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Earth Moving Formulas

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List of 21 Earth Moving Formulas

Earth Moving

1) Coefficient of Traction

$$fx \quad f = \left(\frac{P}{W} \right)$$

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

$$ex \quad 0.9 = \left(\frac{18N}{20.0kg} \right)$$

2) Grade Resistance Factor given Grade Resistance for Motion on Slope

$$fx \quad R_g = \left(\frac{G}{PG \cdot W} \right)$$

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

$$ex \quad 0.124875N/Kg = \left(\frac{9.99N}{4 \cdot 20.0kg} \right)$$

3) Grade Resistance for Motion on Slope

$$fx \quad G = R_g \cdot PG \cdot W$$

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

$$ex \quad 9.984N = 0.1248N/Kg \cdot 4 \cdot 20.0kg$$



4) Percent Grade [Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$fx \quad PG = \left(\frac{G}{R_g \cdot W} \right)$$

$$ex \quad 4.002404 = \left(\frac{9.99N}{0.1248N/Kg \cdot 20.0kg} \right)$$

5) Rolling Resistance to Motion of Wheeled Vehicles [Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

$$fx \quad R = (R_f \cdot W) + (R_p \cdot p \cdot W)$$

$$ex \quad 1200N = (10.0N/Kg \cdot 20.0kg) + (10rad/s^2 \cdot 5m \cdot 20.0kg)$$

6) Rolling Resistance when Rolling Resistance Factor is Two Percent [Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)

$$fx \quad R' = (0.02 + 0.015 \cdot p) \cdot W$$


$$ex \quad 1.9N = (0.02 + 0.015 \cdot 5m) \cdot 20.0kg$$

7) Total Road Resistance given Rolling Resistance and Grade Resistance

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

$$fx \quad T = ((0.02 + 0.015 \cdot p + 0.01 \cdot PG) \cdot W)$$

$$ex \quad 2.7N = ((0.02 + 0.015 \cdot 5m + 0.01 \cdot 4) \cdot 20.0kg)$$

8) Usable Pull to Overcome Loss of Power with Altitude [Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3_img.jpg\)](#)

$$fx \quad P = (f \cdot W)$$

$$ex \quad 18N = (0.9 \cdot 20.0kg)$$



9) Weight on Drivers given Usable Pull [Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5_img.jpg\)](#)


$$fx \quad W = \left(\frac{P}{f} \right)$$

$$ex \quad 20kg = \left(\frac{18N}{0.9} \right)$$

10) Weight on Wheels given Rolling Resistance [Open Calculator !\[\]\(ec9132f1d27c8919987d92907322654d_img.jpg\)](#)

$$fx \quad W = \left(\frac{R}{R_f + R_p \cdot p} \right)$$

$$ex \quad 20kg = \left(\frac{1200N}{10.0N/Kg + 10rad/s^2 \cdot 5m} \right)$$

11) Weight on Wheels given Total Road Resistance [Open Calculator !\[\]\(758ebdf4629c903da74c2e079717ae32_img.jpg\)](#)

$$fx \quad W = \left(\frac{T}{0.02 + 0.015 \cdot p + 0.01 \cdot PG} \right)$$

$$ex \quad 20kg = \left(\frac{2.7N}{0.02 + 0.015 \cdot 5m + 0.01 \cdot 4} \right)$$

12) Weight on Wheels using Grade Resistance for Motion on Slope [Open Calculator !\[\]\(248b91fcdac4810ffd15cf33fb6aec6f_img.jpg\)](#)

$$fx \quad W = \left(\frac{G}{R_g \cdot PG} \right)$$

$$ex \quad 20.01202kg = \left(\frac{9.99N}{0.1248N/Kg \cdot 4} \right)$$



Earth Quantities Hauled

13) Compacted Volume of Soil after Excavation of Soil

$$\text{fx } V_c = (V_o \cdot S)$$

[Open Calculator !\[\]\(74d4806277d7e73349d8e8c0897931e9_img.jpg\)](#)

$$\text{ex } 11\text{m}^3 = (22\text{m}^3 \cdot 0.5)$$

14) Load Factor given Original Volume of Soil

$$\text{fx } LF = \left(\frac{V_o}{V_L} \right)$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$\text{ex } 0.88 = \left(\frac{22\text{m}^3}{25\text{m}^3} \right)$$

15) Loaded Volume of Soil given Original Volume of Soil

$$\text{fx } V_L = \left(\frac{V_o}{LF} \right)$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 25\text{m}^3 = \left(\frac{22\text{m}^3}{0.88} \right)$$


16) Loaded Volume of Soil given Percent Swell

$$\text{fx } V_L = \left(V_o \cdot \frac{100 + 0.01 \cdot s}{100} \right)$$

[Open Calculator !\[\]\(e50091943b385fe16d3277389202856f_img.jpg\)](#)

$$\text{ex } 22.011\text{m}^3 = \left(22\text{m}^3 \cdot \frac{100 + 0.01 \cdot 5.0}{100} \right)$$



17) Original Volume of Soil before Excavation 

$$fx \quad V_O = V_L \cdot LF$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)


$$ex \quad 22m^3 = 25m^3 \cdot 0.88$$

18) Original Volume of Soil before Excavation given Percent Swell 

$$fx \quad V_O = \left(\frac{100}{100 + 0.01 \cdot s} \right) \cdot V_L$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad 24.98751m^3 = \left(\frac{100}{100 + 0.01 \cdot 5.0} \right) \cdot 25m^3$$

19) Original Volume of Soil given Compacted Volume 

$$fx \quad V_O = \left(\frac{V_c}{S} \right)$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 22m^3 = \left(\frac{11m^3}{0.5} \right)$$

20) Shrinkage Factor using Compacted Volume of Soil 

$$fx \quad S = \left(\frac{V_c}{V_O} \right)$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 0.5 = \left(\frac{11m^3}{22m^3} \right)$$



21) Swell in Soil given Original Volume of Soil [Open Calculator !\[\]\(feabb98897b440bc8695a03336a6e2df_img.jpg\)](#)

$$\text{fx } s' = 10000 \cdot \left(\left(\frac{V_L}{V_O} \right) - 1 \right)$$

$$\text{ex } 1363.636 = 10000 \cdot \left(\left(\frac{25\text{m}^3}{22\text{m}^3} \right) - 1 \right)$$









Variables Used

- **f** Coefficient of Traction
- **G** Grade Resistance (*Newton*)
- **LF** Load Factor
- **p** Tire Penetration (*Meter*)
- **P** Usable Pull (*Newton*)
- **PG** Percent Grade
- **R** Rolling Resistance (*Newton*)
- **R'** Rolling Resistance (Rolling Resistance Factor 2%) (*Newton*)
- **R_f** Rolling Resistance Factor (*Newton per Kilogram*)
- **R_g** Grade Resistance Factor (*Newton per Kilogram*)
- **R_p** Tire Penetration Factor (*Radian per Square Second*)
- **s** Swell in Soil
- **s'** Swell
- **S** Shrinkage Factor
- **T** Total Road Resistance (*Newton*)
- **V_c** Compacted Volume (*Cubic Meter*)
- **V_L** Loaded Volume (*Cubic Meter*)
- **V_O** Original volume of Soil (*Cubic Meter*)
- **W** Weight on Wheels (*Kilogram*)



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Weight** in Kilogram (kg)
Weight Unit Conversion 
- **Measurement: Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Angular Acceleration** in Radian per Square Second (rad/s²)
Angular Acceleration Unit Conversion 
- **Measurement: Gravitational Field Intensity** in Newton per Kilogram (N/Kg)
Gravitational Field Intensity 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 Formulas](#)
- [Bearing Capacity of Soils: Meyerhof's Analysis Formulas](#)
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- [Atterberg Limits Formulas](#)
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- [Earth Moving Formulas](#)
- [Lateral Pressure for Cohesive and Non Cohesive Soil Formulas](#)
- [Minimum Depth of Foundation by Rankine's Analysis Formulas](#)
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