




# Question 1

- The Unified Soil Classification System is based on
    - a. Grain size distribution and color
    - b. Grain size distribution and plasticity
    - c. Grain size distribution only
    - d. Suitability for road subgrades
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## Question 2

- Atterberg limit tests on soil samples determined that the moisture content is 45% at the liquid limit and 25% at the plastic limit. The Plasticity Index (PI) is most nearly:
  - c. 20%
  - $PI = LL - PL = 45 - 25 = 20$

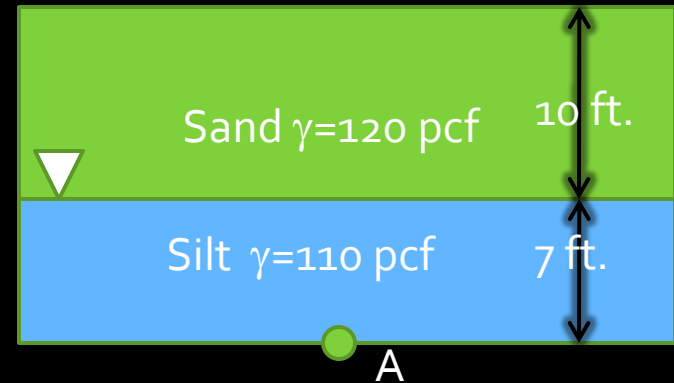
# Question 3

- A soil sample is found to have a void ratio of 0.5 and a Specific Gravity of 2.6. Assuming that the Degree of Saturation is 100%, the moisture content of the sample is most nearly:

$w$	moisture content	$\frac{W_w}{W_s}$	$\frac{W_t}{W_s} - 1$	$\frac{Se}{G}$	$S \left[ \frac{\rho_w}{\rho_D} - \frac{1}{G} \right]$
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- $w = Se/G = 1.00(0.5)/2.6 = 0.19$
- a. 19%

# Question 4



- Given the following conditions, the existing effective vertical soil pressure (overburden pressure) at point A is most nearly:
  - $\sigma = (10 \times 120)(\text{sand}) + (7 \times (110 - 62.4))(\text{silt}) = 1533.2$  pcf
  - a. 1530 psf

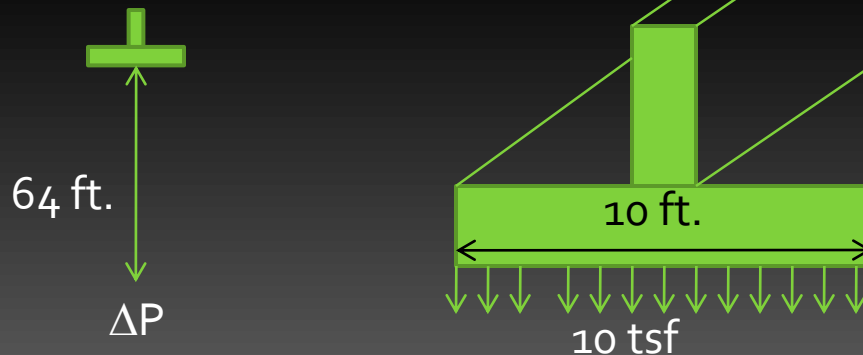
# Question 5

- Effective Stress is defined as:
  - a. The total stress
  - b. The total stress plus pore water pressure
  - c. The total stress minus the unit weight of water
  - d. The total stress minus the pore water pressure

$$\sigma' = \sigma_{\text{total}} - U$$

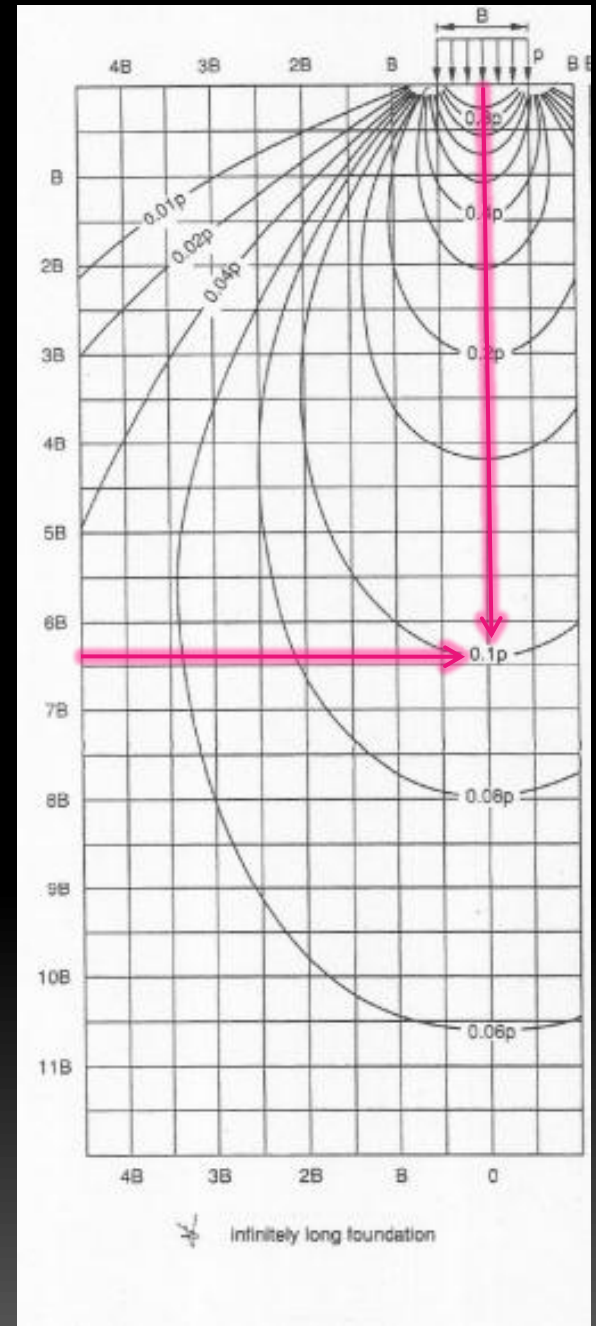
# Question 6

- A 10 ft. wide infinitely long spread footing foundation has a footing pressure of 10 tsf at the surface. The increase in vertical soil pressure at the center of the footing, according to Boussinesq theory at a depth of 64 ft. is most nearly:



# Question 6

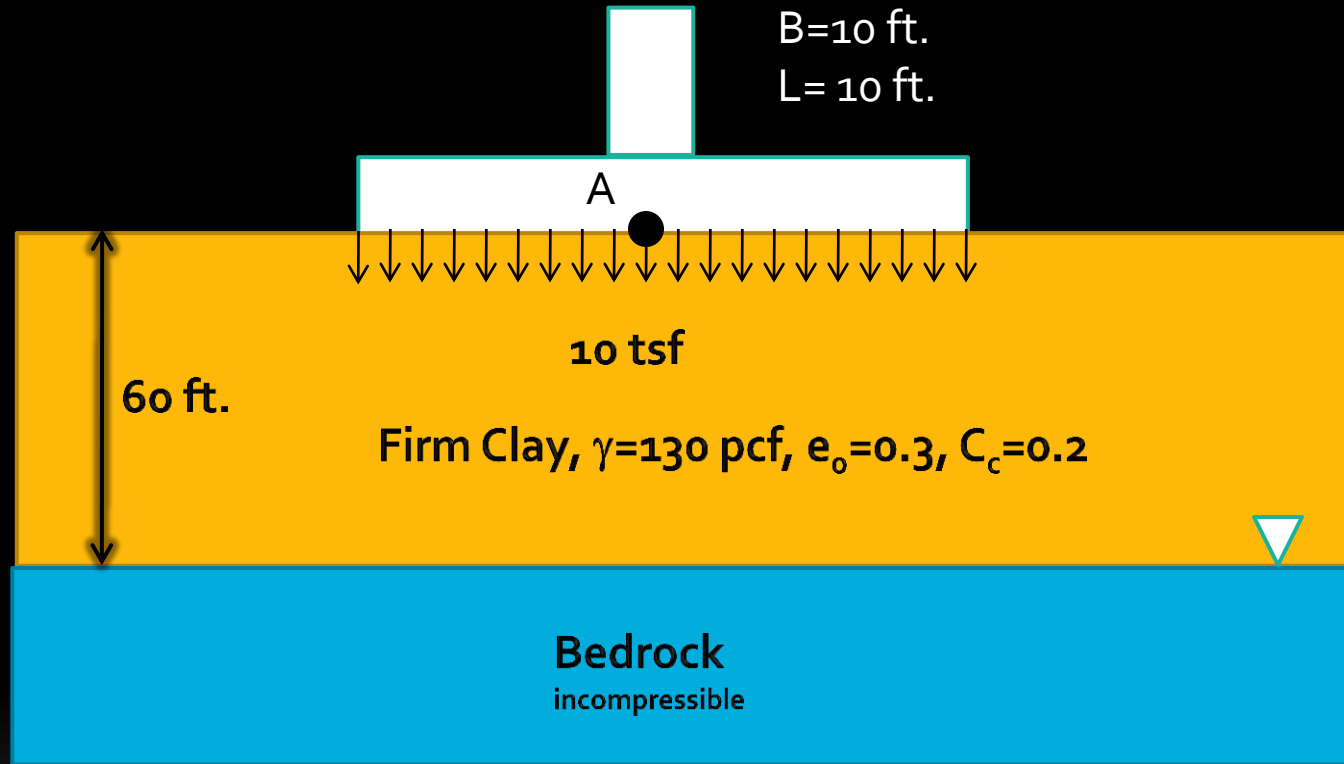
- $B=10$  ft.
- Depth = 64 ft. =  $6.4B$
- Stress contour =  $0.1 p$
- $\Delta P = 0.1 (10) = 1$  tsf
- or 2000 psf
- Answer is d.



# Question 7

- Normally consolidated clay soils have conditions that match which of the following?
  - a. The soils have been preloaded in the past to a vertical pressure greater than the existing vertical pressure
  - b. The soils have vertical soil pressures equal to the pre-consolidation pressure
  - c. The soils have never been loaded to vertical soil pressures higher than the existing soil pressures
  - d. The soils behave normally like other clay soils

# Question 8



Assuming the clay is normally consolidated, and that the footing load is distributed with depth using the Boussinesq theory, the settlement at point A is most nearly:

## Question 8

$$S_c = \sum_i^n \frac{C_c}{1 + e_0} H_0 \log_{10} \frac{\sigma'_{v0} + \Delta\sigma_v}{\sigma'_{v0}}$$

Unknowns:  $\sigma'_{v0}$  and  $\Delta\sigma'_v$

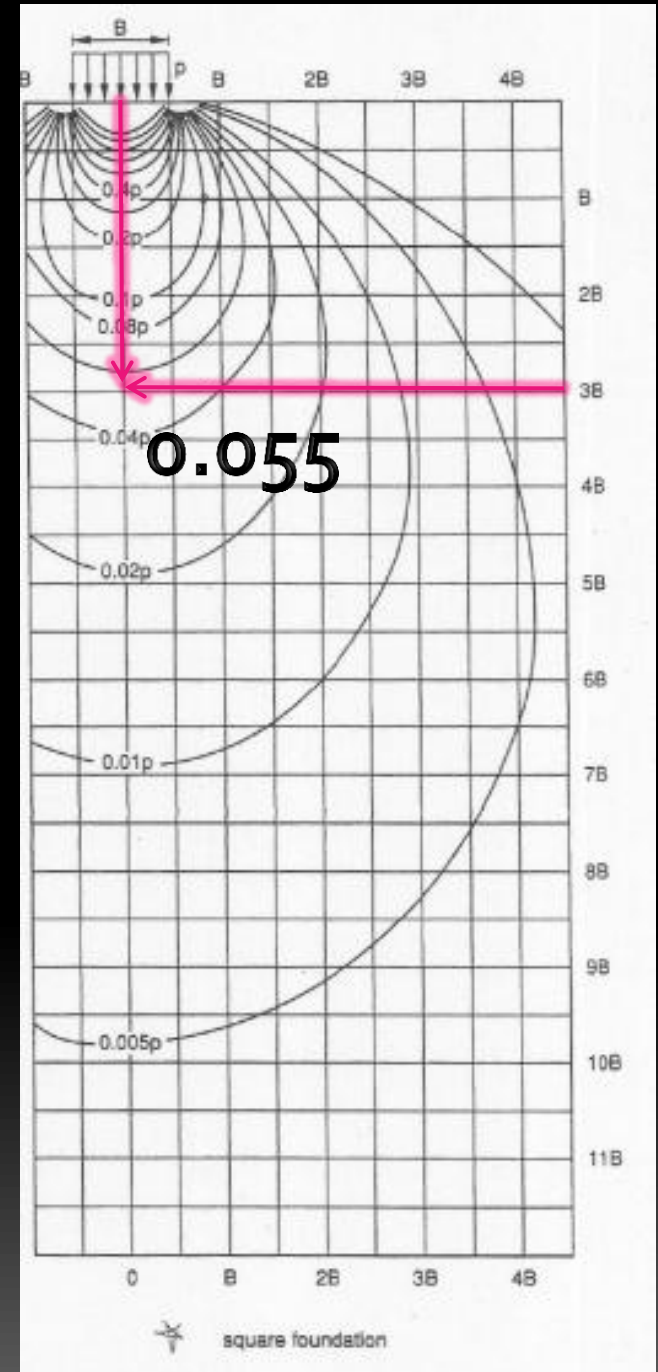
Compute  $\sigma'_{v0}$  and  $\Delta\sigma'_v$  at midpoint of layer!!!!

$$\sigma'_{v0} = 30 \times 130 = 3,900 \text{ psf}$$

# Question 8

Find  $\sigma'_v$  at a depth of 30 ft. (3B)

$$\Delta p = 0.055 \times 20,000 = 1,100 \text{ psf}$$



# Question 8



and



## Question 8

$$S_c = \sum_i^n \frac{0.2}{1+0.3} 60 \text{ ft.} \log_{10} \frac{3900+1100}{3900} = 0.996 \text{ ft.}$$

$$0.996 \text{ ft.} \times 12 \text{ in./ft.} = 11.95 \text{ in.}$$

Answer is b. 12 in.

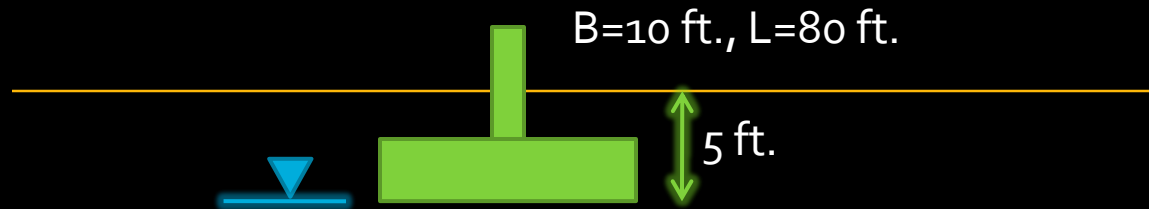
# Question 9

- The theoretical time factor  $T$  for 50% primary settlement is most nearly...
  - a. 0.008
  - b. 0.848
  - c. 0.197
  - d. 0.567

U%	T
0	0
10	0.008
20	0.031
30	0.071
40	0.126
50	0.197
60	0.287
70	0.403
80	0.567
90	0.848
100	$\infty$

# Question 10

- Given the following conditions, the ultimate bearing capacity for the spread footing foundation is most nearly...



Clayey Sand

$\gamma=125$  pcf

$\phi=30^\circ$

Cohesion=400 psf

# Question 10

Effective unit weight

Depth footing

$$q_{ultimate} = cN_c + \frac{1}{2} \gamma B N_\gamma + \gamma D_f N_q$$

cohesion

Bearing capacity factors

Equation may be used for  $L > 5B$   
 $L(80) > 5 * 10 = 50$ , ok

# Question 10

- Find Bearing Capacity Factors  $N_c$ ,  $N_\gamma$ ,  $N_q$  (pg 71)

TABLE 4.4.7.1A Bearing Capacity Factors

$\phi$	$N_c$	$N_q$	$N_\gamma$	$\phi$	$N_c$	$N_q$	$N_\gamma$
0	5.14	1.00	0.00	26	22.25	11.85	12.54
1	5.38	1.09	0.07	27	23.94	13.20	14.47
2	5.63	1.20	0.15	28	25.80	14.72	16.72
3	5.90	1.31	0.24	29	27.86	16.44	19.34
4	6.19	1.43	0.34	30	30.14	18.40	22.40
5	6.49	1.57	0.45	31	32.67	20.63	25.99
6	6.81	1.72	0.57	32	35.49	23.18	30.22
7	7.16	1.88	0.71	33	38.64	26.09	35.19
8	7.53	2.06	0.86	34	42.16	29.44	41.06
9	7.92	2.25	1.03	35	46.12	33.30	48.03
10	8.35	2.47	1.22	36	50.59	37.75	56.31
11	8.80	2.71	1.44	37	55.63	42.92	66.19
12	9.28	2.97	1.69	38	61.35	48.93	78.03
13	9.81	3.26	1.97	39	67.87	55.96	92.25
14	10.37	3.59	2.29	40	75.31	64.20	109.41
15	10.98	3.94	2.65	41	83.86	73.90	130.22
16	11.63	4.34	3.06	42	93.71	85.38	155.55
17	12.34	4.77	3.53	43	105.11	99.02	186.54
18	13.10	5.26	4.07	44	118.37	115.31	224.64
19	13.93	5.80	4.68	45	133.88	134.88	271.76
20	14.83	6.40	5.39	46	152.10	158.51	330.35
21	15.82	7.07	6.20	47	173.64	187.21	403.67
22	16.88	7.82	7.13	48	199.26	222.31	496.01
23	18.05	8.66	8.20	49	229.93	265.51	613.16
24	19.32	9.60	9.44	50	266.89	319.07	762.89
25	20.72	10.66	10.88	—	—	—	—

# Question 10

$$q_{ultimate} = cN_c + \frac{1}{2} \gamma B N_\gamma + \gamma D_f N_q$$

$$q_{ultimate} = (400 \cdot 30.14) + \left(\frac{1}{2} \cdot [125 - 62.4] \cdot 10 \cdot 22.4\right) + (125 \cdot 5 \cdot 18.4)$$

$$q_{ultimate} = 30,567.2 \text{ psf}$$

Answer is a. 30,000 psf