Solution to Homework Set #2
CE 327 - Spring 2009
Assigned Sa, 28/03 Due Mo, 6/04

Problem 1

The moist weight of 0.1 ft^3 of soil is 12.2 lb. If the moisture content is 12% and the specific gravity of the soil solids is 2.72, find the following:

1. Moist unit weight.
2. Dry unit weight.
3. Void ratio.
4. Porosity.
5. Degree of saturation.
6. Volume occupied by water.

***** SOLUTION *****

Moist Unit Weight (γ) = W/V = 12.2 lb / 0.1 ft^3 = 122 lb/ft^3
Dry Unit Weight (γ_d) = $\gamma/(1+\omega)$ = 122 / (1+0.12) = 108.93 lb/ft^3

$$VoidRatio(e) = \frac{Gs \cdot \gamma_w}{\gamma_d} - 1 = \frac{(2.72)(62.4)}{108.93} - 1 = 0.56$$

$$Porosity(n) = \frac{e}{1+e} = \frac{0.56}{1+0.56} = 0.36$$

$$DegreeSaturation(S) = \frac{\omega \cdot Gs}{e} = \frac{(0.12)(2.72)}{0.56} = 0.58$$

Volume occupied by water:

$n = V_v / V \rightarrow V_v = nV = (0.36)(0.10) = 0.0036\ ft^3$
$S = V_w / V_v \rightarrow V_w = S*V_v = (0.58)(0.0036) =$ **0.021 ft^3**

Problem 3

The results of standard Proctor test are given as shown in the table. Determine the maximum dry unit weight of compaction and optimum moisture content. Also determine the moisture contents required to achieve 95% of γ_d (max). If the field dry unit weight for this soil is 95.4 lb/ft^3, what would be the relative density?

Weight of wet soil in the mold (lb)	Moisture Content (%)
3.63	10
3.86	12
4.02	14
3.98	16
3.88	18
3.73	20

***** SOLUTION *****

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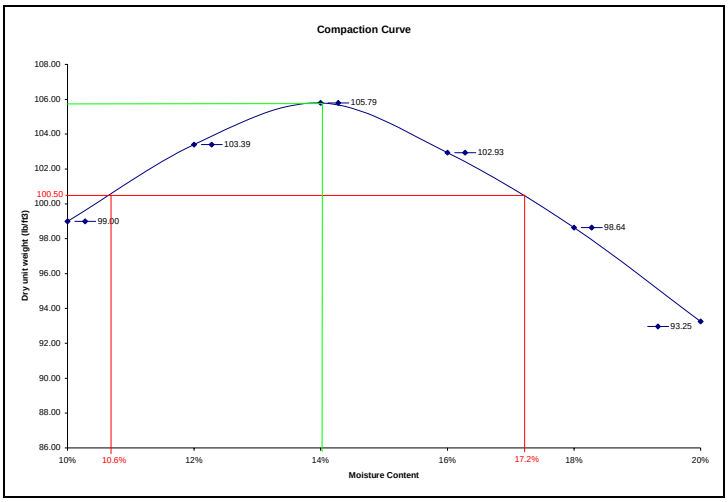
Volume of mold (ft^3)	Weight of wet soil in the mold (lb)	Moisture Content (%)	γ = W/Vm	$\gamma_d = \gamma/(1+\omega)$
1/30	3.63	10%	108.90	99.00
1/30	3.86	12%	115.80	103.39
1/30	4.02	14%	120.60	105.79
1/30	3.98	16%	119.40	102.93
1/30	3.88	18%	116.40	98.64
1/30	3.73	20%	111.90	93.25



Maximum dry unit weight = **105.79 lb/ft^3**
Optimum moisture content = **14%**

γ_d (95% of max) = 0.95*105.79 = 100.50 lb/ft^3

Using the compaction curve → **ω = 10.6% or 17.2%**

$$\text{Relative Compaction (RC)} = \frac{\gamma_{d(field)}}{\gamma_{d(\max.lab)}} \cdot 100 = \frac{95.40}{105.79} \cdot 100 = 90.19\%$$

$$\text{Relative Density, } D_r = \frac{RC - 0.8}{0.2} = \frac{0.9019 - 0.8}{0.2} = 0.51 = 51\%$$

Problem 6

For a dynamic compaction test, we are given: weight of hammer = 15 metric tons and height of drop = 12 m. Determine the significant depth of influence for compaction in both meters and feet.

***** SOLUTION *****

$D = n\sqrt{WH}$, where $n = 0.5$, Therefore,

$$D = 0.5\sqrt{(15)(12)} = 6.71\,\text{m}$$

$$= 22.01\,\text{ft}$$

