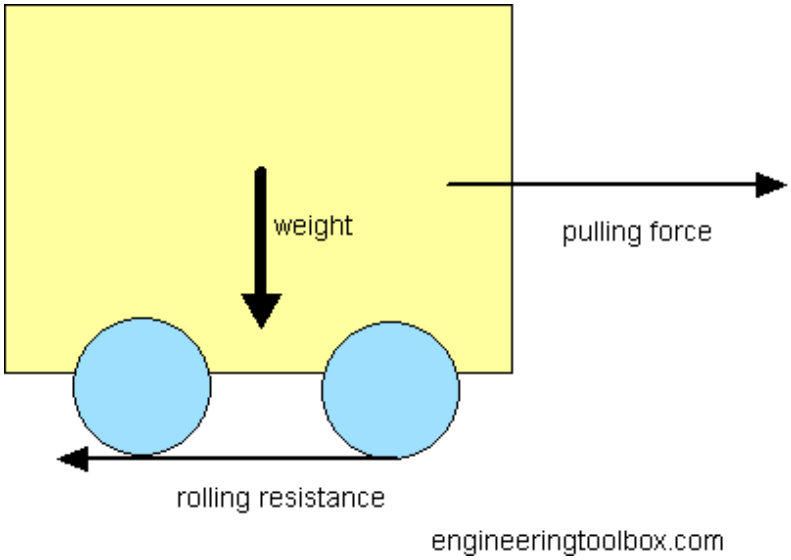
Rolling Resistance

Rolling friction and rolling resistance

The force that resists the motion when a body rolls on a surface is called the **rolling resistance** or the **rolling friction**.



The *rolling resistance* can be expressed as

$$F_r = c\ W \qquad (1)$$

where

F_r = *rolling resistance or rolling friction (N, lb$_f$)*

c = *rolling resistance coefficient - dimensionless (coefficient of rolling friction - CRF)*

$W = m\ g$ = *normal force - weight - of the body (N, lb$_f$)*

m = *mass of body (kg, lb)*

g = *acceleration of gravity (9.81 m/s^2, 32.174 ft/s^2)*

The rolling resistance can alternatively be expressed as

$$F_r = c_l\ W / r \qquad (2)$$

where

c_l = *rolling resistance coefficient with dimension length (coefficient of rolling friction) (mm, in)*

r = *radius of wheel (mm, in)*

Rolling Friction Coefficients

Some typical rolling coefficients:

Rolling Resistance Coefficient		
c	***c_l (mm)***	
0.001 - 0.002	0.5	railroad steel wheels on steel rails
0.001		bicycle tire on wooden track
0.002 - 0.005		low resistance tubeless tires
0.002		bicycle tire on concrete
0.004		bicycle tire on asphalt road
0.005		dirty tram rails
0.006 - 0.01		truck tire on asphalt
0.008		bicycle tire on rough paved road
0.01 - 0.015		ordinary car tires on concrete, new asphalt, cobbles small new
0.02		car tires on tar or asphalt

0.02		car tires on gravel - rolled new
0.03		car tires on cobbles - large worn
0.04 - 0.08		car tire on solid sand, gravel loose worn, soil medium hard
0.2 - 0.4		car tire on loose sand

Rolling Coefficients Cars

The rolling coefficients for pneumatic tyres on dry roads can be estimated as

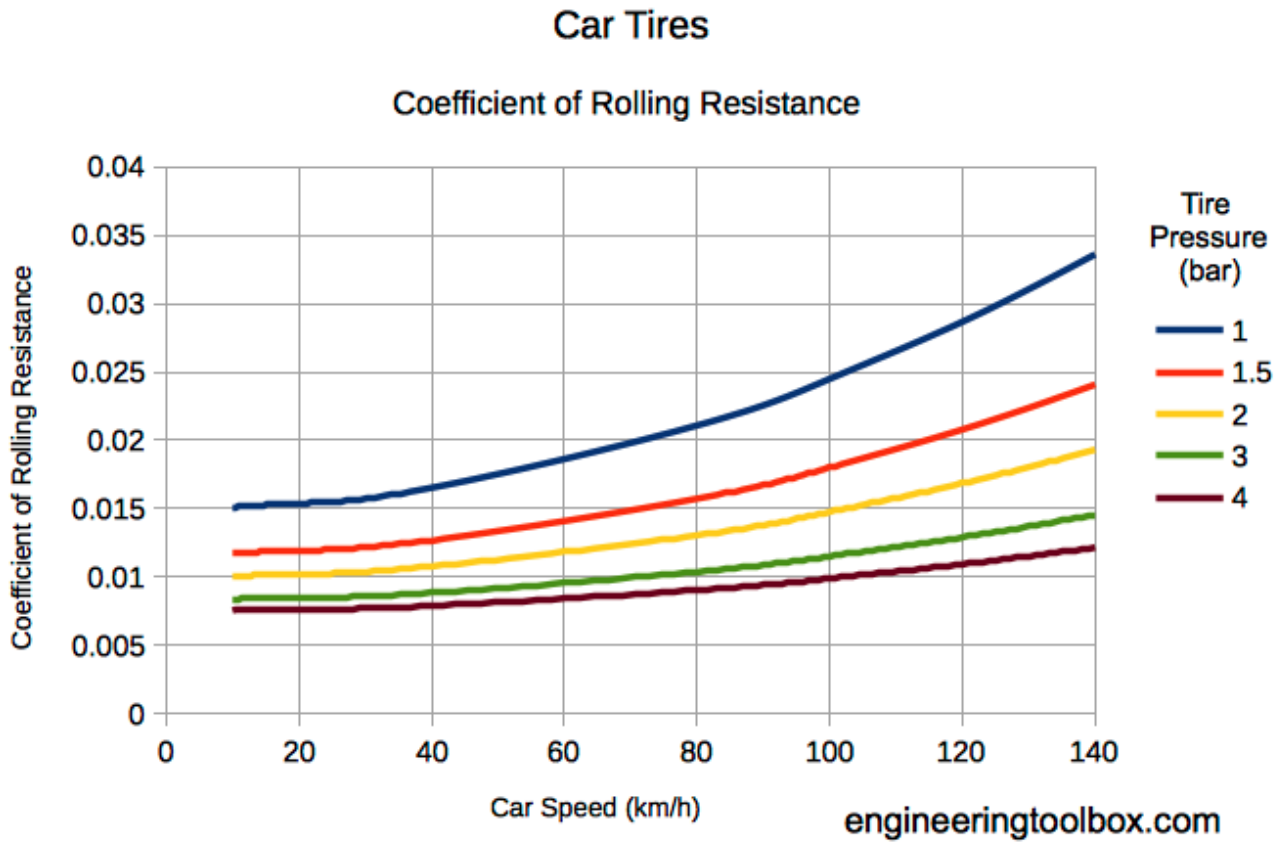
$c = 0.005 + (1 / p) (0.01 + 0.0095 (v / 100)^2)$

where

c = rolling coefficient

p = tyre pressure (bar)

v = velocity (km/h)



- *1 bar = 10^5 Pa = 14.5 psi*
- *1 km/h = 0.6214 mph*

Example - The Rolling Resistance of a Car on Asphalt

The rolling resistance of a car with weight *1500 kg* on asphalt with rolling friction coefficient *0.03* can be estimated as

$F_r = 0.03 (1500 kg) (9.81 m/s^2)$

$= \underline{441} N$

- compare a car rolling resistance with air resistance (drag)

Related Topics

- **Dynamics** - Motion - velocity and acceleration, forces and torques
- **Mechanics** - Forces, acceleration, displacement, vectors, motion, momentum, energy of objects and more

Related Documents

- **Car - Traction Force** - Adhesion and tractive effort
- **Drag Coefficient** - The drag coefficient express the drag of an object in a moving fluid
- **Car - Power and Torque** - Power, torque, efficiency and wheel force

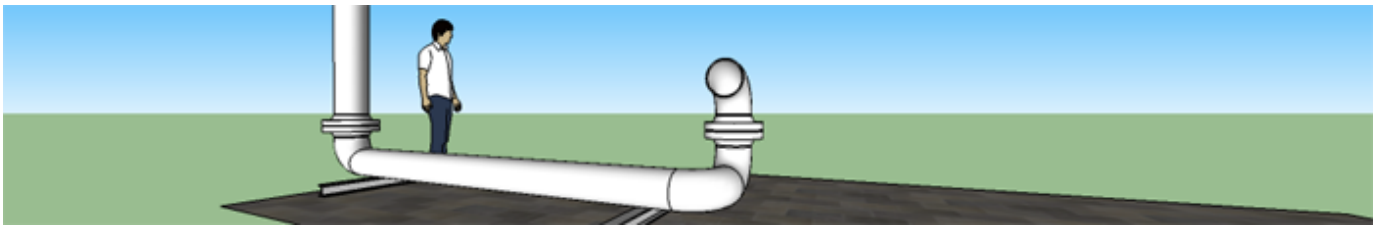
Tag Search

- en: rolling resistance friction body surface weight
- es: fricción resistencia a la rodadura peso de superficie corporal
- de: Rollwiderstand Reibkörper Flächengewicht

Search the Engineering ToolBox

Search - *"Search is the most efficient way to navigate the Engineering ToolBox!"*

Engineering ToolBox - SketchUp Extension - Online 3D modeling!



Add standard and customized parametric components - like flange beams, lumbers, piping, stairs and more - to your SketchUp model with the Engineering ToolBox - SketchUp Extension/Plugin - enabled for use with the amazing, fun and free SketchUp Make and SketchUp Pro. Add the Engineering ToolBox extension to your SketchUp from the Sketchup Extension Warehouse!

Translate the ToolBox

Arabic - Chinese (Simplified) - Chinese (Traditional) - Dutch - French - German - Italian - Japanese - Korean - Portuguese - Russian - Spanish - - Select Your own language . .

About the ToolBox

We appreciate any comments and tips on how to make The Engineering ToolBox a better information source. Please contact us by email

- editor.engineeringtoolbox@gmail.com

if You find any faults, inaccuracies, or otherwise unacceptable information.

3D Schematics Apps

- Home
- Acoustics
- Air Psychrometrics
- Basics
- Combustion
- Drawing Tools
- Dynamics
- Economics
- Electrical
- Environment
- Fluid Mechanics
- Gases and Compressed Air
- HVAC Systems
- Hydraulics and Pneumatics
- Insulation
- Material Properties
- Mathematics
- Mechanics
- Miscellaneous
- Physiology
- Piping Systems
- Process Control
- Pumps
- Standard Organizations
- Statics
- Steam and Condensate
- Thermodynamics
- Water Systems

Unit Converter

Temperature

0.0

- ◉ ^oC
- ○ ^oF

Convert!

Length

1.0

- ◉ *m*
- ○ *km*
- ○ *in*
- ○ *ft*
- ○ *yards*
- ○ *miles*
- ○ *nautical miles*

Convert!

Volume

1.0

- ◉ m^3
- ○ *liters*
- ○ in^3
- ○ ft^3
- ○ *us gal*

Convert!

Weight

1.0

- ◉ kg_f
- ○ *N*
- ○ lb_f

Convert!

Velocity

1.0

- ◉ *m/s*
- ○ *km/h*
- ○ *ft/min*
- ○ *ft/s*
- ○ *mph*
- ○ *knots*

Convert!

Pressure

1.0

- ◉ *Pa* (N/m^2)
- ○ *bar*
- ○ *mm* H_2O

- kg/cm^2
- *psi*
- *inches* H_2O

Convert!

Flow

1.0

- m^3/s
- m^3/h
- *US gpm*
- *cfm*

Convert!

6 23

Share this Page!

print view

Shortcut to Home Screen?

The Engineering ToolBox

bimSystems
- organizing design and development of technical systems!

meetickets
- summarize meetings and keep track of tasks to be done - with tickets!

the Travlet
- tracking and sharing expenses between participants!