PROBLEM 3

GIVEN:

FS=

4 Table P.3.1 in the solution

FIND:

- 1. Find the general bearing capacity
- 2. The allowable gross vertical load-bearing capacity of the foundation

- METHOD: 1.Determine bearing capacity factors, Nc, Ng and Ny using Equation 3.20 or Table 3.3
 - 2. Determine shape, depth, inclination factors using Equations from Table 3.4
 - 3. Determine q (effective stress) or the bearing surcharge
 - 4. Apply equation 3.19 to find the general bearing capacity
 - 5. Apply factor of safety to find the gross allowable load-bearing capacity

SOLUTION:

Given Table on the problem, we can obtain the bearing capacity factors using Table 3.3:

Part	В	L	Df	φэ	c'	γ	β	Туре	Nc	Nq	Ny	
а	4	1E+06	3	0.436	600	110	0	Strip	20.72	10.7	11	English Units
b	2	1E+06	1	0.524	0	17	0	Strip	30.14	18.4	22	SI
С	3	3	2	0.524	0	16.5	0	Square	30.14	18.4	22	SI

^{*}Obs: Since a/b are strip foundations, L=1

2. For the shape, depth and inclination factors we have:

2.1. Shape

Fcs =	1+ (B/L)* (Nq/Nc) =
Fqs =	1 + (B/L) * tan f' =
Fvs =	1 - 0.4 (B/I) =

а	b	С		
1	1	1.61		
1	1	1.577		
1	1	0.6		

2.2 Depth

		Th	Thus For f>0					
	Df/B	Fcd Fqd Fyd						
а	0.75	1.3186	1.2887	1				
b	0.5	1.1526	1.1443	1				
С	0.667	1.2035	1.1925	1				

- *Df/B <= 1 or > 1 changes the formula
- * Fyd=1
- * Consider ϕ =0 or >0

2.3 Inclination factors

	Fci	Fqi	Fyi
a	1	1	1

3. Surcharge Bearing Stress, q=Df*y

		q
а	330	lb/ft^2
b	17	<n m^2<="" th=""></n>
С	33	<n m^2<="" th=""></n>

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b	1	1	1
b c	1	1	1

4. General Bearing Capacity

	qu = c'.Nc.Fcs.Fcd.Fci + q.Nq.Fqs.Fqd.Fqi + 0.5y.B.Ny.Fys.Fyd.Fyi	EQ 3.19
а	23320	

а	23320
b	738.7
С	1475

5. Allowable Bearing Capacity						
	qu/FS					
a	5830					
b	184.7					
С	368.7					

PROBLEM 5

GIVEN: FS= 3 And values on table on the solution

FIND: 1. Find the general bearing capacity

2. The allowable gross vertical load-bearing capacity of the foundation

METHOD: 1.Determine bearing capacity factors, Nc, Nq and Ny using Equation 3.20 or Table 3.3

- 2. Determine shape, depth, inclination factors using Equations from Table 3.4
- 3. Determine q (effective stress) or the bearing surcharge including the wet comp
- 4. Apply equation 3.19 to find the general bearing capacity
- 5. Apply factor of safety to find the gross allowable load-bearing capacity
- 6. Determine the Allowable load

SOLUTION:

1. Given Table on the problem, we can obtain the bearing capacity factors using Table 3.3:

Part	В	L	Df	φ'	c'	γ	β	Туре	Nc	Nq	Ny
а	2	3	1.5	0.436	70	17	0	Strip	20.72	10.7	11

2. For the shape, depth and inclination factors we have:

2.1. Shape

		а
Fcs =	1+ (B/L)* (Nq/Nc) =	1.343
Fqs =	1 + (B/L) * tan f' =	1.311

2.3 Inclination factors

	Fci	Fqi	Fyi
a	1	1	1

Fvs = 1 - 0

1 - 0.4 (B/L) =

0.733

2.2 Depth

		Thus For f>0				
	Df/B	Fcd Fqd Fy				
a	0.75	1.2573	1.2332	1		

3. Surcharge Bearing Stress, q=D1*y+D2y'

	q				
а	21.85 kN/m^2				

4. General Bearing Capacity

EQ 3.19

5. Allowable Bearing Capacity

qu a 2961 **kN/m^2**

qu/FS qall 987.1 **kN/m^2**

6. Allowable Load:

Qall=qall*B*L = **5922.5** kN

PROBLEM 7

GIVEN: Es= 1020 kN/m^2

Poisson's ration, μs= 0.35

And, Gs= Es/2(1+ μ s) = 377.8 kN/m²

(EQ page 155)

FIND: 1. Find the ultimate bearing capacity taking in account the soil compressibility

METHOD: 1.Determine bearing capacity factors, Nc, Nq and Ny using Equation 3.20 or Table 3.3

2. Determine shape, depth, inclination factors using Equations from Table 3.4

3. Determine q (effective stress) or the bearing surcharge

4. Determine the compressibility factors, Fcc, Fqc and Fyc

5. Apply equation 3.27 (Vesic 1973) in order to determine qu (ultimate bearing capacity)

SOLUTION:

1. Given Table on the problem, we can obtain the bearing capacity factors using Table 3.3:

GIVEN	В	L	Df	φ'	c'	γ	β	Туре	Nc	Nq	Ny	
PROBLEM	1	1.5	1	0.436	50	17	0	Rect	20.72	10.7	11	SI

2. For the shape, depth and inclination factors we have:

2.1. Shape

		а
Fcs =		1.343
Fqs =		1.311
Fys =	1 - 0.4 (B/L) =	0.733

2.3 Inclination factors

	Fci	Fqi	Fyi
а	1	1	1

2.2 Depth

		Thus For f>0				
	Df/B	Fcd Fqd Fyd				
a	1	1.3431	1.3109	1		

3. Surcharge Bearing Stress, q=Df*y

		q	
а	17	kN/m^	2

4. Compressibility Factors EQ 3.28

We need q' (effective overburden at a Df + B/2 length)

Determining the rigidity index, Ir:

 $q'= y*(Df+B/2) = 25.5 kN/m^2$

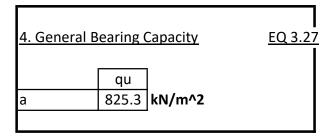
Ir= Gs/c' + q'tanf' =

6.24

EQ 3.28

Determining the critical rigidity index, Ir(cr) EQ 3.29:

Since Ir(cr) > Ir



PROBLEM 8

GIVEN: FS=

And values on table on the solution

Eccentrically loaded foundation shown in Figure P3.8

FIND: 1. Find the general bearing capacity

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2. The allowable load

- METHOD: 1. Determine bearing capacity factors, Nc, Nq and Ny using Equation 3.20 or Table 3.3
 - 2. Determine shape, depth, inclination factors using Equations from Table 3.4
 - 3. Determine q (effective stress) or the bearing surcharge including the wet comp
 - 4. Apply equation 3.19 to find the general bearing capacity
 - 5. Apply factor of safety to find the gross allowable load-bearing capacity
 - 6. Determine the Allowable load

SOLUTION:

0.1 m e=

1. Given Table on the problem, we can obtain the bearing capacity factors using Table 3.3:

Part	В	L	Df	φ'	c'	γ	β	B'=L'	Nc	Nq	Ny	
a	1.5	1.5	0.8	0.559	0	17	0	1.3	20.72	10.7	11	SI

2. For the shape, depth and inclination factors we have:

2.1. Shape

		a
Fcs =	1+ (B/L)* (Nq/Nc) =	1.514
Fqs =	1 + (B/L) * tan f' =	1.625
Fys =	1 - 0.4 (B/L) =	0.6

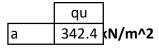
2.3 Inclination factors

	Fci	Fqi	Fyi
a	1	1	1

2.2 Depth

		Thus For f>0				
	Df/B	Fcd	Fqd	Fyd		
a	0.533	1.1587	1.1473	1		

4. General Bearing Capacity EQ 3.19



3. Surcharge Bearing Stress, q=D1*y+D2y'

		q
а	13.6	kN/m^2

5. Allowable Load

Effective Area, A' = 1.95 Qult= 667.7 kN

Qall= 166.9 kN

PROBLEM 13

GIVEN: FS=

3

And values on table on the solution

Two-Way Eccentrically loaded foundation shown in Figure P3.19

FIND: 1. Find the general bearing capacity

2. The allowable load

- METHOD: 1. Determine bearing capacity factors, Nc, Nq and Ny using Equation 3.20 or Table 3.3
 - 2. Determine shape, depth, inclination factors using Equations from Table 3.4
 - 3. Determine q (effective stress) or the bearing surcharge including the wet comp
 - 4. Apply equation 3.19 to find the general bearing capacity
 - 5. Apply factor of safety to find the gross allowable load-bearing capacity
 - 6. Determine the Allowable load

SOLUTION:

eB=

0.12 m

eL=

0.36 m

1. Given Table on the problem, we can obtain the bearing capacity factors using Table 3.3:

	Part	В	L	Df	φ'	c'	γ	β	B'=L'	Nc	Nq	Ny	
ſ	а	1.2	1.8	1	0.611	0	17	0	0.96	20.72	10.7		SI

Need to determine the ratios to find what case the effective lengths fall, thus:

eL/L=

1/5

eB/B=

0.1

With these values we use CASE II

2. For the shape, depth and inclination factors we have:

2.1. Shape

		а
Fcs =	1+ (B/L)* (Nq/Nc) =	1.343
Fqs =	1 + (B/L) * tan f' =	1.467
Fvs =	1 - 0.4 (B/I) =	0.733

2.3 Inclination factors

	Fci	Fqi	Fyi
a	1	1	1

2.2 Depth

		Thus For f>0			
	Df/B	Fcd	Fqd	Fyd	
а	0.833	1.2268	1.2122	1	

4. General Bearing Capacity EQ 3.19

	qu	
a	387.3	kN/m^2

3. Surcharge Bearing Stress, q=D1*y+D2y'

	q	
а	17	kN/m^2

5. Effective Lengths & Area (CASE II)

L1= 1.575 L2= 0.4

A'= 1.188

B'= 0.754 L'= 1.58

5. Allowable Load

Effective Area, A' = 1.188 FOUNDATIONS 14.431 HOMEWORK # 3

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Qult= 460.1 kN

Qall= 153.4 kN