	-73.96	0.00	-0.77	6.166
56	2.7500	6.430	-73.67	0.00	-0.77	6.191
57	2.8000	7.732	-73.32	0.00	-0.78	6.222
58	2.8500	9.041	-72.90	0.00	-0.78	6.258
59	2.9000	10.361	-72.41	0.00	-0.79	6.300
60	2.9500	11.692	-71.86	0.00	-0.79	6.347
61	3.0000	13.035	-71.24	0.00	-0.80	6.400
62	3.0500	14.392	-70.56	0.00	-0.81	6.458
63	3.1000	15.765	-69.80	0.00	-0.82	6.522
64	3.1500	17.154	-68.98	0.00	-0.82	6.591
65	3.2000	18.561	-68.09	0.00	-0.83	6.665
66	3.2500	19.987	-67.12	0.00	-0.84	6.744
67	3.3000	21.433	-66.09	0.00	-0.85	6.828
68	3.3500	22.901	-64.98	0.00	-0.86	6.918
69	3.4000	24.392	-63.80	0.00	-0.88	7.012
70	3.4500	25.908	-62.54	0.00	-0.89	7.111
71	3.5000	27.448	-61.21	0.00	-0.90	7.215
72	3.5500	29.015	-59.80	0.00	-0.92	7.323
73	3.6000	30.610	-58.30	0.00	-0.93	7.436
74	3.6500	32.234	-56.73	0.00	-0.94	7.553
75	3.7000	33.887	-55.08	0.00	-0.96	7.675
76	3.7500	35.571	-53.34	0.00	-0.98	7.801
77	3.8000	37.288	-51.52	0.00	-0.99	7.930
78	3.8500	39.037	-49.62	0.00	-1.01	8.064
79	3.9000	40.820	-47.62	0.00	-1.03	8.202
80	3.9500	42.638	-45.53	0.00	-1.04	8.343
81	4.0000	44.492	-43.35	0.00	-1.06	8.487
82	4.0500	46.382	-41.08	0.00	-1.08	8.635
83	4.1000	48.309	-38.72	0.00	-1.10	8.786
84	4.1500	50.275	-36.25	0.00	-1.12	8.940
85	4.2000	52.279	-33.69	0.00	-1.14	9.096
86	4.2500	54.323	-31.02	0.00	-1.16	9.255
87	4.3000	56.407	-28.25	0.00	-1.18	9.417
88	4.3500	58.532	-25.38	0.00	-1.20	9.580
89	4.4000	60.697	-22.40	0.00	-1.22	9.746
90	4.4500	62.905	-19.31	0.00	-1.24	9.913
91	4.5000	65.154	-16.11	0.00	-1.26	10.082
92	4.5500	67.446	-12.79	0.00	-1.28	10.251
93	4.6000	69.780	-9.36	0.00	-1.30	10.422
94	4.6500	72.157	-5.82	0.00	-1.32	10.594
95	4.7000	74.577	-2.15	0.00	-1.35	10.766
96	4.7500	77.040	1.64	0.00	-1.37	10.938
97	4.8000	-10.454	1.06	0.00	-1.39	11.110
98	4.8500	-7.905	0.60	0.00	-1.41	11.282
99	4.9000	-5.313	0.27	0.00	-1.43	11.454
100	4.9500	-2.678	0.07	0.00	-1.45	11.626
101	5.0000	0.000	0.00	0.00	-1.47	11.798



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