PROBLEM 2

GIVEN: Soil Profile shown in Figure P2.2, with the standard penetration numbers in the clay layer.

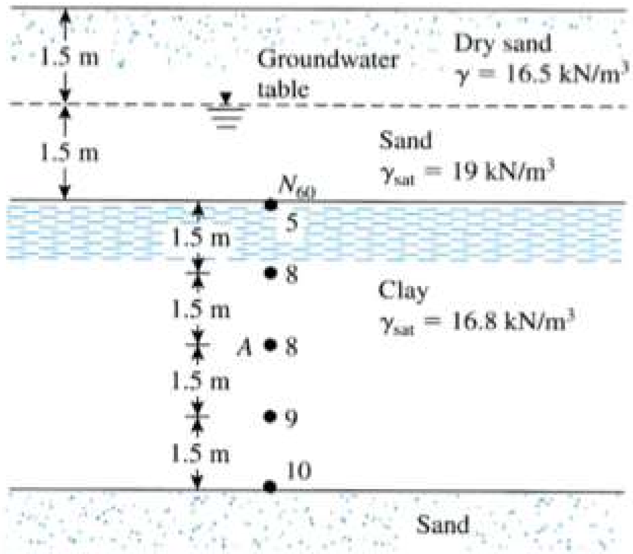


Figure P2.2

pa= 100 kN/m2

FIND: *Use Eqs (2.8) and (2.9) to determine the variation of cu and OCR with depth.*
What is the average value of cu and OCR?

METHOD: *A. Use Eqs (2.8) and (2.9) to determine the variation of cu and OCR with depth.*

SOLUTION: To determine cu, we use Eq. 2.8

Depth (m)	N60	cu
3	5	92.397
4.5	8	129.61
6	8	129.61
7.5	9	141.08
9	10	152.19

Thus the average cu= 129 kN/m2

In order to determine the OCR, we must find the effective vertical stress in MN/m2

Depth (m)	Y, kN/m3	Total Stress, s (MN/m2)	Pore Pressure, u (MN/m2)	Effective Stress, s' (MN/m2)	OCR
0	16.5	0	0	0	NOT CLAY
1.5	16.5	0.0248	0.015	0.01	NOT CLAY
3	19	0.0533	0.029	0.024	7.675

4.5	16.8	0.0785	0.044	0.034	8.251
6	16.8	0.1037	0.059	0.045	6.866
7.5	16.8	0.1289	0.074	0.055	6.442
9	16.8	0.1541	0.088	0.066	6.146

Thus the average OCR = 7.076

PROBLEM 3

GIVEN: Following is the variation of the field standard penetration number N60 in a sand deposit:

Table 3.1 - Depth and N60 in a sand deposit

Depth (m)	N60
1.5	6
3	8
4.5	9
6	8
7.9	13
9	14

The groundwater table is located at a depth of 6m.
Yd for sand from 0-6m = 18 kN/m3
Ysat for sand 6-12m = 20.2 kN/m3

FIND: *Use Skempton relationships in Eq. (2.12) to determine the corrected penetration numbers.*

METHOD: A. Use Eq. for effective stress in order to determine effective stress on the layers
B. Use Eq. 2.12 to determine the correction factor and Eq. 2.10 for the corrected (N1)60.

SOLUTION: The values searched can be found on the last column of the table below:

Table 3.1 - Calculations and Results:

Depth (m)	Y, kN/m3	N60	Total Stress, s (kN/m2)	Pore Pressure, u (kN/m2)	Effective Stress, s' (kN/m2)	Cn (Eq 2.12)	ANSWER: (N1)60
0	18	-	0	0	0	-	-
1.5	18	6	27	0	27	1.575	9
3	18	8	54	0	54	1.299	10
4.5	18	9	81	0	81	1.105	10
6	18	8	108	0	108	0.962	8
7.9	20.2	13	146	18.62	127.76	0.878	11

9	20.2	14	169	29.4	139.2	0.836	12

PROBLEM 4

GIVEN: For the soil profie described in Problem 2.3

FIND: *Estimate an average peak soil friction angle (Use Eq. 2.28)*

METHOD: Use Eq. 2.28

SOLUTION: Using Table 3.1 Above, we have the following values:

Table 4.1 - Calculations and Results:

Depth (m)	(N1)60	Φ'
0	-	-
1.5	9	33.7
3	10	34.4
4.5	10	34.1
6	8	32.4
7.9	11	35.1
9	12	35.3

The average peak soil friction angle is = 34.2

PROBLEM 5

GIVEN: Repeat Problem 2.4, using Eq. (2.27)

FIND: *Repeat Problem 2.4, using Eq. (2.27)*

METHOD: Use Eq (2.27)

SOLUTION: Using Table 3.1 Above, we have the following values:

Table 4.1 - Calculations and Results:

Depth (m)	N60	Bottom	N60/Bottom	power	Φ'
0	0	-			
1.5	6	17.7	0.339	0.692	34.7
3	8	23.2	0.345	0.697	34.9
4.5	9	28.6	0.314	0.675	34.0
6	8	34.1	0.234	0.611	31.4
7.9	13	38.1	0.341	0.694	34.7
9	14	40.5	0.346	0.697	34.9

The average peak soil friction angle is = 34.1

PROBLEM 6

GIVEN: Refer to Problem 2.3, using Eq. 2.20

FIND: *Determine the average relative density of sand*

METHOD: Refer to Problem 2.3, using Eq. 2.20

SOLUTION:

Table 6.1 - Calculations and Results for Relative Density

Depth (m)	N60	Dr
0	-	-
1.5	6	0.5055
3	8	0.5167
4.5	9	0.497
6	8	0.4317
7.9	13	0.5223
9	14	0.527

The average relative density is = 50.00 %

PROBLEM 13

GIVEN: A) A vane shear test was conducted in a saturated clay.

H= 4 in Tmax= 23 lb-ft

D= 2 in

B) The clay soil described in part (a) has:

LL= 58 PL= 29

FIND: *A) Determine the undrained shear strength of the clay*
B) What is the corrected undrained shear strength of the clay for design purposes?

METHOD: A. Use Eq. 2.31 and 2.33b to obtain cu
B. Use Bjerrum's relationship for λ (Eq (2.35a))

SOLUTION: ***A)*** First we must use Eq. 2.33b to determine K (note that H/D=2)

K= 0.0168 in^3

Next, we can obtain cu, using Eq. 2.31

cu= 1369 lb/ft^2

B) To use Eq.2.35a we need PI: PI = LL - PL = 29

Using Eq.2.35a we obtain l: λ= 0.91

Eq. 2.35a determines, $\boxed{\text{cu.corrected = 1246 lb/ft^2}}$

PROBLEM 14

GIVEN: Refer to problem 2.13
σ'o= 1340 lb/ft2

FIND: *Determine the overconsolidation ratio for the clay. Use Eqs. 2.37 and 2.40.*

METHOD: Use Eqs. (2.37) and (2.40)

SOLUTION: Determining β with Eq. 2.40: β= 4.175

Determining OCR with Eq. 2.37: $\boxed{\text{OCR= 4.3}}$

PROBLEM 17

GIVEN: In the soil profile shown in Figure P2.17, if the cone penetration resistance at A,
qc= 800 kN/m2

Electric Cone= Nk= 15

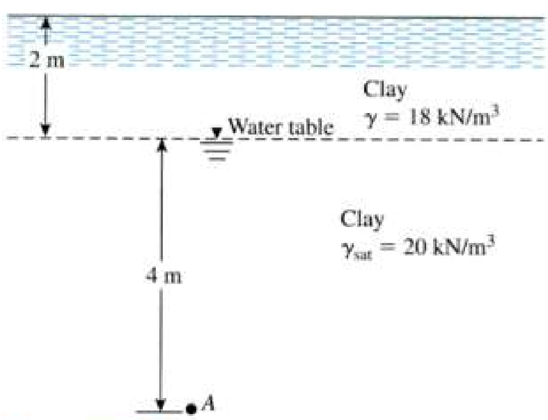


Figure P2.17

FIND: *A) Determine the undrained cohesion, cu*

B) The overconsolidation ratio, OCR

METHOD: A. Eq. 2.51 for cu

SOLUTION:

Point	Depth, m	Y, kN/m3	σ	u	σ'
-	0	18	0	0	0
-	2	18	36	0	36
A	6	20	116	39.2	76.8

cu= 45.6 kPa

OCR= 3.368

PROBLEM 22

GIVEN: The results of a refraction survey (Figure 2.42a) at a site are given in the following table.

Table 22.1 - Results of refraction survey at a site

Distance from the source of disturbance, m	Time of first arrival of P-waves (sx10^3)
2.5	5.08
5	10.16
7.5	15.24
10	17.01
15	20.02
20	24.2
25	27.1
30	28.0
40	31.1
50	33.90

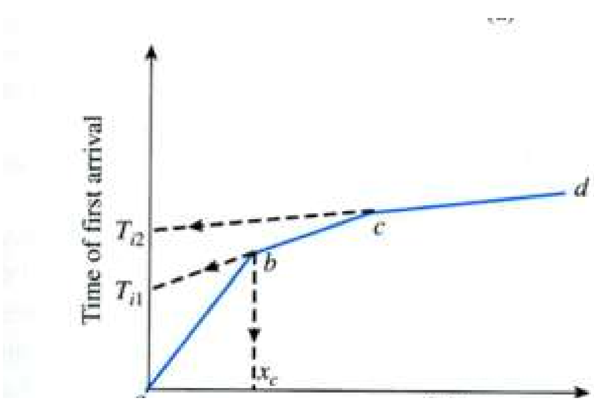
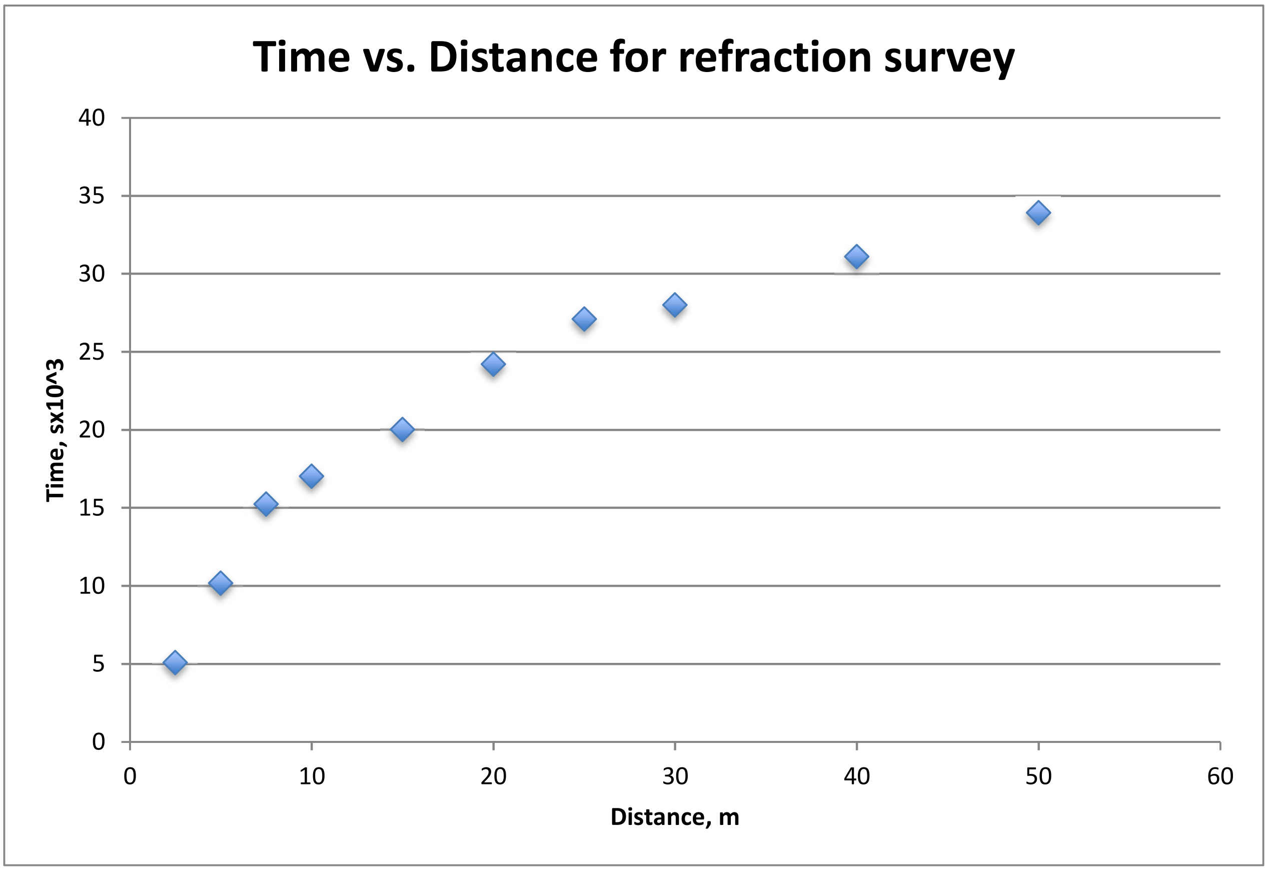


Figure 2.42 Seismic refraction survey

<u>FIND:</u> *Determine the thickness and the P-wave velocity of the materials encountered.*

<u>METHOD:</u> Plot graph similar to Figure 2.42a.

<u>SOLUTION:</u>



From the graph we have: xc= 8 m

Using Eqs from Step 3 (pg 120):

v1=	492.1	m/s
v2=	1408	m/s
v3=	3425	m/s

Using Eq. 2.73, we have Z1: $\boxed{Z1= \ 2.78 \ m}$

Ti2= 0.02 s

Using Eq. 2.74, we have Z2: $\boxed{Z2= \ 6.82 \ m}$