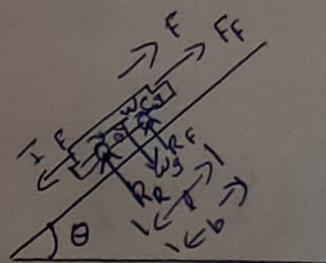


ASSIGNMENT T-2



w = weight of car

C_G = centre of gravity

b = wheel base

F = max. fwd acceleration

F_f = max. tractive effort

$R \& f$ = Rear & Front wheel

$R_r \& R_f$ = total normal reaction at front & rear wheel.

h = height from C_G to road

I_f = Inertia Force = $m \cdot F - w \sin \theta$
 $m \cdot F - w \sin \theta$

$$= \frac{w}{g} \cdot F - w \sin \theta \quad \text{--- (1)}$$

$$\sum V = 0 \quad \text{--- (2)}$$

$$\sum H = 0 \quad \text{--- (3)}$$

using (2)

$$w \cos \theta = R_f + R_r \quad \text{--- (4)}$$

using ③

$$F_f = \frac{\omega}{g} \cdot F + \omega \sin \theta$$

$$\mu R_f = \frac{\omega}{g} \cdot F + \omega \sin \theta$$

$$R_f = \frac{\omega}{g} F + \frac{\omega}{\mu} \sin \theta \quad \text{--- ⑦} \quad \frac{\omega}{\mu} \left\{ \frac{F}{g} + \sin \theta \right\}$$

Taking moment about A

$$R_f \times b + \left(\frac{\omega}{g} F + \omega \sin \theta \right) h = \omega \cos \theta \times l$$

$$\left(\frac{\omega}{g} \frac{F}{\mu} + \frac{\omega}{\mu} \sin \theta \right) b + \left(\frac{\omega}{g} F + \omega \sin \theta \right) h = \omega \cos \theta \times l$$

$$\left(\frac{F}{g\mu} + \frac{\sin \theta}{\mu} \right) b + \left(\frac{F}{g} + \sin \theta \right) h = \cos \theta l$$

$$\frac{b}{\mu} \left(\frac{F}{g} + \sin \theta \right) + \left(\frac{F}{g} + \sin \theta \right) h = \cos \theta l$$

$$\left(\frac{F}{g} + \sin \theta \right) \left(\frac{b}{\mu} + h \right) = \cos \theta l$$

$$\frac{F}{g} + \sin \theta = \frac{\cos \theta l}{\frac{b}{\mu} + h} \quad \text{--- ⑧}$$

$$\frac{F}{g} = \left(\frac{\cos \theta l}{\frac{b}{\mu} + h} \right) - \sin \theta$$

$$F = g \left[\frac{\cos \theta l}{\frac{b}{\mu} + h} - \sin \theta \right] \quad \text{--- ⑨}$$

$$R_f = \frac{w}{\mu} \times \left(\frac{\cos \theta}{\frac{b}{\mu} + h} \right) \quad \text{--- (10)}$$

$$= \frac{w \cos \theta}{b + \mu h}$$

$$R_R = w \cos \theta - R_f$$

$$= w \cos \theta - \frac{w}{\mu} \frac{\cos \theta}{\left(\frac{b}{\mu} + h \right)}$$

$$= w \cos \theta \left(1 - \frac{1}{b + \mu h} \right)$$

$$= w \cos \theta \left(\frac{b + \mu h - 1}{b + \mu h} \right)$$

$$F_f = \mu R_f = \mu \times \left(\frac{w \cos \theta}{b + \mu h} \right)$$

=====

4- wheel drive

$$F = R_f + F_f = \mu R_R + \mu R_f$$

$$\Sigma V = 0$$

$$W = R_f + R_R$$

$$\Sigma H = 0$$

$$(w/g) F = \mu R_R + \mu R_f$$

$$= \mu (R_R + R_f) = \mu W$$

$$F/g = \mu$$

$$\sum V = 0$$

$$\omega = R_R + R_f$$

$$\sum H = 0$$

$$\left(\frac{\omega}{g}\right)F = \mu R_R + \mu R_f$$

Assuming slip occurred at front wheels

First $R_f < R_R$ then

$$\sum M_R = 0$$

$$2\mu R_f = \frac{\omega}{g} F$$

$$R_f b + \frac{\omega}{g} F h = \omega,$$

$$2) \quad M = 1765 \text{ kg}$$

$$l = 2.84 \text{ m}$$

$$a_1 = 1.22 \text{ m}$$

$$a_2 = 1.62 \text{ m}$$

$$\text{load on front axles} = F_{AF} = mg \left(\frac{a_2}{l} \right)$$

$$\text{load on rear axles} = F_{AR} = mg \left(\frac{a_1}{l} \right)$$

$$F_{AR} = mg \left(\frac{a_1}{l} \right)$$

$$= 1765 \times 9.8 \left(\frac{1.22}{2.84} \right)$$

~~load on rear axles:~~

$$= \underline{\underline{7430.40 \text{ N}}}$$

$$F_{AF} = mg \left(\frac{a_2}{l} \right)$$

$$= 1765 \times 9.8 \left(\frac{1.62}{2.84} \right)$$

$$= \underline{\underline{9866.89 \text{ N}}}$$

3. Different parts of tires

i) Beads

- They hold tire to the rim or outer edge of wheel.
- made of Cu, brass or bronze.
- Prevent tires from sliding out when wheel rolls.

ii) Bead fillers

- rubber compound inside tire beads.
- provide stability to lower sidewalls & bead area.
- density & stiffness of a bead filler helps to determine a tire's performance characteristics.

iii) Radial cord body

- gives tire the strength & transmits cornering forces from tread to the wheel.
- Rubber coated fabric cord, called body ^{plies} ~~plies~~, make up ^{the} ~~the~~ cord body.
- Body plies can be made of polyester, rayon, nylon.
- Polyester is commonly used.

iv) Inner Liner

- Rubber Compound bounded to inside of cord body that retains air under pressure.
- has no cord reinforcement, & functions like an inner tube.
- modern cars tires have no inner tubes anymore.
- A tire's beads, bead filler, inner liner work together to hold air within tire walls.

v) Belt Plies

- These are 2 or more layer of cord just under the tread area of ~~tire~~ tire.
- Primary function is to provide strength & stability, to tire tread.
- Play vital role in improving tire mileage, impact resistance & traction.
- Steel is the most common material used in belt plies.

vi) Side wall

area of tire from bead to tread - the side of tire is called side wall.

It forms a protective covering for cord body.

1) Tire Tread

- Portion of tire that comes in contact with road surface.
- The tread's compound & its design have to ~~be~~ balance wear, traction, handling, Fuel economy, resistance & other characteristics of tire