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Soil Origin and Its Properties Formulas

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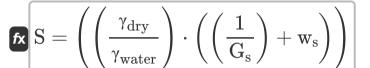
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List of 31 Soil Origin and Its Properties Formulas

Soil Origin and Its Properties ⤴

1) Degree of Saturation given Dry Unit Weight of Soil ⤴

Open Calculator ⤴

$$fx \quad S = \left(\left(\frac{\gamma_{dry}}{\gamma_{water}} \right) \cdot \left(\left(\frac{1}{G_s} \right) + w_s \right) \right)$$

$$ex \quad 0.615967 = \left(\left(\frac{6.12 \text{kN/m}^3}{9.81 \text{kN/m}^3} \right) \cdot \left(\left(\frac{1}{2.65} \right) + 0.61 \right) \right)$$

2) Degree of Saturation of Soil ⤴

Open Calculator ⤴

$$fx \quad S = \left(\frac{w_s \cdot G_s}{e_s} \right)$$

$$ex \quad 0.702826 = \left(\frac{0.61 \cdot 2.65}{2.3} \right)$$

3) Dry Unit Weight of Soil given Relative Density ⤴

Open Calculator ⤴

$$fx \quad \gamma_{dry} = \left(\frac{\gamma_{min} \cdot \gamma_{max}}{\gamma_{max} - R_D \cdot (\gamma_{max} - \gamma_{min})} \right)$$

$$ex \quad 7.518797 \text{kN/m}^3 = \left(\frac{5 \text{kN/m}^3 \cdot 10 \text{kN/m}^3}{10 \text{kN/m}^3 - 0.67 \cdot (10 \text{kN/m}^3 - 5 \text{kN/m}^3)} \right)$$

4) Dry Unit Weight of Soil with any Degree of Saturation ⤴

Open Calculator ⤴

$$fx \quad \gamma_{dry} = \left(\frac{\gamma_{water} \cdot G_s \cdot S}{1 + (w_s \cdot G_s)} \right)$$

$$ex \quad 5.961361 kN/m^3 = \left(\frac{9.81 kN/m^3 \cdot 2.65 \cdot 0.6}{1 + (0.61 \cdot 2.65)} \right)$$

5) Maximum Porosity given Relative Density in Porosity ⤴

Open Calculator ⤴

$$fx \quad n_{max} = n_{min} \cdot \frac{R - (\eta \cdot R) - \eta + 1}{R - (\eta \cdot R) + n_{min} - 1}$$

$$ex \quad 0.896703 = 0.8 \cdot \frac{11 - (0.32 \cdot 11) - 0.32 + 1}{11 - (0.32 \cdot 11) + 0.8 - 1}$$

6) Maximum Unit Weight of Soil given Relative Density ⤴

Open Calculator ⤴

$$fx \quad \gamma_{max} = \left(\frac{\gamma_{min} \cdot \gamma_{dry} \cdot R}{\gamma_{dry} \cdot (R - 1) + \gamma_{min}} \right)$$

$$ex \quad 5.084592 kN/m^3 = \left(\frac{5 kN/m^3 \cdot 6.12 kN/m^3 \cdot 11}{6.12 kN/m^3 \cdot (11 - 1) + 5 kN/m^3} \right)$$

7) Maximum Void Ratio of Soil given Relative Density ⤴

Open Calculator ⤴

$$fx \quad e_{max} = \frac{e_o - (R \cdot e_{min})}{1 - R}$$

$$ex \quad 0.28 = \frac{0.50 - (11 \cdot 0.30)}{1 - 11}$$

8) Minimum Porosity given Relative Density in Porosity ⤴

Open Calculator ⤴

$$fx \quad n_{min} = n_{max} \cdot \frac{1 + (\eta \cdot R) - \eta - R}{n_{max} - \eta - R + (\eta \cdot R)}$$

$$ex \quad 0.909302 = 0.92 \cdot \frac{1 + (0.32 \cdot 11) - 0.32 - 11}{0.92 - 0.32 - 11 + (0.32 \cdot 11)}$$

9) Minimum Unit Weight of Soil given Relative Density ⤴

Open Calculator ⤴

$$fx \quad \gamma_{min} = \left(\frac{\gamma_{dry} \cdot \gamma_{max} \cdot (R - 1)}{(R \cdot \gamma_{dry}) - \gamma_{max}} \right)$$

$$ex \quad 10.6769 \text{kN/m}^3 = \left(\frac{6.12 \text{kN/m}^3 \cdot 10 \text{kN/m}^3 \cdot (11 - 1)}{(11 \cdot 6.12 \text{kN/m}^3) - 10 \text{kN/m}^3} \right)$$

10) Minimum Void Ratio of Soil given Relative Density ⎘

fx $e_{min} = \left(e_{max} - \left(\frac{e_{max} - e_o}{R} \right) \right)$

Open Calculator ⎘

ex $0.772727 = \left(0.80 - \left(\frac{0.80 - 0.50}{11} \right) \right)$

11) Natural Void Ratio of Soil given Relative Density ⎘

fx $e_o = (e_{max} \cdot (1 - R_D) + (R_D \cdot e_{min}))$

Open Calculator ⎘

ex $0.465 = (0.80 \cdot (1 - 0.67) + (0.67 \cdot 0.30))$

12) Porosity Given Relative Density in Porosity ⎘

fx $\eta = \frac{n_{max} \cdot (1 - n_{min} - R_D) + R_D \cdot n_{min}}{1 - n_{min} + R_D \cdot n_{min} - R_D \cdot n_{max}}$

Open Calculator ⎘

ex $0.866221 = \frac{0.92 \cdot (1 - 0.8 - 0.67) + 0.67 \cdot 0.8}{1 - 0.8 + 0.67 \cdot 0.8 - 0.67 \cdot 0.92}$

13) Porosity of soil ⎘

fx $\eta = \left(\frac{V_v}{V} \right)$

Open Calculator ⎘

ex $0.325 = \left(\frac{6.5m^3}{20m^3} \right)$

14) Porosity of Soil given Void Ratio ↗

fx $\eta = \left(\dfrac{e_s}{1 + e_s} \right)$

Open Calculator ↗

ex $0.69697 = \left(\dfrac{2.3}{1 + 2.3} \right)$

15) Relative density given porosity ↗

fx $R_D = \dfrac{(n_{max} - \eta) \cdot (1 - n_{min})}{(n_{max} - n_{min}) \cdot (1 - \eta)}$

Open Calculator ↗

ex $1.470588 = \dfrac{(0.92 - 0.32) \cdot (1 - 0.8)}{(0.92 - 0.8) \cdot (1 - 0.32)}$

16) Relative Density of Cohesionless Soil given Unit Weight of Soil ↗

fx $R_D = \dfrac{\left(\dfrac{1}{\gamma_{min}} \right) - \left(\dfrac{1}{\gamma_{dry}} \right)}{\left(\dfrac{1}{\gamma_{min}} \right) - \left(\dfrac{1}{\gamma_{max}} \right)}$

Open Calculator ↗

ex $0.366013 = \dfrac{\left(\dfrac{1}{5kN/m^3} \right) - \left(\dfrac{1}{6.12kN/m^3} \right)}{\left(\dfrac{1}{5kN/m^3} \right) - \left(\dfrac{1}{10kN/m^3} \right)}$

17) Relative Density of Cohesionless Soil given Void Ratio ⎘

Open Calculator ⎘

$$fx \; R_D = \left(\frac{e_{max} - e_o}{e_{max} - e_{min}} \right)$$

$$ex \; 0.6 = \left(\frac{0.80 - 0.50}{0.80 - 0.30} \right)$$

18) Specific Gravity of Soil given Degree of Saturation ⎘

Open Calculator ⎘

$$fx \; G_s = \left(\frac{S \cdot e_s}{w_s} \right)$$

$$ex \; 2.262295 = \left(\frac{0.6 \cdot 2.3}{0.61} \right)$$
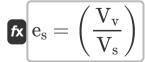
19) Total Volume of Soil using Porosity ⎘

Open Calculator ⎘

$$fx \; V = \left(\frac{V_v}{\eta} \right)$$

$$ex \; 20.3125 m^3 = \left(\frac{6.5 m^3}{0.32} \right)$$

20) Void ratio of soil ⎘

Open Calculator ⎘

$$fx \; e_s = \left(\frac{V_v}{V_s} \right)$$

$$ex \; 2.166667 = \left(\frac{6.5 m^3}{3 m^3} \right)$$

21) Void Ratio of Soil given Degree of Saturation

fx $e_s = \left(\dfrac{w_s \cdot G_s}{S} \right)$

Open Calculator

ex $2.694167 = \left(\dfrac{0.61 \cdot 2.65}{0.6} \right)$

22) Void Ratio of Soil given Porosity

fx $e_s = \left(\dfrac{\eta}{1 - \eta} \right)$

Open Calculator

ex $0.470588 = \left(\dfrac{0.32}{1 - 0.32} \right)$

23) Volume of Voids using Porosity

fx $V_v = (\eta \cdot V)$

Open Calculator

ex $6.4m^3 = (0.32 \cdot 20m^3)$

24) Water Content of Soil given Degree of Saturation

fx $w_s = \left(\dfrac{S \cdot e_s}{G_s} \right)$

Open Calculator

ex $0.520755 = \left(\dfrac{0.6 \cdot 2.3}{2.65} \right)$

Degree of Saturation 🔗

25) Air Content with Respect to Degree of Saturation 🔗

fx $a_c = 1 - S$

Open Calculator 🔗

ex $0.4 = 1 - 0.6$

26) Buoyant Unit Weight of Soil with Saturation 100 Percent 🔗

fx $\gamma_b = \left(\dfrac{(G_s \cdot \gamma_{water}) - \gamma_{water}}{1 + e} \right)$

Open Calculator 🔗

ex $7.3575 \text{kN/m}^3 = \left(\dfrac{(2.65 \cdot 9.81 \text{kN/m}^3) - 9.81 \text{kN/m}^3}{1 + 1.2} \right)$

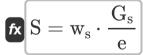## 27) Degree of Saturation given Air Content with Respect to Degree of Saturation 🔗

fx $S = 1 - a_c$

Open Calculator 🔗

ex $0.6 = 1 - 0.4$

28) Degree of Saturation given Void Ratio in Specific Gravity 🔗

fx $S = w_s \cdot \dfrac{G_s}{e}$

Open Calculator 🔗

ex $1.347083 = 0.61 \cdot \dfrac{2.65}{1.2}$

29) Degree of Saturation of Soil Sample 🔗

Open Calculator 🔗

$$fx \quad S = \left(\frac{Vw}{Vv} \right)$$

$$ex \quad 0.666667 = \left(\frac{2m^3}{3m^3} \right)$$

30) Volume of Voids given Degree of Saturation of Soil Sample 🔗

Open Calculator 🔗

$$fx \quad Vv = \frac{Vw}{S}$$

$$ex \quad 3.333333m^3 = \frac{2m^3}{0.6}$$

31) Volume of Water given Degree of Saturation of Soil Sample 🔗

Open Calculator 🔗

$$fx \quad Vw = S \cdot Vv$$

$$ex \quad 1.8m^3 = 0.6 \cdot 3m^3$$

Variables Used

- **a_c** Air Content
- **e** Void Ratio
- **e_{max}** Maximum Void Ratio
- **e_{min}** Minimum Void Ratio
- **e_o** Natural Void Ratio
- **e_s** Void Ratio of Soil
- **G_s** Specific Gravity of Soil
- **n_{max}** Maximum Porosity
- **n_{min}** Minimum Porosity
- **R** Relative Density
- **R_D** Relative Density in Soil Mechanics
- **S** Degree of Saturation
- **V** Volume of Soil *(Cubic Meter)*
- **V_s** Solid Volume *(Cubic Meter)*
- **V_v** Volume of Voids *(Cubic Meter)*
- **Vv** Void Space Volume *(Cubic Meter)*
- **Vw** Volume of Water *(Cubic Meter)*
- **w_s** Water Content of Soil from Pycnometer
- **γ_b** Buoyant Unit Weight *(Kilonewton per Cubic Meter)*
- **γ_{dry}** Dry Unit Weight *(Kilonewton per Cubic Meter)*
- **γ_{max}** Maximum Unit Weight *(Kilonewton per Cubic Meter)*

- γ_{min} Minimum Unit Weight *(Kilonewton per Cubic Meter)*

- γ_{water} Unit Weight of Water *(Kilonewton per Cubic Meter)*

- η Porosity of Soil

Constants, Functions, Measurements used

- Measurement: **Volume** in Cubic Meter (m³)
  Volume Unit Conversion

- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
  Specific Weight Unit Conversion

Check other formula lists

- **Bearing Capacity for Strip Footing for C-Φ Soils Formulas** ⤴
- **Bearing Capacity of Cohesive Soil Formulas** ⤴
- **Bearing Capacity of Non-cohesive Soil Formulas** ⤴
- **Bearing Capacity of Soils: Meyerhof's Analysis Formulas** ⤴
- **Foundation Stability Analysis Formulas** ⤴
- **Atterberg Limits Formulas** ⤴
- **Bearing Capacity of Soil: Terzaghi's Analysis Formulas** ⤴
- **Compaction of Soil Formulas** ⤴
- **Earth Moving Formulas** ⤴
- **Lateral Pressure for Cohesive and Non Cohesive Soil Formulas** ⤴

- **Minimum Depth of Foundation by Rankine's Analysis Formulas** ⤴
- **Pile Foundations Formulas** ⤴
- **Scraper Production Formulas** ⤴
- **Seepage Analysis Formulas** ⤴
- **Slope Stability Analysis using Bishops Method Formulas** ⤴
- **Slope Stability Analysis using Culman's Method Formulas** ⤴
- **Soil Origin and Its Properties Formulas** ⤴
- **Vibration Control in Blasting Formulas** ⤴
- **Void Ratio of Soil Sample Formulas** ⤴
- **Water Content of Soil and Related Formulas** ⤴

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