

# Important Earth Moving Formulas PDF



## Formulas Examples with Units

### List of 21 Important Earth Moving Formulas

#### 1) Coefficient of Traction Formula

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

$$0.1249\text{N/Kg} = \left( \frac{9.99\text{N}}{4 \cdot 20.0\text{kg}} \right)$$

Evaluate Formula 

#### 3) Grade Resistance for Motion on Slope Formula

Formula

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

Example with Units

$$9.984\text{N} = 0.1248\text{N/Kg} \cdot 4 \cdot 20.0\text{kg}$$

Evaluate Formula 

#### 4) Percent Grade Formula

Formula

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

Example with Units

$$4.0024 = \left( \frac{9.99\text{N}}{0.1248\text{N/Kg} \cdot 20.0\text{kg}} \right)$$

Evaluate Formula 

#### 5) Rolling Resistance to Motion of Wheeled Vehicles Formula

Formula

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

Example with Units

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

Evaluate Formula 

#### 6) Rolling Resistance when Rolling Resistance Factor is Two Percent Formula

Formula

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

Example with Units

$$1.9\text{N} = (0.02 + 0.015 \cdot 5\text{m}) \cdot 20.0\text{kg}$$

Evaluate Formula 



## 7) Total Road Resistance given Rolling Resistance and Grade Resistance Formula

Formula

$$T = \left( (0.02 + 0.015 \cdot p + 0.01 \cdot PG) \cdot W \right)$$

Evaluate Formula 

Example with Units

$$2.7N = \left( (0.02 + 0.015 \cdot 5_m + 0.01 \cdot 4) \cdot 20.0_{kg} \right)$$

## 8) Usable Pull to Overcome Loss of Power with Altitude Formula

Formula

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

Example with Units

$$18N = (0.9 \cdot 20.0_{kg})$$

Evaluate Formula 

## 9) Weight on Drivers given Usable Pull Formula

Formula

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

Example with Units

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

Evaluate Formula 

## 10) Weight on Wheels given Rolling Resistance Formula

Formula

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

Example with Units

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

Evaluate Formula 

## 11) Weight on Wheels given Total Road Resistance Formula

Formula

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

Example with Units

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

Evaluate Formula 

## 12) Weight on Wheels using Grade Resistance for Motion on Slope Formula

Formula

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

Example with Units

$$20.012_{kg} = \left( \frac{9.99N}{0.1248N/Kg \cdot 4} \right)$$

Evaluate Formula 

## 13) Earth Quantities Hauled Formulas

### 13.1) Compacted Volume of Soil after Excavation of Soil Formula

Formula

$$V_c = (V_o \cdot S)$$

Example with Units

$$11m^3 = (22m^3 \cdot 0.5)$$

Evaluate Formula 



### 13.2) Load Factor given Original Volume of Soil Formula

Formula

$$LF = \left( \frac{V_O}{V_L} \right)$$

Example with Units

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

Evaluate Formula 

### 13.3) Loaded Volume of Soil given Original Volume of Soil Formula

Formula

$$V_L = \left( \frac{V_O}{LF} \right)$$

Example with Units

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

Evaluate Formula 

### 13.4) Loaded Volume of Soil given Percent Swell Formula

Formula

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

Example with Units

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

Evaluate Formula 

### 13.5) Original Volume of Soil before Excavation Formula

Formula

$$V_O = V_L \cdot LF$$

Example with Units

$$22 \text{ m}^3 = 25 \text{ m}^3 \cdot 0.88$$

Evaluate Formula 

### 13.6) Original Volume of Soil before Excavation given Percent Swell Formula

Formula

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

Example with Units

$$24.9875 \text{ m}^3 = \left( \frac{100}{100 + 0.01 \cdot 5.0} \right) \cdot 25 \text{ m}^3$$

Evaluate Formula 

### 13.7) Original Volume of Soil given Compacted Volume Formula

Formula

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

Example with Units

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

Evaluate Formula 

### 13.8) Shrinkage Factor using Compacted Volume of Soil Formula

Formula

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

Example with Units

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

Evaluate Formula 



### 13.9) Swell in Soil given Original Volume of Soil Formula

Formula

$$s = 10000 \cdot \left( \left( \frac{V_L}{V_0} \right) - 1 \right)$$

Example with Units

$$1363.6364 = 10000 \cdot \left( \left( \frac{25 \text{ m}^3}{22 \text{ m}^3} \right) - 1 \right)$$







Evaluate Formula 



## Variables used in list of Earth Moving Formulas above

- **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<sub>f</sub>** Rolling Resistance Factor (*Newton per Kilogram*)
- **R<sub>g</sub>** Grade Resistance Factor (*Newton per Kilogram*)
- **R<sub>p</sub>** Tire Penetration Factor (*Radian per Square Second*)
- **s** Swell in Soil
- **s'** Swell
- **S** Shrinkage Factor
- **T** Total Road Resistance (*Newton*)
- **V<sub>c</sub>** Compacted Volume (*Cubic Meter*)
- **V<sub>L</sub>** Loaded Volume (*Cubic Meter*)
- **V<sub>O</sub>** Original volume of Soil (*Cubic Meter*)
- **W** Weight on Wheels (*Kilogram*)

## Constants, Functions, Measurements used in list of Earth Moving Formulas above

- **Measurement: Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement: Weight** in Kilogram (kg)  
*Weight Unit Conversion* 
- **Measurement: Volume** in Cubic Meter (m<sup>3</sup>)  
*Volume Unit Conversion* 
- **Measurement: Force** in Newton (N)  
*Force Unit Conversion* 
- **Measurement: Angular Acceleration** in Radian per Square Second (rad/s<sup>2</sup>)  
*Angular Acceleration Unit Conversion* 
- **Measurement: Gravitational Field Intensity** in Newton per Kilogram (N/Kg)  
*Gravitational Field Intensity Unit Conversion* 



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