

Important Void Ratio of Soil Sample Formulas PDF



Formulas
Examples
with Units

List of 23 Important Void Ratio of Soil Sample Formulas

1) Air Content of Soil Formula ↻

Formula

$$a_c = \frac{V_a}{V_{\text{void}}}$$

Example with Units

$$0.3494 = \frac{2.1 \text{ m}^3}{6.01 \text{ m}^3}$$

Evaluate Formula ↻

2) Air Content with respect to Volume of Water Formula ↻

Formula

$$a_c = 1 - \left(\frac{V_w}{V_{\text{void}}} \right)$$

Example with Units

$$0.6672 = 1 - \left(\frac{2 \text{ m}^3}{6.01 \text{ m}^3} \right)$$

Evaluate Formula ↻

3) Percentage Air Voids given Void Ratio Formula ↻

Formula

$$n_a = \left(e \cdot \frac{1 - S}{1 + e} \right) \cdot 100$$

Example

$$10.3636 = \left(1.2 \cdot \frac{1 - 0.81}{1 + 1.2} \right) \cdot 100$$

Evaluate Formula ↻

4) Percentage of Air Voids of Soil Formula ↻

Formula

$$n_a = \frac{V_a \cdot 100}{V}$$

Example with Units

$$10.5 = \frac{2.1 \text{ m}^3 \cdot 100}{20 \text{ m}^3}$$

Evaluate Formula ↻

5) Total Volume of Soil given Percentage of Air Voids of Soil Formula ↻

Formula

$$V = \frac{V_a \cdot 100}{n_a}$$

Example with Units

$$21 \text{ m}^3 = \frac{2.1 \text{ m}^3 \cdot 100}{10}$$

Evaluate Formula ↻

6) Void Ratio given Dry Density Formula ↻

Formula

$$e = \left(\frac{G \cdot \gamma_{\text{water}}}{\gamma_{\text{dry}}} \right) - 1$$

Example with Units

$$24.6631 = \left(\frac{16.01 \cdot 9.81 \text{ kN/m}^3}{6.12 \text{ kN/m}^3} \right) - 1$$

Evaluate Formula ↻



7) Void Ratio given Percentage Air Voids in Void Ratio Formula ↻

Formula

$$e = \frac{\frac{n_a}{100}}{1 - S - \left(\frac{n_a}{100}\right)}$$

Example

$$1.1111 = \frac{\frac{10}{100}}{1 - 0.81 - \left(\frac{10}{100}\right)}$$

Evaluate Formula ↻

8) Void Ratio given Specific Gravity Formula ↻

Formula

$$e = w_s \cdot \frac{G_s}{S}$$

Example

$$1.9957 = 0.61 \cdot \frac{2.65}{0.81}$$

Evaluate Formula ↻

9) Void Ratio given Specific Gravity for Fully Saturated Soil Formula ↻

Formula

$$e = w_s \cdot G_s$$

Example

$$1.6165 = 0.61 \cdot 2.65$$

Evaluate Formula ↻

10) Void Ratio of Soil Sample Formula ↻

Formula

$$e = \frac{V_{\text{void}}}{V_s}$$

Example with Units

$$1.202 = \frac{6.01 \text{ m}^3}{5 \text{ m}^3}$$

Evaluate Formula ↻

11) Void Ratio of Soil using Buoyant Unit Weight Formula ↻

Formula

$$e = \left(\frac{G_s \cdot \gamma_{\text{water}} - \gamma_{\text{water}} - \gamma_b}{\gamma_b} \right)$$

Example with Units

$$1.6978 = \left(\frac{2.65 \cdot 9.81 \text{ kN/m}^3 - 9.81 \text{ kN/m}^3 - 6 \text{ kN/m}^3}{6 \text{ kN/m}^3} \right)$$

Evaluate Formula ↻

12) Void Ratio of Soil using Dry Unit Weight Formula ↻

Formula

$$e = \left(\left(\frac{G_s \cdot \gamma_{\text{water}}}{\gamma_{\text{dry}}} \right) - 1 \right)$$

Example with Units

$$3.2478 = \left(\left(\frac{2.65 \cdot 9.81 \text{ kN/m}^3}{6.12 \text{ kN/m}^3} \right) - 1 \right)$$

Evaluate Formula ↻

13) Void Ratio of Soil using Saturated Unit Weight Formula ↻

Formula

$$e = \left(\frac{(G_s \cdot \gamma) - \gamma_{\text{sat}}}{\gamma_{\text{sat}} - \gamma_{\text{water}}} \right)$$

Example with Units

$$1.6702 = \left(\frac{(2.65 \cdot 18 \text{ kN/m}^3) - 24 \text{ kN/m}^3}{24 \text{ kN/m}^3 - 9.81 \text{ kN/m}^3} \right)$$

Evaluate Formula ↻



14) Volume of Air Voids given Air Content of Soil Formula

Formula

$$V_a = a_c \cdot V_{\text{void}}$$

Example with Units

$$2.404\text{m}^3 = 0.4 \cdot 6.01\text{m}^3$$

Evaluate Formula 

15) Volume of Air Voids given Percentage of Air Voids of Soil Formula

Formula

$$V_a = \frac{n_a \cdot V}{100}$$

Example with Units

$$2\text{m}^3 = \frac{10 \cdot 20\text{m}^3}{100}$$

Evaluate Formula 

16) Volume of Air Voids with respect to Volume of Voids Formula

Formula

$$V_a = V_{\text{void}} - V_w$$

Example with Units

$$4.01\text{m}^3 = 6.01\text{m}^3 - 2\text{m}^3$$

Evaluate Formula 

17) Volume of Solids given Void Ratio of Soil Sample Formula

Formula

$$V_s = \frac{V_{\text{void}}}{e}$$

Example with Units

$$5.0083\text{m}^3 = \frac{6.01\text{m}^3}{1.2}$$

Evaluate Formula 

18) Volume of Voids given Air Content of Soil Formula

Formula

$$V_{\text{void}} = \frac{V_a}{a_c}$$

Example with Units

$$5.25\text{m}^3 = \frac{2.1\text{m}^3}{0.4}$$

Evaluate Formula 

19) Volume of Voids given Air Content with respect to Volume of Water Formula

Formula

$$V_{\text{void}} = \frac{V_w}{1 - a_c}$$

Example with Units

$$3.3333\text{m}^3 = \frac{2\text{m}^3}{1 - 0.4}$$

Evaluate Formula 

20) Volume of Voids given Void Ratio of Soil Sample Formula

Formula

$$V_{\text{void}} = e \cdot V_s$$

Example with Units

$$6\text{m}^3 = 1.2 \cdot 5\text{m}^3$$

Evaluate Formula 

21) Volume of Voids given Volume of Air Voids with respect to Volume of Voids Formula

Formula

$$V_{\text{void}} = V_a + V_w$$

Example with Units

$$4.1\text{m}^3 = 2.1\text{m}^3 + 2\text{m}^3$$

Evaluate Formula 



22) Volume of Water given Air Content with respect to Volume of Water Formula

Formula

$$V_w = V_{\text{void}} \cdot (1 - a_c)$$

Example with Units

$$3.606\text{m}^3 = 6.01\text{m}^3 \cdot (1 - 0.4)$$

Evaluate Formula 

23) Volume of Water given Volume of Air Voids Formula

Formula

$$V_w = V_{\text{void}} - V_a$$

Example with Units

$$3.91\text{m}^3 = 6.01\text{m}^3 - 2.1\text{m}^3$$



Evaluate Formula 



Variables used in list of Void Ratio of Soil Sample Formulas above

- a_c Air Content
- e Void Ratio
- G Specific Gravity of Particle
- G_s Specific Gravity of Soil
- n_a Percentage of Air Voids
- S Degree of Saturation
- V Volume of Soil (Cubic Meter)
- V_a Volume Air Voids (Cubic Meter)
- V_{void} Volume of Voids (Cubic Meter)
- V_s Volume of Solids (Cubic Meter)
- V_w Volume of Water (Cubic Meter)
- w_s Water Content of Soil from Pycnometer
- γ Unit Weight of Soil (Kilonewton per Cubic Meter)
- γ_b Buoyant Unit Weight (Kilonewton per Cubic Meter)
- γ_{dry} Dry Unit Weight (Kilonewton per Cubic Meter)
- γ_{sat} Saturated Unit Weight (Kilonewton per Cubic Meter)
- γ_{water} Unit Weight of Water (Kilonewton per Cubic Meter)

Constants, Functions, Measurements used in list of Void Ratio of Soil Sample Formulas above






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



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