



# Forces on Steering System and Axles Formulas

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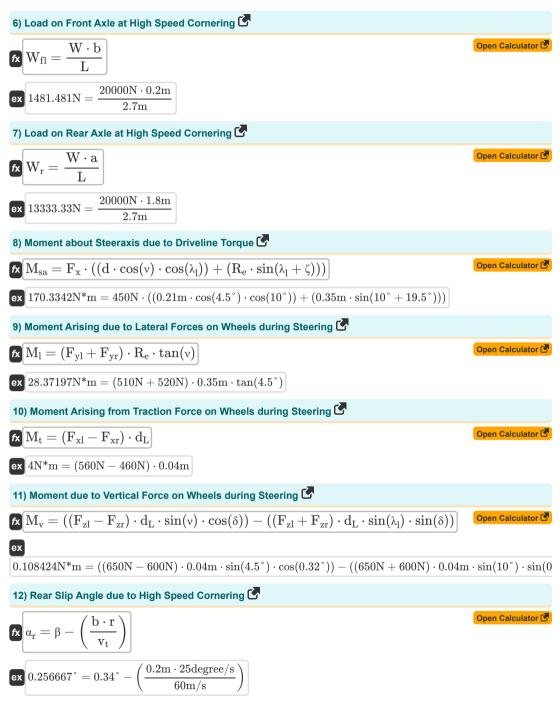


## List of 14 Forces on Steering System and Axles Formulas

Forces on Steering System and Axles C  
1) Centripetal Acceleration during Cornering C  
(a. 
$$= \frac{v_t \cdot v_t}{R}$$
 (gen Calculater C  
(a.  $= \frac{v_t \cdot v_t}{R}$  (gen Calculater C  
(a.  $= \frac{v_t \cdot v_t}{R}$  (gen Calculater C  
(b.  $v_u = \sqrt{\frac{57.3 \cdot L \cdot g}{K}}$  (gen Calculater C  
(c.  $v_u = \sqrt{\frac{57.3 \cdot L \cdot g}{K}}$  (gen Calculater C  
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(c.  $v_o = -\sqrt{\frac{57.3 \cdot 2.7m \cdot 9.8m/s^2}{0.104^*}}$   
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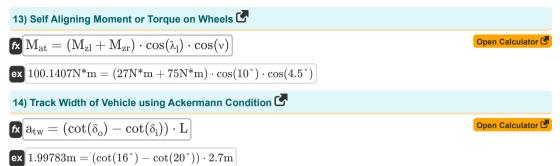








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### Variables Used

- a Distance of c.g from Front Axle (Meter)
- ac Centripetal Acceleration during Cornering (Meter per Square Second)
- atw Track Width of Vehicle (Meter)
- A<sub>α</sub> Horizontal Lateral Acceleration (Meter per Square Second)
- b Distance of c.g from Rear Axle (Meter)
- d Distance between Steeraxis and Tire center (Meter)
- dL Lateral Offset at Ground (Meter)
- F<sub>x</sub> Tractive Force (Newton)
- F<sub>xl</sub> Tractive Force on Left Wheels (Newton)
- Fxr Tractive Force on Right Wheels (Newton)
- F<sub>vl</sub> Lateral Force on Left Wheels (Newton)
- Fvr Lateral Force on Right Wheels (Newton)
- Fzl Vertical Load on Left Wheels (Newton)
- Fzr Vertical Load on Right Wheels (Newton)
- g Acceleration due to Gravity (Meter per Square Second)
- K Understeer Gradient (Degree)
- L Wheelbase of Vehicle (Meter)
- Mat Self Aligning Moment (Newton Meter)
- MI Moment on Wheels Arising from Lateral Force (Newton Meter)
- Msa Moment about Steeraxis due to Driveline Torque (Newton Meter)
- Mt Moment Arising from Traction Force (Newton Meter)
- M<sub>v</sub> Moment arising from Vertical Forces on Wheels (Newton Meter)
- M<sub>zl</sub> Aligning Moment Acting on Left Tires (Newton Meter)
- Mzr Aligning Moment on Right Tires (Newton Meter)
- r Yaw Velocity (Degree per Second)
- R Radius of Turn (Meter)
- Re Radius of Tire (Meter)
- Vo Critical Speed for Oversteer Vehicles (Meter per Second)
- Vt Total Velocity (Meter per Second)
- Vu Characteristic Speed for Understeer Vehicles (Meter per Second)
- W Total Load of Vehicle (Newton)
- W<sub>fl</sub> Load on Front Axle at High Speed Cornering (Newton)
- Wr Load on Rear Axle at High Speed Cornering (Newton)



- α<sub>f</sub> Slip Angle of Front Wheel (Degree)
- $\alpha_r$  Slip Angle of Rear Wheel (Degree)
- **β** Vehicle Body Slip Angle (Degree)
- δ Steer Angle (Degree)
- +  $\delta_i$  Steering Angle Inner Wheel (Degree)
- δ<sub>o</sub> Steering Angle Outer Wheel (Degree)
- ζ Angle made by Front Axle with Horizontal (Degree)
- λ<sub>I</sub> Lateral Inclination Angle (Degree)
- V Caster Angle (Degree)





# **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: cot, cot(Angle) Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a right 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.

• Function: sqrt, sqrt(Number)

A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.

- Function: tan, tan(Angle) The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- 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/s<sup>2</sup>) Acceleration Unit Conversion
- Measurement: Force in Newton (N) Force Unit Conversion
- Measurement: Angle in Degree (°) Angle Unit Conversion
- Measurement: Angular Velocity in Degree per Second (degree/s) Angular Velocity Unit Conversion
- Measurement: Torque in Newton Meter (N\*m) Torque Unit Conversion







- Forces on Steering System and Axles Formulas 
   Steering System Formulas
- Movement Ratio Formulas

Steering System Formulas C
 Turning Dynamics Formulas C

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