calculatoratoz.com

unitsconverters.com

Tire Rolling and Slipping Formulas

Calculators!　　**Examples!**　　**Conversions!**

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 17 Tire Rolling and Slipping Formulas

Tire Rolling and Slipping 🔗

1) Gradient Resistance of Vehicle 🔗

fx $F_g = M_v \cdot g \cdot \sin(\alpha)$

Open Calculator 🔗

ex $44130.64\text{N} = 9000\text{N} \cdot 9.8\text{m/s}^2 \cdot \sin(0.524\text{rad})$

2) Lateral Slip Velocity 🔗

fx $v_{\text{lateral}} = V_{\text{Roadway}} \cdot \sin(\alpha_{\text{slip}})$

Open Calculator 🔗

ex $2.606709\text{m/s} = 30\text{m/s} \cdot \sin(0.0870\text{rad})$

3) Longitudinal Slip Velocity 🔗

fx $v_{\text{longitudinal}} = V_{\text{Roadway}} \cdot \cos(\alpha_{\text{slip}}) - V_B$

Open Calculator 🔗

ex $4.886537\text{m/s} = 30\text{m/s} \cdot \cos(0.0870\text{rad}) - 25\text{m/s}$

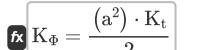### 4) Longitudinal Slip Velocity for Zero Slip Angle 🔗

fx $s_{\text{ltd}} = \Omega - \Omega_0$

Open Calculator 🔗

ex $9\text{rad/s} = 58.5\text{rad/s} - 49.5\text{rad/s}$
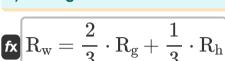
5) Roll rate or Roll stiffness ⟳

fx $K_\Phi = \dfrac{(a^2) \cdot K_t}{2}$

Open Calculator ⟳

ex $72\text{Nm/rad} = \dfrac{\left((1.2\text{m})^2\right) \cdot 100\text{N/m}}{2}$

6) Rolling Radius of Tire ⟳

fx $R_w = \dfrac{2}{3} \cdot R_g + \dfrac{1}{3} \cdot R_h$

Open Calculator ⟳

ex $0.416667\text{m} = \dfrac{2}{3} \cdot 0.45\text{m} + \dfrac{1}{3} \cdot 0.35\text{m}$

7) Rolling Resistance at Wheels ⟳

fx $F_r = P \cdot f_r$

Open Calculator ⟳

ex $14.5\text{N} = 1000\text{N} \cdot 0.0145$

8) Rolling Resistance Coefficient ⟳

fx $f_r = \dfrac{a_v}{r}$

Open Calculator ⟳

ex $0.014 = \dfrac{0.007\text{m}}{0.5\text{m}}$

9) Slip of Tire 🡕

Open Calculator 🡕

$$fx \quad \lambda = \left(\frac{v - \omega \cdot r_d}{v} \right) \cdot 100$$

$$ex \quad 86.8 = \left(\frac{50\text{m/s} - 12\text{rad/s} \cdot 0.55\text{m}}{50\text{m/s}} \right) \cdot 100$$

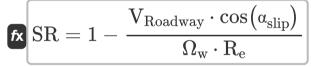## 10) Slip Ratio Defined According to Calspan TIRF 🡕

Open Calculator 🡕

$$fx \quad SR = \Omega_w \cdot \frac{R_l}{V_{\text{Roadway}} \cdot \cos\left(\alpha_{\text{slip}}\right)} - 1$$

$$ex \quad 0.177788 = 44\text{rad/s} \cdot \frac{0.8\text{m}}{30\text{m/s} \cdot \cos(0.0870\text{rad})} - 1$$

11) Slip Ratio Defined According to Goodyear 🡕

Open Calculator 🡕

$$fx \quad SR = 1 - \frac{V_{\text{Roadway}} \cdot \cos\left(\alpha_{\text{slip}}\right)}{\Omega_w \cdot R_e}$$

$$ex \quad 0.171659 = 1 - \frac{30\text{m/s} \cdot \cos(0.0870\text{rad})}{44\text{rad/s} \cdot 0.82\text{m}}$$

12) Slip Ratio Defined According to SAE J670 ⬀

fx $$\mathrm{SR} = \Omega_\mathrm{w} \cdot \frac{R_e}{V_\mathrm{Roadway} \cdot \cos\left(\alpha_\mathrm{slip}\right)} - 1$$

Open Calculator ⬀

ex $$0.207233 = 44\mathrm{rad/s} \cdot \frac{0.82\mathrm{m}}{30\mathrm{m/s} \cdot \cos(0.0870\mathrm{rad})} - 1$$

13) Slip Ratio given Longitudinal Slip Velocity and Velocity of Free Rolling Wheel ⬀

fx $$\mathrm{SR} = \frac{s_\mathrm{ltd}}{\Omega_0}$$

Open Calculator ⬀

ex $$0.181818 = \frac{9\mathrm{rad/s}}{49.5\mathrm{rad/s}}$$

14) Slip Ratio given Velocity of Driven Wheel and Free Rolling Wheel ⬀

fx $$\mathrm{SR} = \frac{\Omega}{\Omega_0} - 1$$

Open Calculator ⬀

ex $$0.181818 = \frac{58.5\mathrm{rad/s}}{49.5\mathrm{rad/s}} - 1$$

15) Traction Force Required to Climb Curb ⬀

fx $$R = G \cdot \cos(\theta)$$

Open Calculator ⬀

ex $$3859.411\mathrm{N} = 5000\mathrm{N} \cdot \cos(0.689\mathrm{rad})$$

16) Tractive Effort in Multi-Geared Vehicle at any given Gear ⤴
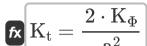
Open Calculator ⤴

$$fx \quad F_t = \frac{T_p \cdot i_g \cdot i_o \cdot \eta_t}{r_d}$$

$$ex \quad 2078.018N = \frac{270N*m \cdot 2.55 \cdot 2 \cdot 0.83}{0.55m}$$

17) Wheel rate given Roll rate ⤴

Open Calculator ⤴

$$fx \quad K_t = \frac{2 \cdot K_\Phi}{a^2}$$

$$ex \quad 100N/m = \frac{2 \cdot 72Nm/rad}{(1.2m)^2}$$

Variables Used

- **a** Track Width of Vehicle *(Meter)*
- **a_v** Distance of Opposing Torque from Vertical *(Meter)*
- **F_g** Gradient Resistance *(Newton)*
- **f_r** Rolling Resistance Coefficient
- **F_r** Rolling Resistance at Wheel *(Newton)*
- **F_t** Tractive Effort in Multi-geared Vehicle *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **G** Weight on Single Wheel *(Newton)*
- **i_g** Gear Ratio of Transmission
- **i_o** Gear Ratio of Final Drive
- **K_t** Wheel Rate of Vehicle *(Newton per Meter)*
- **K_Φ** Roll Rate/ Roll Stiffness *(Newton Meter per Radian)*
- **M_v** Vehicle Weight in Newtons *(Newton)*
- **P** Normal Load on Wheels *(Newton)*
- **r** Effective Wheel Radius *(Meter)*
- **R** Traction Force required to Climb Curb *(Newton)*
- **r_d** Effective Radius of Wheel *(Meter)*
- **R_e** Effective Rolling Radius for Free Rolling *(Meter)*
- **R_g** Geometrical Radius of Tire *(Meter)*
- **R_h** Loaded Height of Tire *(Meter)*
- **R_l** Height of Axle above Road Surface (Loaded Radius) *(Meter)*

- R_w Rolling Radius of Tire *(Meter)*

- s_{ltd} Longitudinal Slip Angular Velocity *(Radian per Second)*

- SR Slip Ratio

- T_p Torque Output of Vehicle *(Newton Meter)*

- v Forward Velocity of Vehicle *(Meter per Second)*

- V_B Circumferential Velocity of Tire under Traction *(Meter per Second)*

- $v_{lateral}$ Lateral Slip Velocity *(Meter per Second)*

- $v_{longitudinal}$ Longitudinal Slip Velocity *(Meter per Second)*

- $V_{Roadway}$ Axle Speed over Roadway *(Meter per Second)*

- α Angle of Inclination of Ground from Horizontal *(Radian)*

- α_{slip} Slip Angle *(Radian)*

- η_t Transmission Efficiency of Vehicle

- θ Angle between Traction Force and Horizontal Axis *(Radian)*

- λ Slip of Tire

- ω Vehicle Wheel Angular Velocity *(Radian per Second)*

- Ω Angular Velocity of Driven or Braked Wheel *(Radian per Second)*

- Ω_0 Angular Velocity of Free Rolling Wheel *(Radian per Second)*

- Ω_w Wheel Angular Velocity *(Radian per Second)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.

- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.

- Measurement: **Length** in Meter (m)
  Length Unit Conversion

- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion

- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion

- Measurement: **Force** in Newton (N)
  Force Unit Conversion

- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion

- Measurement: **Surface Tension** in Newton per Meter (N/m)
  Surface Tension Unit Conversion

- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion

- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

- Measurement: **Torsion Constant** in Newton Meter per Radian (Nm/rad)
  Torsion Constant Unit Conversion

Check other formula lists

- **Angular Velocity Formulas** ↗
- **Tire Rolling and Slipping Formulas** ↗

- **Wheel Parameters Formulas** ↗

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

9/20/2024 | 10:27:17 AM UTC

Please leave your feedback here...