FIRM:DesignCalcs, Inc. JOB NO. SHEET NO: 1
MADE BY:KJH DATE:07-16-2012 CHECKED BY: DATE:
TITLE:Example of DCALC Program BEARPRES

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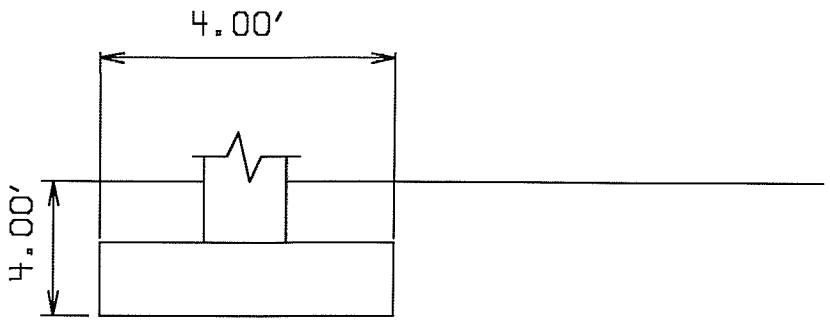
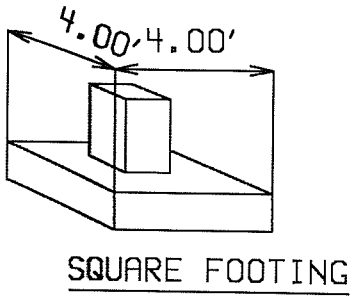
ULTIMATE SOIL BEARING PRESSURE:

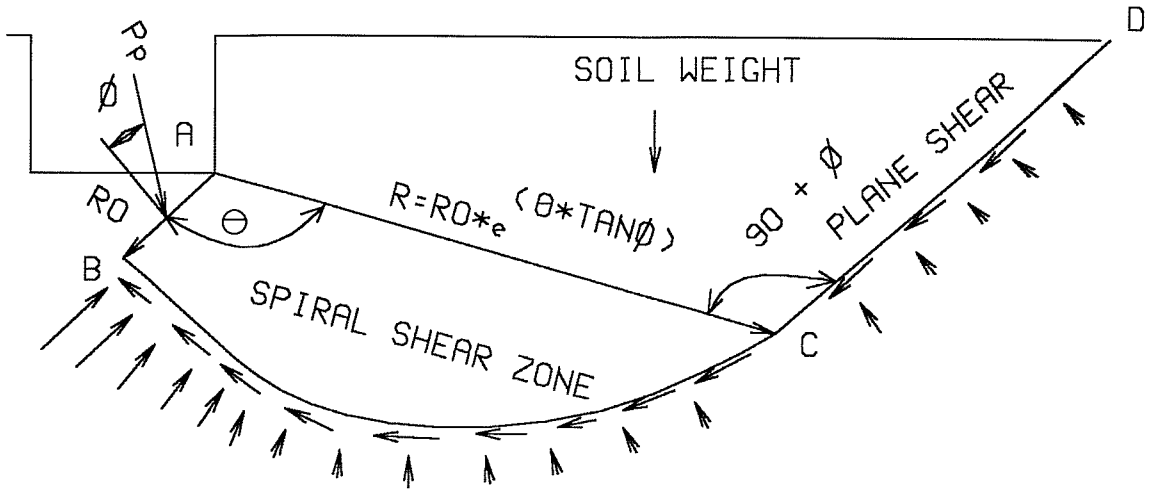




SQUARE FOOTING

Design Data:

This program uses a numerical approach that was developed by Karl Terzaghi, as described in his 1943 book, "Theoretical Soil Mechanics". Essentially, the problem is to find the minimum passive force, "Pp", from a large number of spiral failure planes in the soil mass:



This powerful technique is the same as Coloumb's method, which is typically used to analyze the stability of slopes and wall pressures.

Soil properties:
Unit Weight = 120 pcf
Internal Angle of Friction, =30.000 degrees
Cohesion, c = 0.000 ksf

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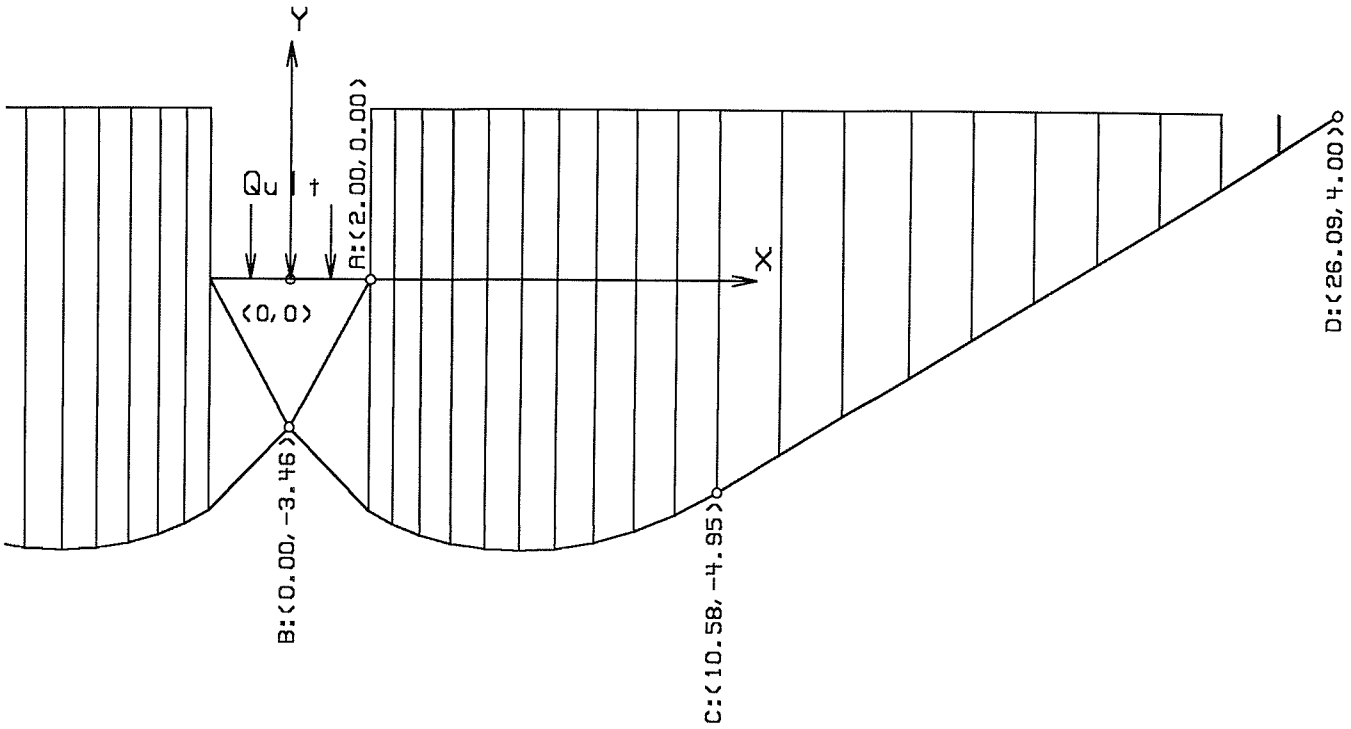
ULTIMATE SOIL BEARING PRESSURE:

Minimum Passive Pressure Failure Surface Based on 20 Iterations:



Ultimate bearing pressure:
Computed by conventional formula, Qult = 17.16 ksf; Net Qn,ult=16.68 ksf
Computed by numerical method, Qult = 15.63 ksf; Net Qn,ult=15.15 ksf
Angle of spiral failure zone, = 90.00 degrees

ULTIMATE SOIL BEARING PRESSURE:

Conventional Bearing Capacity Detailed Calculation:

The conventional Terzaghi equation, modified by Vesic, is

$q_{ult} = c*N_c *s_c + \gamma *D*N_q *s_q + 0.5*\gamma *B*N_g *s_g$

The properties of the soil layer are,
γ = .120 kcf
φ = 30.000 degrees
c = 0.000 ksf

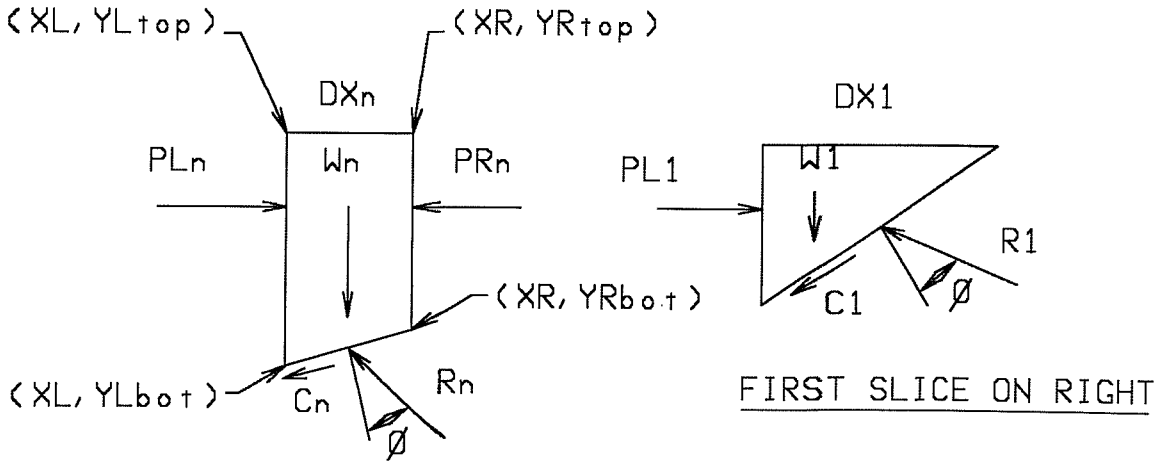
For φ=30.000 degrees, the following factors apply based on on the studies of Prandtl, Reissner and Brinch Hansen:
N_c = 30.10, N_q = 18.40, N_g = 22.40

For a square footing, the following shape factors apply:
$s_c = 1.0 + (N_q / N_c) = 1.611$
$s_q = 1.0 + \tan(\varphi') = 1.577$
$s_g = 0.6$

Therefore,
q_{ult} = 0.00 * 30.10 * 1.611
+ .12 * 4.00 * 18.40 * 1.577
+ .12 * 4.00 * 22.40 * .600
= 17.16 ksf

In terms of net ultimate bearing capacity,
$q_{net\ ult} = q_{ult} - \gamma *D$
= 17.16 - .120 * 4.00' = 16.68 ksf

ULTIMATE SOIL BEARING PRESSURE:



SLICES TO THE LEFT OF FIRST SLICE

Numerical Method Detailed Calculation:

Slice No.	XL (ft)	YLtop (ft)	YLbot (ft)	Wn (k)	Csn (k)	Rn (k)	PRn (k)	PLn (k)
1	24.536	4.000	3.105	0.08	0.00	.17	0.00	.14
2	22.985	4.000	2.209	.25	0.00	.50	.14	.58
3	21.435	4.000	1.314	.42	0.00	.83	.58	1.30
4	19.884	4.000	.419	.58	0.00	1.17	1.30	2.31
5	18.333	4.000	-.477	.75	0.00	1.50	2.31	3.61
6	16.782	4.000	-1.372	.92	0.00	1.83	3.61	5.19
7	15.232	4.000	-2.267	1.08	0.00	2.17	5.19	7.07
8	13.681	4.000	-3.163	1.25	0.00	2.50	7.07	9.23
9	12.130	4.000	-4.058	1.42	0.00	2.83	9.23	11.69
10	10.579	4.000	-4.953	1.58	0.00	3.17	11.69	14.43
11	9.544	4.000	-5.481	1.14	0.00	2.10	14.43	16.19
12	8.523	4.000	-5.874	1.19	0.00	1.89	16.19	17.66
13	7.529	4.000	-6.141	1.19	0.00	1.69	17.66	18.85
14	6.572	4.000	-6.293	1.17	0.00	1.51	18.85	19.81
15	5.661	4.000	-6.341	1.13	0.00	1.35	19.81	20.54
16	4.803	4.000	-6.297	1.06	0.00	1.19	20.54	21.08
17	4.005	4.000	-6.171	.98	0.00	1.05	21.08	21.46
18	3.270	4.000	-5.974	.89	0.00	.92	21.46	21.70
19	2.601	4.000	-5.718	.79	0.00	.80	21.70	21.82
20	2.000	4.000	-5.412	.69	0.00	.69	21.82	21.86
21	0.000	2.000	-3.464	1.66	0.00	28.32	21.86	29.78

The vertical force component acting on slice 21 is,
Fv = 30.1 k * Sin(120.00) + 0.0 k * Sin(60.00) = 26.05 k
Qult'= 2*Fv/B = 2* 26.0 k/ 4.000 ft = 13.02 k/ft per ft (strip footing)

For a square footing, modify the strip footing solution by 1.2:
qult = 1.2 * 13.02 = 15.63 ksf