# Geotechnical Engineering–I

*BSc Civil Engineering – 4th Semester*

Lecture # 12

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*by*

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*Lecture Handouts: https://groups.google.com/d/forum/geotec-1*

# Practice Problem #2

The laboratory test results of a standard Proctor test are given in the following table:

| Volume of mold ($ft^3$) | Weight of moist soil in mold (lb) | Moisture content, *w* (%) |
|---|---|---|
| $\frac{1}{30}$ | 3.63 | 10 |
| $\frac{1}{30}$ | 3.86 | 12 |
| $\frac{1}{30}$ | 4.02 | 14 |
| $\frac{1}{30}$ | 3.98 | 16 |
| $\frac{1}{30}$ | 3.88 | 18 |
| $\frac{1}{30}$ | 3.73 | 20 |

Determine the maximum dry unit weight of compaction and the optimum moisture content.

# Practice Problem #2

| Volume of mold, $V$ ($ft^3$) | Weight of soil, $W$ (lb) | Moist unit weight, $\gamma$ ($lb/ft^3$)[a] | Moisture content, $w$ (%) | Dry unit weight, $\gamma_d$ ($lb/ft^3$)[b] |
|---|---|---|---|---|
| $\frac{1}{30}$ | 3.63 | 108.9 | 10 | 99.0 |
| $\frac{1}{30}$ | 3.86 | 115.8 | 12 | 103.4 |
| $\frac{1}{30}$ | 4.02 | 120.6 | 14 | 105.8 |
| $\frac{1}{30}$ | 3.98 | 119.4 | 16 | 102.9 |
| $\frac{1}{30}$ | 3.88 | 116.4 | 18 | 98.6 |
| $\frac{1}{30}$ | 3.73 | 111.9 | 20 | 93.3 |

[a] $\gamma = W/V$

[b] $\gamma_d = \gamma/\{1 + [w\,(\%)/100]\}$

# Practice Problem #2

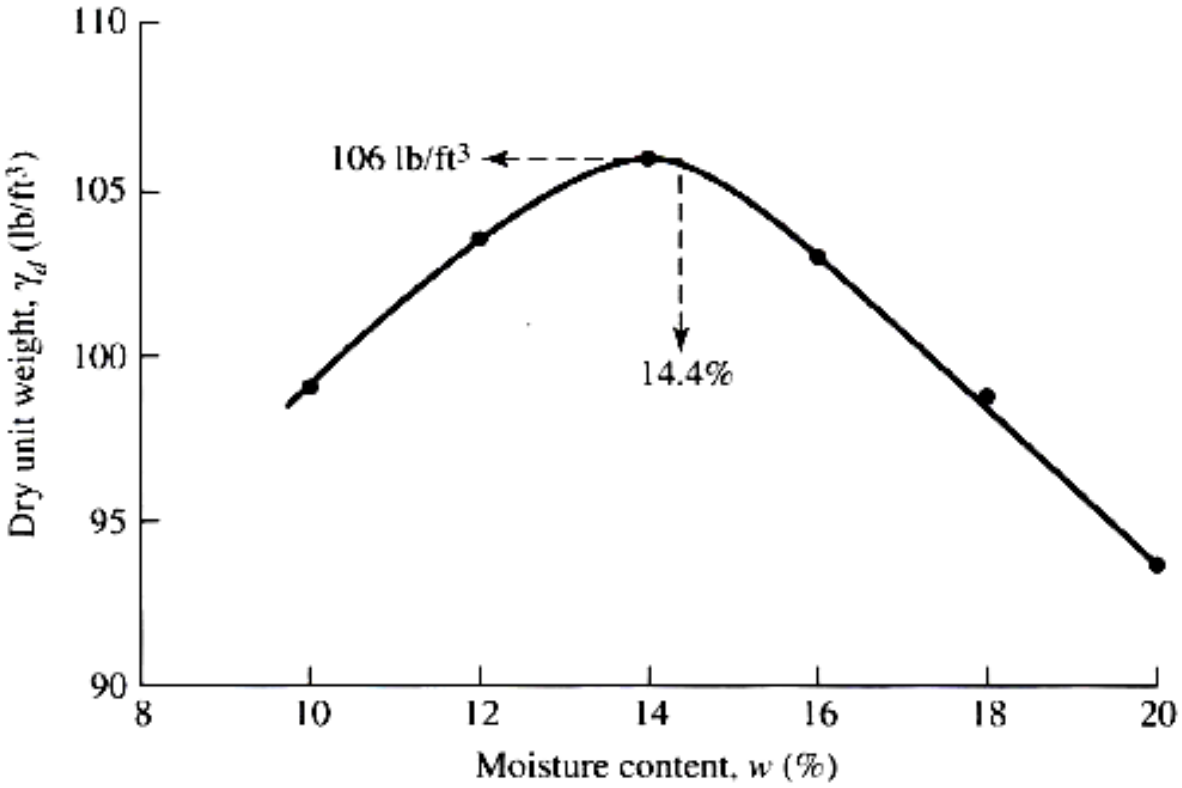


***Figure 5.7*** Moisture content, $w$ (%)

The plot of $\gamma_d$ versus $w$ is shown in Figure 5.7. From the plot, we see that the maximum dry unit weight $(\gamma_{d(\max)})$ = **106 lb/ft$^3$** and that the optimum moisture content is **14.4%**. ■

# Practice Problem #3

If a sample is saturated at a water content of 30%, what is its density? Assume $G_s$=2.70.

# Practice Problem #4

Q: The following data are available in connection with the construction of an embankment:

(a) Soil from borrow Pit: Natural density = 1.75 Mg/m$^3$, Natural moisture content = 12%

(b) (b) Soil after Compaction: Density 2 Mg/m$^3$, water content 18%

For every 100 m$^3$ of compacted soil of the embankment, estimate

(i) the quantity of soil to be excavated from the borrow pit, and

(ii) the amount of water to be added.

# Practice Problem #5

A borrow pit's soil is being used as earth fill at a construction project. The in situ dry unit weight of the borrow pit soil was determined to be 17.18 kN/m$^3$. The soil at the construction site is to be compacted to a dry unit weight of 18.90 kN/m$^3$. The construction project requires 15,000 m$^3$ of compacted fill.

Determine the volume of soil required to be excavated from the borrow pit to provide the necessary volume of compacted fill.

**Solution**

Total dry weight required to furnish the compacted fill

$$= \text{Total dry weight of soil required to be excavated from the borrow pit}$$

$$= (18.90\ \text{kN/m}^3)(15{,}000\ \text{m}^3) = 283{,}500\ \text{kN}$$

Volume of soil required to be obtained from the borrow pit

$$= \frac{283{,}500\ \text{kN}}{17.18\ \text{kN/m}^3} = 16{,}500\ \text{m}^3$$

# Practice Problem #6

The natural moisture content of a borrow pit material is 8%. Assuming 3000 g of moist soil for a standard compaction test, how much water is to be added to bring the sample to 11%, 15%, and 20% water content?

# CONCLUDED