

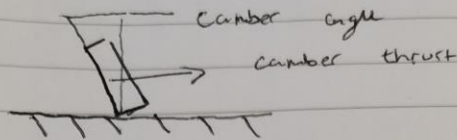
Lewis Aubrey

Vehicle tech

1.

i.)

Camber angle creates thrust that can generate and increase lateral grip to a point at which reducing the contact patch lowers grip

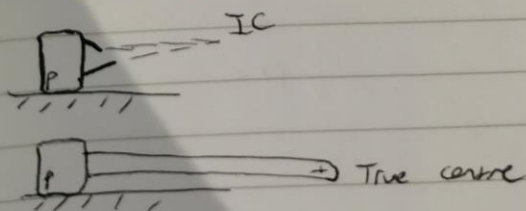


ii.)

Caster angle ~~creates~~ creates a self centre torque which increases stability. But this yields a large caster trail making steering heavier.

iii.)

Instant centre is the point at which suspension rotates at that instant of time. This is effectively the swing arm pivot. A long swing arm length reduces the amount of camber change with bump as a short swing arm length increases it. A low or high instant centre results in an increased scrub.



iv.) The roll centre is the point of time at which the chassis rotates. A high roll centre will reduce body roll but results in an increased jacking force's. A low roll centre increases body roll but decreases jacking forces.

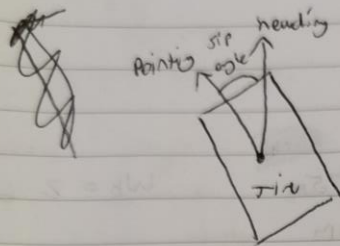
2.) mass = 915 kg       $C_{gh} = 0.375m$        $W_b = 2.65$   
 velocity = 25 m/s      Track = 1.16m  
 radius corner = 130m

$$a = \frac{v^2}{r} = \frac{25^2}{130} = 4.81 \text{ m/s}^2$$

ii.)  $W_t = \frac{Mah}{t} = \frac{915 \times 4.81 \times 0.375}{1.16} = 1422.8 \text{ N}$

iii.) The outside vertical tyre load increases by the same amount as the inside load reduces, due to the non linear relationship of a tyre between its vertical load and lateral grip. Not as much grip is increased on the outside wheel as lost by the inside tyre. This results in a loss of total grip.

iv.) Slip angle is the angle between the direction ~~of the vehicle~~ in which a wheel is pointing and the angle at which the vehicle is traveling. This is affected by tyre deflection created by lateral load, this means the tyre path is not the same as the vehicle.



3.)  $M_s = 215 \text{ kg}$   $K_1 = 13,000 \text{ N/m}$   
 $M_{SR} \quad K_2 = 28,000 \text{ N/m}$

$$K_1 + K_2 = 13,000 + 28,000 = 41,000 \text{ N/m}$$

$$\frac{1}{K} = \frac{1}{13,000} + \frac{1}{28,000} = 8878.05$$

$$K = K_1 + K_2$$

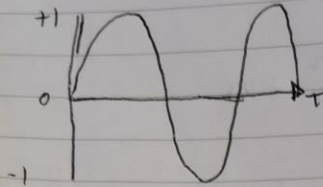
$$K = 8878.05 \times 2$$

$$K = 17756.1 \text{ N/m}$$

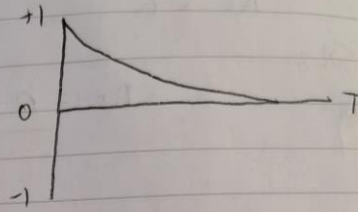
ii.)  $f_n = \frac{1}{2\pi} \sqrt{\frac{K}{m}}$   $f_n = \frac{1}{2\pi} \sqrt{\frac{17756.1}{215}}$   $f_n = 1.45 \text{ Hz}$

iii.) The frequency of this vehicle's suspension is taken off roading as its so to absorb bumps when going over uneven terrain, this travel in the suspension allows it to remain a constant contact tyre patch.

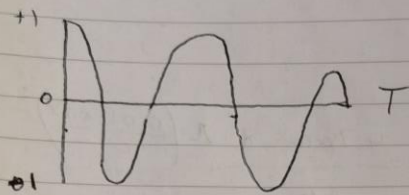
IV.) Undamped



Overdamped



Underdamped:



4.)  $M = 875 \text{ Kg}$

decel =  $7.5 \text{ m/s}^2$

$F = ma$

$F = 875 \times 7.5 = 6562.5 \text{ N}$

vi.) pedal ratio = 4:1  
SCPAD = 44.45 mm

MCPD = 15.875 mm

NOSC = 2

PCDF = 0.42

EPR = 0.15 m

RR = 0.285

Force per wheel =  $\frac{6562.5}{2} = 3281.25 \text{ N}$

Torque required per wheel =  $F_w \times R = 3281.25 \times 0.285 = 935.23 \text{ Nm}$

Slave piston force =  $\frac{T}{N \times r} = \frac{935.23}{0.42 \times 0.15} = 14844.88 \text{ N}$

5.

$$\text{line pressure} = \frac{F_s}{A_s \times n}$$

~~14844.88 N~~  
(~~1.55 \times 10^{-3} \times 2~~)

$$A_s = \frac{0.0445^2}{2} \times \pi$$

$$\frac{14844.88}{1.55 \times 10^{-3} \times 2} = A_s \quad \pi \times 0.2225^2$$

$$A_s = 1.55 \times 10^{-3}$$

$$4.78 \times 10^6 \text{ N/m}^2$$

$$\text{Peda Force} = \frac{p \times A_m}{PR} = \frac{4.78 \times 10^6 \times \pi \left( \frac{0.01587}{2} \right)^2}{4}$$

$$\text{Peda Force} = 236.53 \text{ N}$$