Important Front Lateral Load Transfer for Race Cars Formulas PDF

Formulas
Examples
with Units

List of 9
Important Front Lateral Load Transfer for Race Cars Formulas

1) COG Position Distance from Rear Wheels given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$x = \frac{W_f \cdot \frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}}}{\frac{Z_{rf}}{b}}$$

Example with Units

$$2.268\,\text{m} = \frac{226\,\text{kg} \cdot \frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}}}{\frac{245\,\text{m}}{2.7\,\text{m}}}$$

2) Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$W_f = \frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}} + \frac{x}{b} \cdot Z_{rf}$$

Example with Units

$$228.9019\,\text{kg} = \frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}} + \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}$$

3) Front Roll Centre Height given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$Z_{rf} = \left(W_f \cdot \frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}} \right) \cdot \frac{b}{x}$$

Example with Units

$$241.5934\,\text{m} = \left(226\,\text{kg} \cdot \frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}} \right) \cdot \frac{2.7\,\text{m}}{2.3\,\text{m}}$$

4) Front Roll Rate given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$K_{\Phi f} = \frac{K_{\Phi r}}{\left(\frac{\frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot H}{\left(W_f - \frac{x}{b} \cdot Z_{rf}\right)}\right) - 1}$$

Example with Units

$$67659.5693\,\text{Nm/rad} = \frac{67800\,\text{Nm/rad}}{\left(\frac{\frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m}}{\left(226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}\right)}\right) - 1}$$

5) Front Track Width given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$t_F = \frac{\frac{A_y}{[g]} \cdot m \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}}}{W_f - \frac{x}{b} \cdot Z_{rf}}$$

Example with Units

$$1.7517\,\text{m} = \frac{\frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot 155\,\text{kg} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}}}{226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}}$$

6) Height of Centre of Gravity from Roll Axis given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$H = \frac{W_f - \frac{x}{b} \cdot Z_{rf}}{\frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}}}$$

Example with Units

$$0.2869\,\text{m} = \frac{226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}}{\frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}}}$$

7) Lateral Acceleration given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$A_y = \frac{W_f - \frac{x}{b} \cdot Z_{rf}}{\frac{1}{[g]} \cdot \frac{m}{t_F} \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}}}$$

Example with Units

$$8.4006\,\text{m/s}^2 = \frac{226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}}{\frac{1}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}}}$$

8) Rear Roll Rate given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$K_{\Phi r} = K_{\Phi f} \cdot \left(\frac{\frac{A_y}{[g]} \cdot \frac{m}{t_F} \cdot H}{W_f - \frac{x}{b} \cdot Z_{rf}} - 1 \right)$$

Example with Units

$$95096.9695\,\text{Nm/rad} = 94900\,\text{Nm/rad} \cdot \left(\frac{\frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{155\,\text{kg}}{1.5\,\text{m}} \cdot 0.335\,\text{m}}{226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}} - 1 \right)$$

9) Total Vehicle Mass given Front Lateral Load Transfer Formula

Evaluate Formula

Formula

$$m = \frac{W_f - \frac{x}{b} \cdot Z_{rf}}{\frac{A_y}{[g]} \cdot \frac{1}{t_F} \cdot H \cdot \frac{K_{\Phi f}}{K_{\Phi f} + K_{\Phi r}}}$$

Example with Units

$$132.7311\,\text{kg} = \frac{226\,\text{kg} - \frac{2.3\,\text{m}}{2.7\,\text{m}} \cdot 245\,\text{m}}{\frac{9.81\,\text{m/s}^2}{9.8066\,\text{m/s}^2} \cdot \frac{1}{1.5\,\text{m}} \cdot 0.335\,\text{m} \cdot \frac{94900\,\text{Nm/rad}}{94900\,\text{Nm/rad} + 67800\,\text{Nm/rad}}}$$

Variables used in list of Front Lateral Load Transfer for Race Cars Formulas above

- A_y Lateral Acceleration *(Meter per Square Second)*
- **b** Wheelbase of Vehicle *(Meter)*
- **H** Centre of Gravity Distance to Roll Axis *(Meter)*
- $K_{\Phi f}$ Front Roll Rate *(Newton Meter per Radian)*
- $K_{\Phi r}$ Rear Roll Rate *(Newton Meter per Radian)*
- **m** Mass of Vehicle *(Kilogram)*
- t_F Front Track Width *(Meter)*
- W_f Front Lateral Load Transfer *(Kilogram)*
- **x** Horizontal Distance of C.G. from Rear Axle *(Meter)*
- Z_{rf} Front Roll Centre Height *(Meter)*

Constants, Functions, Measurements used in list of Front Lateral Load Transfer for Race Cars Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Torsion Constant** in Newton Meter per Radian (Nm/rad)
  Torsion Constant Unit Conversion

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