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Atterberg Limits Formulas

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List of 16 Atterberg Limits Formulas

Atterberg Limits

1) Activity Index of Soil

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

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

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

2) Angle of Internal Friction for Soil

$$\text{fx } \varphi = \arctan \left(\frac{F_s}{F_n} \right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 40.24532^\circ = \arctan \left(\frac{48.5\text{N}}{57.3\text{N}} \right)$$

3) Coefficient of Internal Friction for Soil

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

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 0.323333 = \left(\frac{48.5\text{N}}{150\text{N}} \right)$$



4) Liquid Limit of Soil given Plasticity Index

$$\text{fx } W_l = I_p + W_p$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 2.4 = 1.2 + 1.20$$

5) Liquidity Index of Soil

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 0.491667 = \frac{1.79 - 1.20}{1.2}$$

6) Moisture Content of Soil given Liquidity Index

$$\text{fx } w = ((I_l \cdot I_p) + W_p)$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 1.92 = ((0.6 \cdot 1.2) + 1.20)$$

7) Normal Force on given Plane in Cohesionless Soil

$$\text{fx } F_n = \left(\frac{F_s}{\tan \phi} \right)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

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



8) Percent of Soil Finer than Clay Size given Activity Index [Open Calculator](#) 

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

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

9) Plastic Limit of Soil given Plasticity Index [Open Calculator](#) 

$$fx \quad W_p = W_l - I_p$$

$$ex \quad 1.2 = 2.4 - 1.2$$

10) Plastic Limit of Soil given Shrinkage Index [Open Calculator](#) 

$$fx \quad W_p = (I_s + W_s)$$

$$ex \quad 1.2 = (1.07 + 0.13)$$

11) Plasticity Index of Soil [Open Calculator](#) 

$$fx \quad I_p = W_l - W_p$$

$$ex \quad 1.2 = 2.4 - 1.20$$

12) Plasticity Index of Soil given Activity Index [Open Calculator](#) 

$$fx \quad I_p = (A_c \cdot \mu)$$

$$ex \quad 1.2 = (6 \cdot 0.20)$$



13) Plasticity Index of Soil given Liquidity Index

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 0.983333 = \frac{1.79 - 1.20}{0.6}$$

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

$$\text{fx } F_s = (F_n \cdot \tan \phi)$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 28.65\text{N} = (57.3\text{N} \cdot 0.50)$$

15) Shrinkage Index of Soil

$$\text{fx } I_s = (W_p - W_s)$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 1.07 = (1.20 - 0.13)$$

16) Shrinkage Limit of Soil given Shrinkage Index

$$\text{fx } W_s = (W_p - I_s)$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$\text{ex } 0.13 = (1.20 - 1.07)$$



Variables Used

- A_c Activity Index
- F_s Shear Force on Soil (Newton)
- F_n Normal Force on Soil (Newton)
- I_l Liquidity Index
- I_p Plasticity Index
- I_s Shrinkage Index
- P Total Normal Force (Newton)
- $\tan\phi$ 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

- **Function:** **arctan**, $\arctan(\text{Number})$
Inverse trigonometric tangent function
- **Function:** **ctan**, $\text{ctan}(\text{Angle})$
Trigonometric cotangent function
- **Function:** **tan**, $\tan(\text{Angle})$
Trigonometric tangent function
- **Measurement:** **Force** in Newton (N)
Force Unit Conversion 
- **Measurement:** **Angle** in Degree ($^{\circ}$)
Angle Unit Conversion 



Check other formula lists

- [Bearing Capacity for Strip Footing for C- \$\Phi\$ 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](#)
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