Important Atterberg Limits Formulas PDF

Formulas
Examples
with Units

List of 16
Important Atterberg Limits Formulas

1) Activity Index of Soil Formula

Evaluate Formula

Formula

$$A_c = \left(\frac{I_p}{\mu}\right)$$

Example

$$6 = \left(\frac{1.2}{0.20}\right)$$

2) Angle of Internal Friction for Soil Formula

Evaluate Formula

Formula

$$\varphi = \arctan\left(\frac{F_s}{Fn}\right)$$

Example with Units

$$40.2453° = \arctan\left(\frac{48.5\,\text{N}}{57.3\,\text{N}}\right)$$

3) Coefficient of Internal Friction for Soil Formula

Evaluate Formula

Formula

$$\tan\varphi = \left(\frac{F_s}{P}\right)$$

Example with Units

$$0.3233 = \left(\frac{48.5\,\text{N}}{150\,\text{N}}\right)$$

4) Liquid Limit of Soil given Plasticity Index Formula

Evaluate Formula

Formula

$$W_l = I_p + W_p$$

Example

$$2.4 = 1.2 + 1.20$$

5) Liquidity Index of Soil Formula

Evaluate Formula

Formula

$$I_l = \frac{w - W_p}{I_p}$$

Example

$$0.4917 = \frac{1.79 - 1.20}{1.2}$$

6) Moisture Content of Soil given Liquidity Index Formula

Evaluate Formula

Formula

$$w = \left(\left(I_l \cdot I_p\right) + W_p\right)$$

Example

$$1.92 = \left(\left(0.6 \cdot 1.2\right) + 1.20\right)$$

7) Normal Force on given Plane in Cohesionless Soil Formula

Evaluate Formula

Formula

$$Fn = \left(\frac{F_s}{\tan\varphi}\right)$$

Example with Units

$$97\,\text{N} = \left(\frac{48.5\,\text{N}}{0.50}\right)$$

8) Percent of Soil Finer than Clay Size given Activity Index Formula

Evaluate Formula

Formula

$$\mu = \left(\frac{I_p}{A_c}\right)$$

Example

$$0.2 = \left(\frac{1.2}{6}\right)$$

9) Plastic Limit of Soil given Plasticity Index Formula

Evaluate Formula

Formula

$$W_p = W_l - I_p$$

Example

$$1.2 = 2.4 - 1.2$$

10) Plastic Limit of Soil given Shrinkage Index Formula

Evaluate Formula

Formula

$$W_p = \left(I_s + W_s\right)$$

Example

$$1.2 = \left(1.07 + 0.13\right)$$

11) Plasticity Index of Soil Formula

Evaluate Formula

Formula

$$I_p = W_l - W_p$$

Example

$$1.2 = 2.4 - 1.20$$

12) Plasticity Index of Soil given Activity Index Formula

Evaluate Formula

Formula

$$I_p = \left(A_c \cdot \mu\right)$$

Example

$$1.2 = \left(6 \cdot 0.20\right)$$

13) Plasticity Index of Soil given Liquidity Index Formula

Evaluate Formula

Formula

$$I_p = \frac{w - W_p}{I_l}$$

Example

$$0.9833 = \frac{1.79 - 1.20}{0.6}$$

14) Shearing Force on Plane when Sliding on Plane is Impending Formula

Evaluate Formula

Formula

$$F_s = \left(Fn \cdot \tan\varphi\right)$$

Example with Units

$$28.65\,\text{N} = \left(57.3\,\text{N} \cdot 0.50\right)$$

15) Shrinkage Index of Soil Formula

Evaluate Formula

Formula

$$I_s = \left(W_p - W_s \right)$$

Example

$$1.07 = \left(1.20 - 0.13 \right)$$

16) Shrinkage Limit of Soil given Shrinkage Index Formula

Evaluate Formula

Formula

$$W_s = \left(W_p - I_s \right)$$

Example

$$0.13 = \left(1.20 - 1.07 \right)$$

Variables used in list of Atterberg Limits Formulas above

- A_c Activity Index
- F_s Shear Force on Soil *(Newton)*
- **Fn** Normal Force on Soil *(Newton)*
- I_l Liquidity Index
- I_p Plasticity Index
- I_s Shrinkage Index
- **P** Total Normal Force *(Newton)*
- **tanφ** Coefficient of Internal Friction
- **w** Water Content of Soil
- W_l Liquid Limit
- W_p Plastic Limit
- W_s Shrinkage Limit
- **μ** Percentage of Clay Fraction
- **φ** Angle of Internal Friction *(Degree)*

Constants, Functions, Measurements used in list of Atterberg Limits Formulas above

- Functions: **arctan**, arctan(Number)
  Inverse trigonometric functions are usually accompanied by the prefix - arc. Mathematically, we represent arctan or the inverse tangent function as tan-1 x or arctan(x).
- Functions: **ctan**, ctan(Angle)
  Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a right triangle.
- Functions: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

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