Important Density of Soil Formulas PDF

Formulas
Examples
with Units

List of 17
Important Density of Soil Formulas

1) Bulk Density of Soil Formula

Evaluate Formula

Formula

$$\gamma_t = \frac{W_t}{V}$$

Example with Units

$$6.5285\,\text{kg/m}^3 = \frac{80\,\text{kg}}{12.254\,\text{m}^3}$$

2) Density of Water given Dry Density and Void Ratio Formula

Evaluate Formula

Formula

$$\rho_w = \rho_{ds} \cdot \frac{1 + e}{G_s}$$

Example with Units

$$995.3962\,\text{kg/m}^3 = 1199\,\text{kg/m}^3 \cdot \frac{1 + 1.2}{2.65}$$

3) Dry Density Given Void Ratio Formula

Evaluate Formula

Formula

$$\rho_{ds} = \frac{G_s \cdot \rho_w}{1 + e}$$

Example with Units

$$1200.9318\,\text{kg/m}^3 = \frac{2.65 \cdot 997.0\,\text{kg/m}^3}{1 + 1.2}$$

4) Dry Density of Soil Formula

Evaluate Formula

Formula

$$\rho_d = \frac{W_s}{V}$$

Example with Units

$$0.0491\,\text{kg/m}^3 = \frac{0.602\,\text{kg}}{12.254\,\text{m}^3}$$

5) Dry Density of Solids Formula

Evaluate Formula

Formula

$$\rho_{dry} = \frac{W_s}{v_{so}}$$

Example with Units

$$0.049\,\text{kg/m}^3 = \frac{0.602\,\text{kg}}{12.28\,\text{m}^3}$$

6) Mass of Saturated Sample given Saturated Density of Soil Formula

Evaluate Formula

Formula

$$W_{sat} = \rho_{sat} \cdot V$$

Example with Units

$$19.974\,\text{kg} = 1.63\,\text{kg/m}^3 \cdot 12.254\,\text{m}^3$$

7) Saturated Density of Soil Formula

Evaluate Formula

Formula

$$\rho_{sat} = \frac{M_{sat}}{V}$$

Example with Units

$$1.6321\,\text{kg/m}^3 = \frac{20\,\text{kg}}{12.254\,\text{m}^3}$$

8) Saturated Unit Weight given Submerged Unit Weight Formula

Evaluate Formula

Formula

$$\gamma_{saturated} = y_S + \gamma_{water}$$

Example with Units

$$10.77\,\text{kN/m}^3 = 0.96\,\text{kN/m}^3 + 9.81\,\text{kN/m}^3$$

9) Submerged Unit Weight of Soil Formula

Evaluate Formula

Formula

$$y_S = \frac{W_{su}}{V}$$

Example with Units

$$0.963\,\text{kN/m}^3 = \frac{11.8\,\text{kN}}{12.254\,\text{m}^3}$$

10) Submerged Weight of Soil given Submerged Unit Weight of Soil Formula

Evaluate Formula

Formula

$$W_{su} = y_S \cdot V$$

Example with Units

$$11.7638\,\text{kN} = 0.96\,\text{kN/m}^3 \cdot 12.254\,\text{m}^3$$

11) Total Mass of Soil given Bulk Density of Soil Formula

Evaluate Formula

Formula

$$W_t = \gamma_t \cdot V$$

Example with Units

$$79.8961\,\text{kg} = 6.52\,\text{kg/m}^3 \cdot 12.254\,\text{m}^3$$

12) Total Volume given Submerged Unit Weight of Soil Formula

Evaluate Formula

Formula

$$V = \frac{W_{su}}{y_S}$$

Example with Units

$$12.2917\,\text{m}^3 = \frac{11.8\,\text{kN}}{0.96\,\text{kN/m}^3}$$

13) Total Volume of Soil given Bulk Density of Soil Formula

Evaluate Formula

Formula

$$V = \frac{W_t}{\gamma_t}$$

Example with Units

$$12.2699\,\text{m}^3 = \frac{80\,\text{kg}}{6.52\,\text{kg/m}^3}$$

14) Total Volume of Soil given Dry Unit Weight Formula

Evaluate Formula

Formula

$$V = \frac{W_{sk}}{\gamma_{dry}}$$

Example with Units

$$30.0327\,\text{m}^3 = \frac{183.8\,\text{kN}}{6.12\,\text{kN/m}^3}$$

15) Total Volume with respect to Saturated Unit Weight of Soil Formula

Evaluate Formula

Formula

$$V = \frac{W_{satk}}{\gamma_{saturated}}$$

Example with Units

$$7.6165\,\text{m}^3 = \frac{90.56\,\text{kN}}{11.89\,\text{kN/m}^3}$$

16) Unit Weight of Water Formula

Evaluate Formula

Formula

$$\gamma_{water} = \gamma_{saturated} - \gamma_S$$

Example with Units

$$10.93\,\text{kN/m}^3 = 11.89\,\text{kN/m}^3 - 0.96\,\text{kN/m}^3$$

17) Weight of Solids given Unit Weight of Solids Formula

Evaluate Formula

Formula

$$W_{sk} = \gamma_{soilds} \cdot V$$

Example with Units

$$183.81\,\text{kN} = 15\,\text{kN/m}^3 \cdot 12.254\,\text{m}^3$$

Variables used in list of Density of Soil Formulas above

- **e** Void Ratio
- G_s Specific Gravity of Soil
- M_{sat} Mass of Saturated Soil *(Kilogram)*
- **V** Total Volume in Soil Mechanics *(Cubic Meter)*
- v_{so} Volume of Solids in Soil *(Cubic Meter)*
- W_s Weight of Solids in Soil Mechanics *(Kilogram)*
- W_{sat} Saturated Weight of Soil *(Kilogram)*
- W_{satk} Saturated Weight of Soil in KN *(Kilonewton)*
- W_{sk} Weight of Solids in Soil Mechanics in KN *(Kilonewton)*
- W_{su} Submerged Weight of Soil *(Kilonewton)*
- W_t Total Weight of Soil *(Kilogram)*
- y_S Submerged Unit Weight in KN per Cubic Meter *(Kilonewton per Cubic Meter)*
- γ_{dry} Dry Unit Weight *(Kilonewton per Cubic Meter)*
- $\gamma_{saturated}$ Saturated Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- γ_{soilds} Unit Weight of Solids *(Kilonewton per Cubic Meter)*
- γ_t Bulk Density of Soil *(Kilogram per Cubic Meter)*
- γ_{water} Unit Weight of Water *(Kilonewton per Cubic Meter)*
- ρ_d Dry Density *(Kilogram per Cubic Meter)*
- ρ_{dry} Dry Density of Solids *(Kilogram per Cubic Meter)*
- ρ_{ds} Dry Density in Soil Mechanics *(Kilogram per Cubic Meter)*
- ρ_{sat} Saturated Density *(Kilogram per Cubic Meter)*
- ρ_w Density of Water *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used in list of Density of Soil Formulas above

- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m^3)
  Density Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
  Specific Weight Unit Conversion

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