

CIE 444 – SOIL MECHANICS
Lebanese American University – Fall 2010
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HOMEWORK#2

Out Wednesday Oct. 13, 2010
 Due Wednesday Oct. 20, 2010, IN CLASS

Solve problems **4.11, 4.15, 4.17, 4.18, and 4.19** in the textbook:
 “Geotechnical Engineering: Principles and Practices”, **2nd Edition**, by Coduto et al.

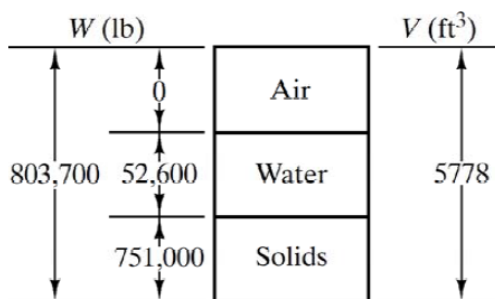
SOLUTION

Problem 4.11

Solution

a.

$$V = (214 \text{ yd}^3) (27 \text{ ft}^3/\text{yd}^3) = 5778 \text{ ft}^3$$

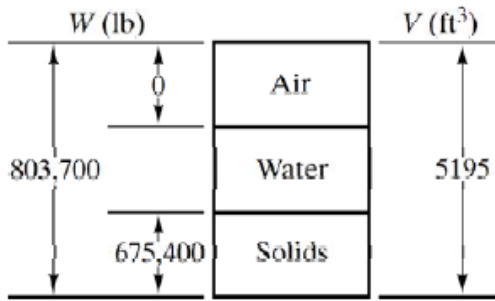


$$\gamma_d = \frac{W_s}{V} \rightarrow 130 \text{ lb/ft}^3 = \frac{W_s}{5778 \text{ ft}^3} \rightarrow W_s = 751,100 \text{ lb}$$

$$w = \frac{W_w}{W_s} \times 100\% \rightarrow 0.070 = \frac{W_w}{751,100 \text{ lb}} \rightarrow W_w = 52,600 \text{ lb}$$

$$W = 52,600 \text{ lb} + 751,000 \text{ lb} = 803,700 \text{ lb} = 402 \text{ tons}$$

b.



$$W_s = \frac{W}{1+w} = \frac{803,700 \text{ lb}}{1+0.19} = 675,400 \text{ lb}$$

$$\gamma_d = \frac{W_s}{V} \rightarrow 130 = \frac{675,400 \text{ lb}}{V} \rightarrow V = 5195 \text{ ft}^3 = 192 \text{ yd}^3$$

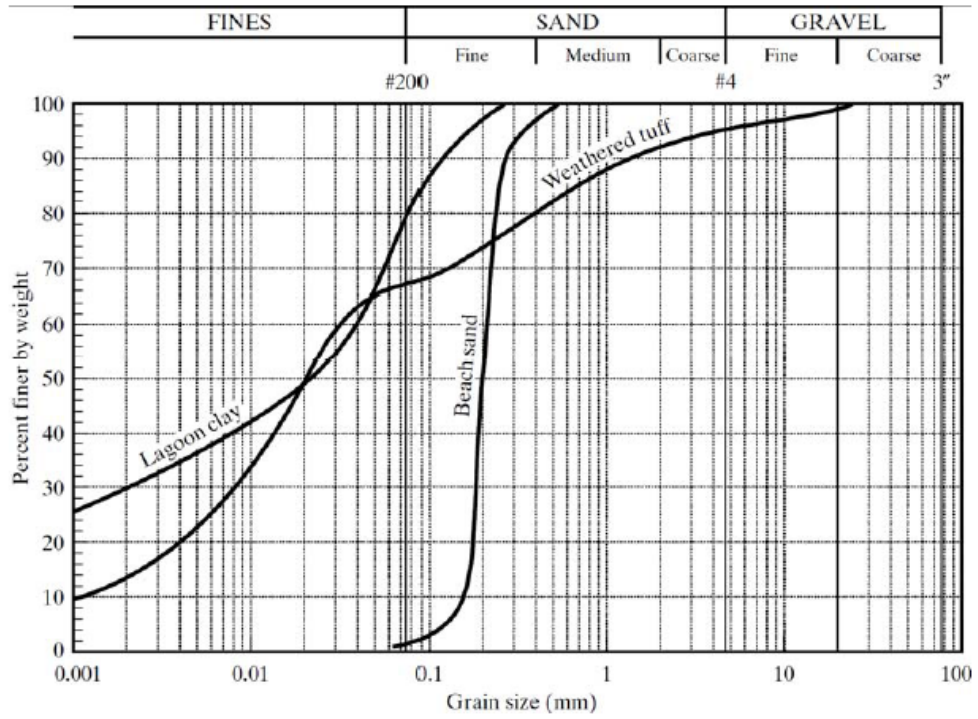
Problem 4.15

Solution

	Percent		
	Gravel	Sand	Fines
Soil A	0	12	88
Soil B	36	62	2
Soil C	0	100	0
Soil D	12	48	40
Soil E	44	48	8

Problem 4.17

Solution



Problem 4.18

Solution

Weathered Tuff

$$\begin{aligned}C_u &= \frac{D_{60}}{D_{10}} \\ &= \frac{0.032}{0.001} = 32\end{aligned}$$

$$\begin{aligned}C_c &= \frac{(D_{30})^2}{D_{10}D_{60}} \\ &= \frac{(0.008)^2}{(0.001)(0.032)} = 1.68\end{aligned}$$

Lagoon Clay

Assume $D_{10} = 0.0001$ mm

$$\begin{aligned}C_u &= \frac{D_{60}}{D_{10}} \\ &= \frac{0.04}{0.0001} = 400\end{aligned}$$

$$\begin{aligned}C_c &= \frac{(D_{30})^2}{D_{10}D_{60}} \\ &= \frac{(0.002)^2}{(0.0001)(0.04)} = 1.0\end{aligned}$$

Beach Sand

$$\begin{aligned}C_u &= \frac{D_{60}}{D_{10}} \\ &= \frac{0.21}{0.15} = 1.4\end{aligned}$$

$$\begin{aligned}C_c &= \frac{(D_{30})^2}{D_{10}D_{60}} \\ &= \frac{(0.175)^2}{(0.15)(0.21)} = 0.97\end{aligned}$$

The weathered tuff is the most well-graded soil because it has the flattest particle size distribution curve and thus encompasses the widest range of particle sizes.

Note: The lagoon clay has a higher C_u , so some may say it is the most well-graded. However, it is almost entirely silt and clay, and does not have the wide range of particle sizes found in the weathered tuff.

Problem 4.19

a.

Sieve Designation	Percent Passing by Weight		Conclusion
	Specification	Soil A	
1 inch	100	100	Fail
3/8 inch	50-85	100	Fail
#4	35-65	100	Fail
#10	25-50	100	Fail
#40	15-30	100	Fail
#200	5-15	88	Fail

Conclusion: Soil A does not satisfy the specifications.

b.

Sieve Designation	Percent Passing by Weight		Conclusion
	Specification	Soil B	
1 inch	100	90	Fail
3/8 inch	50-85	75	Pass
#4	35-65	63	Pass
#10	25-50	44	Pass
#40	15-30	15	Pass
#200	5-15	0	Fail

Conclusion: Soil B does not satisfy the specifications.

c.

Sieve Designation	Percent Passing by Weight		Conclusion
	Specification	Soil C	
1 inch	100	100	Pass
3/8 inch	50-85	100	Fail
#4	35-65	100	Fail
#10	25-50	95	Fail
#40	15-30	0	Fail
#200	5-15	0	Fail

Conclusion: Soil C does not satisfy the specifications.

d.

Sieve Designation	Percent Passing by Weight		Conclusion
	Specification	Soil D	
1 inch	100	99	Fail
3/8 inch	50-85	94	Fail
#4	35-65	87	Fail
#10	25-50	77	Fail
#40	15-30	58	Fail
#200	5-15	40	Fail

Conclusion: Soil D does not satisfy the specifications.

e.

Sieve Designation	Percent Weight Specification	Passing by Soil E	Conclusion
1 inch	100	95	Fail
3/8 inch	50-85	57	Pass
#4	35-65	46	Pass
#10	25-50	42	Pass
#40	15-30	34	Fail
#200	5-15	9	Pass

Conclusion: Soil E does not satisfy the specifications.