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## Wheel Centre Rates for Independent Suspension Formulas

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## List of 12 Wheel Centre Rates for Independent Suspension Formulas

Wheel Centre Rates for Independent Suspension 1) Area of Brake Lining 

$$\text{fx } A_l = \frac{w \cdot r_b \cdot \alpha \cdot \pi}{180}$$

Open Calculator 


$$\text{ex } 0.002778\text{m}^2 = \frac{0.19\text{m} \cdot 0.4\text{m} \cdot 120^\circ \cdot \pi}{180}$$

2) Assumed Initial Roll Rate given Required Anti-Roll Bar Rate 

$$\text{fx } K_\Phi = \left( K_a + K_w \cdot \frac{a^2}{2} \right) \cdot \frac{K_t \cdot \frac{a^2}{2}}{K_t \cdot \frac{a^2}{2} + K_a + K_w \cdot \frac{a^2}{2}}$$

Open Calculator 

$$\text{ex } 76693.26\text{Nm/rad} = \left( 89351\text{Nm/rad} + 35239\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} \right) \cdot \frac{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2}}{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} + 89351\text{Nm/rad} + 352}$$

3) Brake Fluid Pressure 

$$\text{fx } P = \frac{F_{cl}}{A}$$

Open Calculator 

$$\text{ex } 16666.67\text{N/m}^2 = \frac{500\text{N}}{0.03\text{m}^2}$$

4) Braking Efficiency 

$$\text{fx } \eta = \left( \frac{F}{W} \right) \cdot 100$$

Open Calculator 

$$\text{ex } 60 = \left( \frac{7800\text{N}}{13000\text{N}} \right) \cdot 100$$

5) Power Absorbed by Disc Brake 

$$\text{fx } P_d = 2 \cdot p \cdot A_p \cdot \mu_p \cdot R_m \cdot n \cdot 2 \cdot n \cdot \frac{N}{60}$$

Open Calculator 

$$\text{ex } 0.006105\text{W} = 2 \cdot 8\text{N/m}^2 \cdot 0.01\text{m}^2 \cdot 0.34 \cdot 0.25\text{m} \cdot 2.01 \cdot 2 \cdot 2.01 \cdot \frac{200/\text{min}}{60}$$




6) Required Anti-Roll Bar Rate 


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

Open Calculator 


$$ex \quad 89350.41\text{Nm/rad} = 76693\text{Nm/rad} \cdot \frac{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2}}{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} - 76693\text{Nm/rad}} - 35239\text{N/m} \cdot \frac{(1.2\text{m})^2}{2}$$

7) Ride Rate given Wheel Centre Rate 

$$fx \quad K_r = \frac{K_t \cdot K_w}{K_t + K_w}$$

Open Calculator 

$$ex \quad 31756.4\text{N/m} = \frac{321330\text{N/m} \cdot 35239\text{N/m}}{321330\text{N/m} + 35239\text{N/m}}$$

8) Tyre Rate given Required Anti-Roll Bar Rate 

$$fx \quad K_t = \left( \frac{\left( K_a + K_w \cdot \frac{a^2}{2} \right) \cdot K_\Phi}{\left( K_a + K_w \cdot \frac{a^2}{2} \right) - K_\Phi} \right) \cdot \frac{2}{a^2}$$

Open Calculator 

$$ex \quad 321326.7\text{N/m} = \left( \frac{\left( 89351\text{Nm/rad} + 35239\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} \right) \cdot 76693\text{Nm/rad}}{\left( 89351\text{Nm/rad} + 35239\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} \right) - 76693\text{Nm/rad}} \right) \cdot \frac{2}{(1.2\text{m})^2}$$

9) Tyre Vertical Rate given Wheel Centre Rate 

$$fx \quad K_t = \frac{K_w \cdot K_r}{K_w - K_r}$$

Open Calculator 

$$ex \quad 321330\text{N/m} = \frac{35239\text{N/m} \cdot 31756.4\text{N/m}}{35239\text{N/m} - 31756.4\text{N/m}}$$

10) Wheel Centre Rate 

$$fx \quad K_w = \frac{K_r \cdot K_t}{K_t - K_r}$$

Open Calculator 


$$ex \quad 35239\text{N/m} = \frac{31756.4\text{N/m} \cdot 321330\text{N/m}}{321330\text{N/m} - 31756.4\text{N/m}}$$



11) Wheel Centre Rate given Required Anti-Roll Bar Rate Open Calculator 

$$\text{fx } K_w = \frac{K_\Phi \cdot \frac{K_t \cdot \frac{a^2}{2}}{K_t \cdot \frac{a^2}{2} - K_\Phi} - K_a}{\frac{a^2}{2}}$$

$$\text{ex } 35238.18\text{N/m} = \frac{76693\text{Nm/rad} \cdot \frac{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2}}{321330\text{N/m} \cdot \frac{(1.2\text{m})^2}{2} - 76693\text{Nm/rad}} - 89351\text{Nm/rad}}{\frac{(1.2\text{m})^2}{2}}$$

12) Work Done in Braking Open Calculator 

$$\text{fx } W_b = F \cdot S$$

$$\text{ex } 156000\text{N} \cdot \text{m} = 7800\text{N} \cdot 20\text{m}$$













## Variables Used

- **a** Track Width of Vehicle (Meter)
- **A** Area of Master Cylinder Piston (Square Meter)
- **A<sub>l</sub>** Area of Brake Lining (Square Meter)
- **A<sub>p</sub>** Area of One Piston Per Caliper (Square Meter)
- **F** Braking Force on Brake Drum (Newton)
- **F<sub>cl</sub>** Force Produced By Master Cylinder (Newton)
- **K<sub>a</sub>** Required Anti Roll Bar Rate (Newton Meter per Radian)
- **K<sub>r</sub>** Ride Rate (Newton per Meter)
- **K<sub>t</sub>** Tyre Vertical Rate (Newton per Meter)
- **K<sub>w</sub>** Wheel Centre Rate (Newton per Meter)
- **K<sub>φ</sub>** Assumed Initial Roll Rate (Newton Meter per Radian)
- **n** Number of Caliper Units
- **N** Revolution of Discs Per Minute (1 Per Minute)
- **p** Line Pressure (Newton per Square Meter)
- **P** Brake Fluid Pressure (Newton per Square Meter)
- **P<sub>d</sub>** Power Absorbed By Disc Brake (Watt)
- **r<sub>b</sub>** Brake Drum Radius (Meter)
- **R<sub>m</sub>** Mean Radius of Caliper Unit to Disc Axis (Meter)
- **S** Stopping Distance During Braking in Meters (Meter)
- **w** Brake Lining Width (Meter)
- **W** Weight of Vehicle (Newton)
- **W<sub>b</sub>** Work Done in Braking (Newton Meter)
- **α** Angle Between Linings of Brake Shoes (Degree)
- **η** Braking Efficiency
- **μ<sub>p</sub>** Coefficient of Friction of Pad Material



## Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288  
*Archimedes' constant*
- **Measurement:** **Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement:** **Area** in Square Meter (m<sup>2</sup>)  
*Area Unit Conversion* 
- **Measurement:** **Pressure** in Newton per Square Meter (N/m<sup>2</sup>)  
*Pressure Unit Conversion* 
- **Measurement:** **Power** in Watt (W)  
*Power Unit Conversion* 
- **Measurement:** **Force** in Newton (N)  
*Force Unit Conversion* 
- **Measurement:** **Angle** in Degree (°)  
*Angle Unit Conversion* 
- **Measurement:** **Surface Tension** in Newton per Meter (N/m)  
*Surface Tension 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* 
- **Measurement:** **Time Inverse** in 1 Per Minute (1/min)  
*Time Inverse Unit Conversion* 



## Check other formula lists

- [Rates for Axle Suspension in Race Car Formulas](#) 
- [Ride Rate and Ride Frequency for Race Cars Formulas](#) 
- [Wheel Centre Rates for Independent Suspension Formulas](#) 

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