

Formulas for Vehicle Braking Dynamics

1. Torque created by the caliper on the rotor (at the wheel) = T_w

$$T_w = P_s \times A_p \times \mu \times R_E$$

P_s = Pressure of system, A_p = Total Area of pistons in caliper,
 μ = Friction Coefficient, R_E = Effective Radius of clamping force.

2. Weight transfer during braking = ΔW_R

$$\Delta W_R = M \times \gamma \times ht_{cg} / L_{WB}$$

M = Mass of vehicle, γ = rate of velocity change (- since decelerating),

$M \gamma$ is termed Force of Inertia, ht_{cg} = height of Center of Gravity,

L_{WB} = Length of wheelbase.

The amount of weight that is available to transfer is limited by the static weight on the rear wheels, in this example it would be called $W_{R \text{ static}}$. $W_{R \text{ static}}$ establishes a limit for weight that can transfer based on this one variable. Aerodynamic loading and cornering while braking will affect this limit dynamically, thereby changing the maximum rate of deceleration possible.