Week 1

Longitudinal Acceleration

Braking

Bad braking

1 How to make a stoppie with a van.mp4

2 Car Stoppie 2.mp4

3 Car Stoppie Fail.mp4

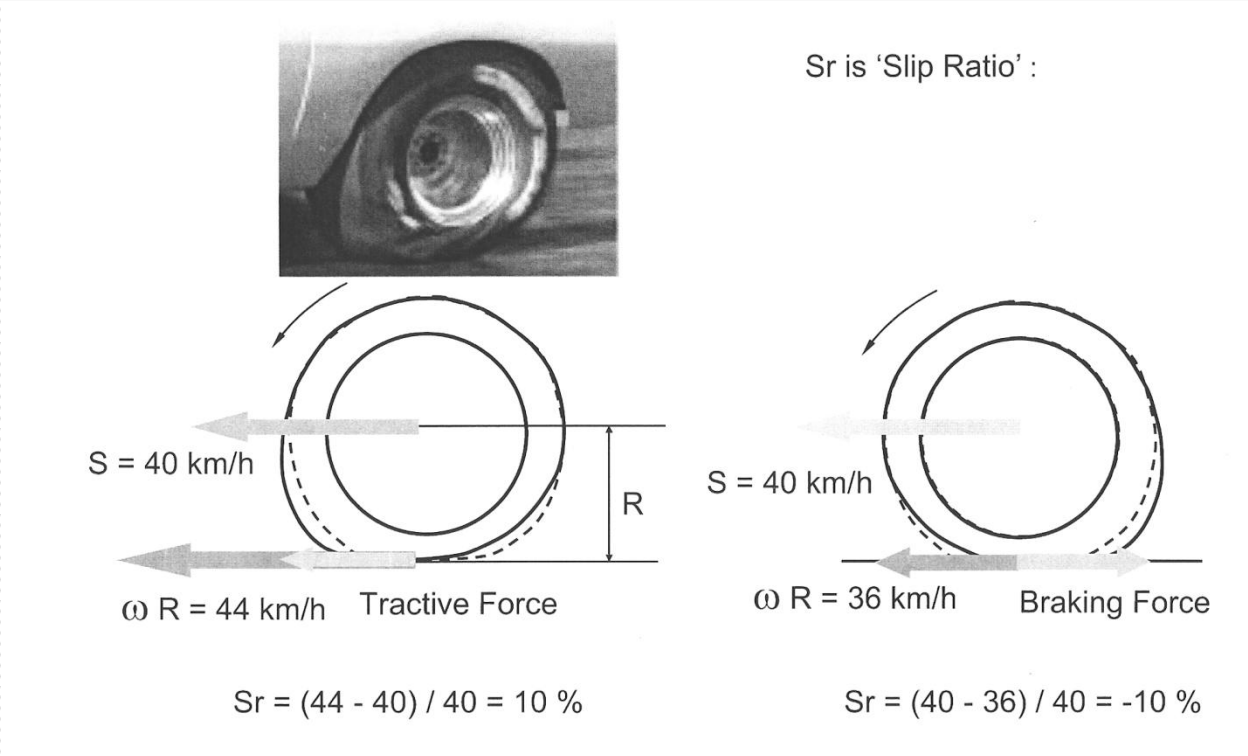
Grip between tyre and road

Several mechanisms for generating ‘frictional’ forces

- Hysteresis – interlocking of tyre and road
- Adhesion – chemical bonding
- Conventional friction- smooth surfaces rubbing

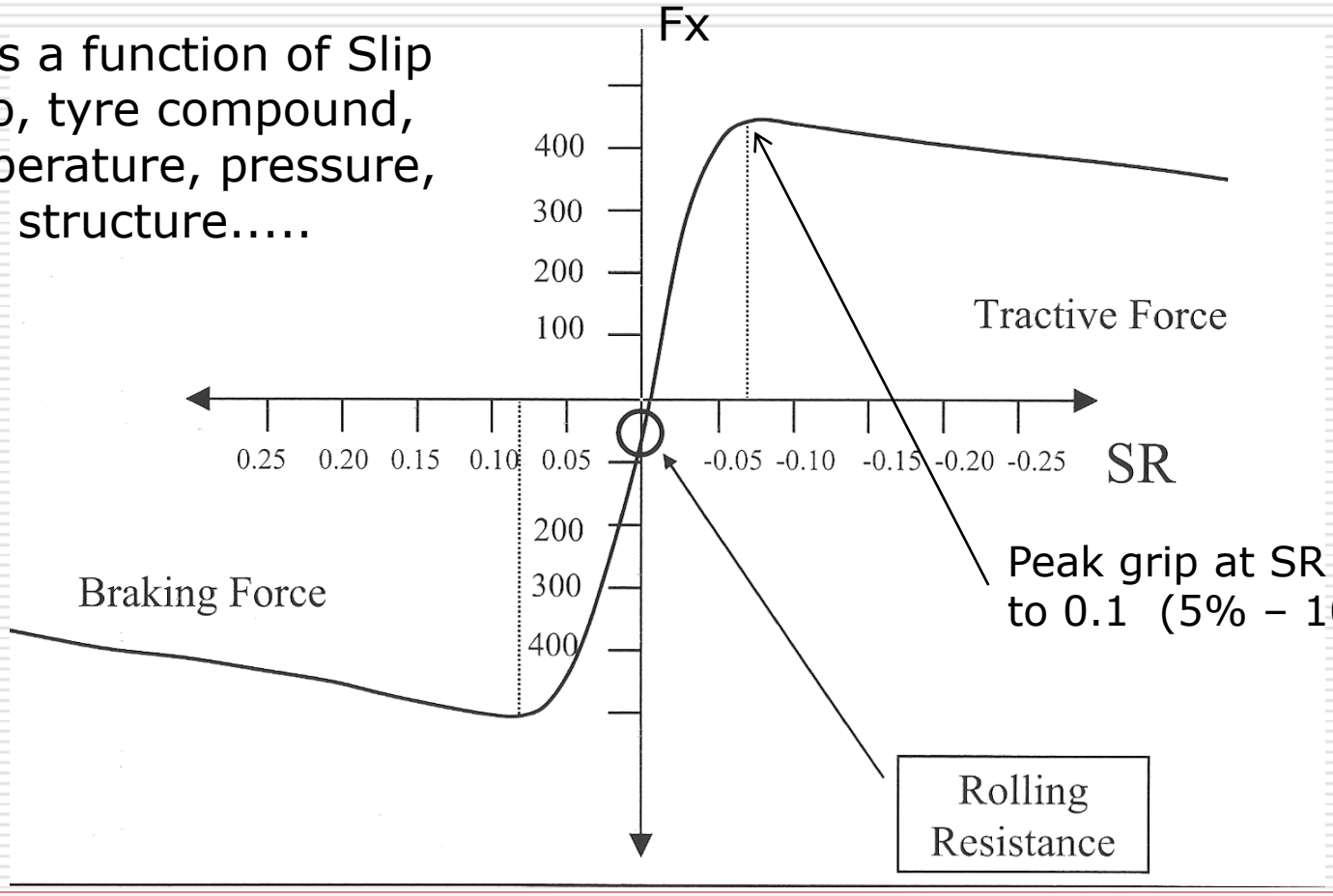
Tyre characteristics

Longitudinal Slip Definition

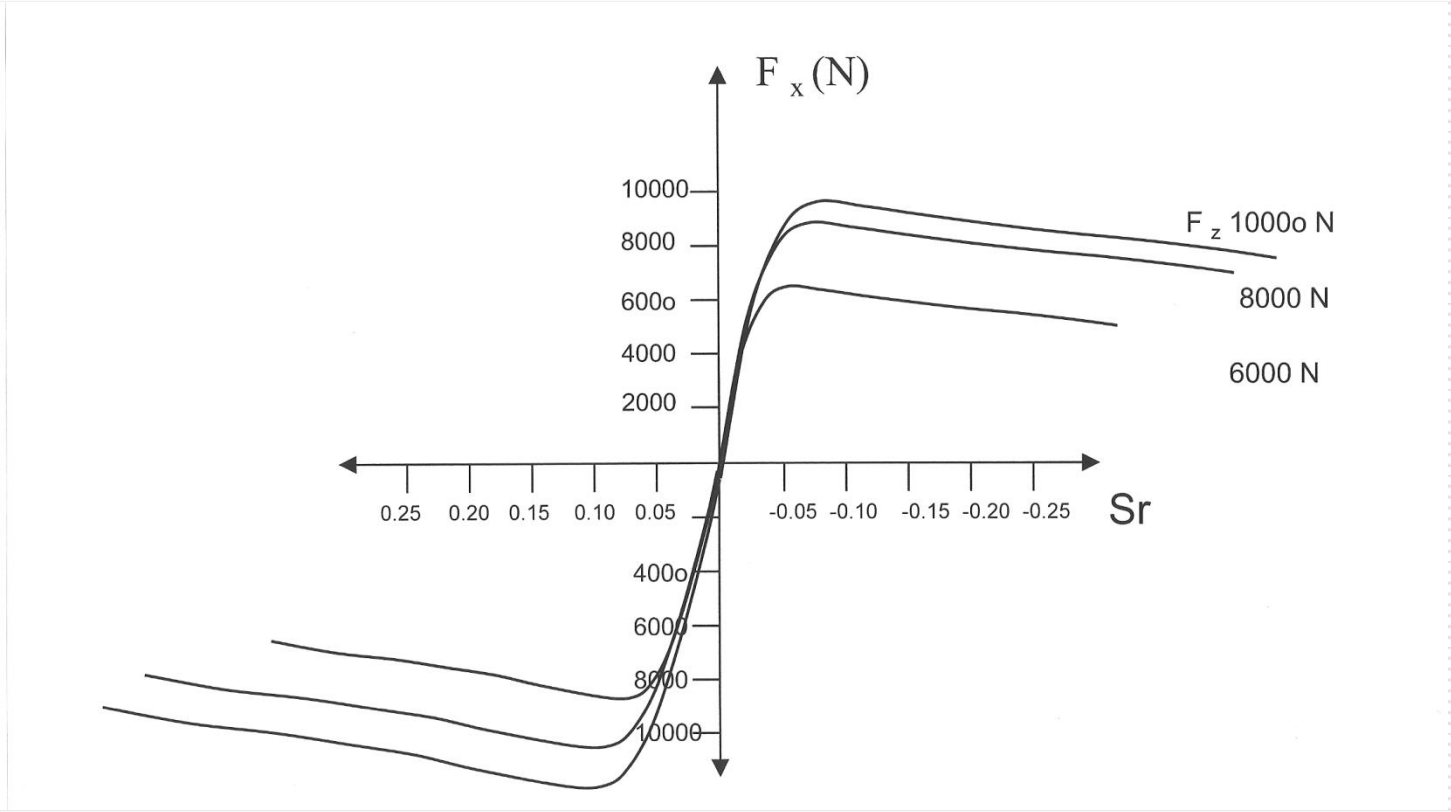


Longitudinal Force , Fx

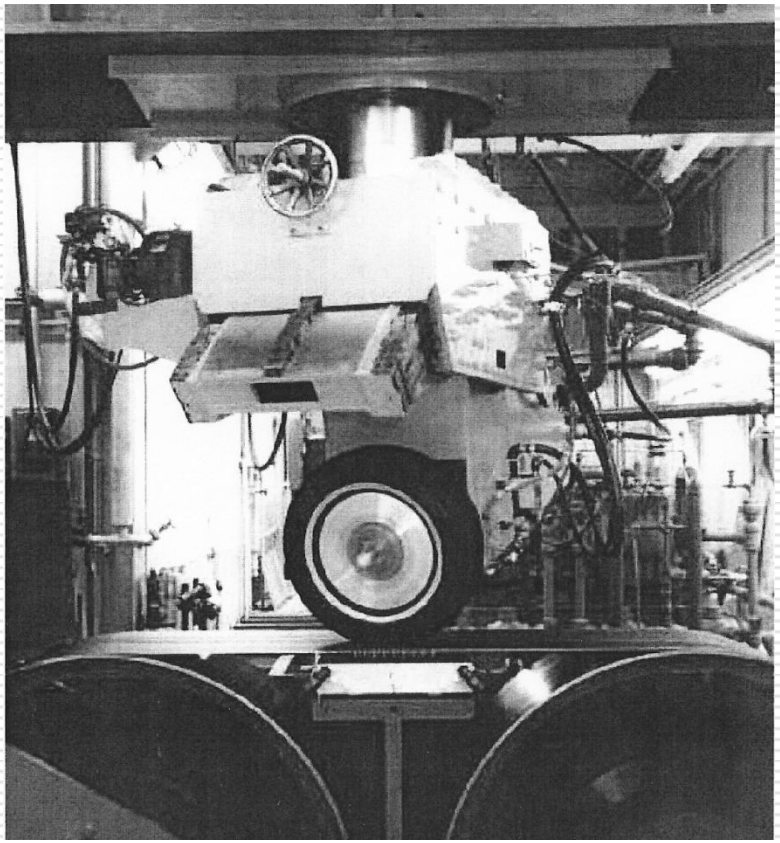
Fx, is a function of Slip Ratio, tyre compound, temperature, pressure, road structure.....



Influence of vertical load



Measuring the Longitudinal Friction Coefficient



Using single tyre forces in a laboratory

Tire Force Test.mp4

http://www.youtube.com/watch#!v=nmo_dkNZIHM&feature=related

Track Test

How could we obtain a value for the longitudinal friction coefficient of the tyres on one axle with a track test ?

Finding μ from a track test

$$\mu = \frac{\text{Friction Force (F)}}{\text{Reaction Force (R)}}$$

In this example:

$F = F_x$ and $R = Wb$

So $$\mu = \frac{F_x}{Wb}$$

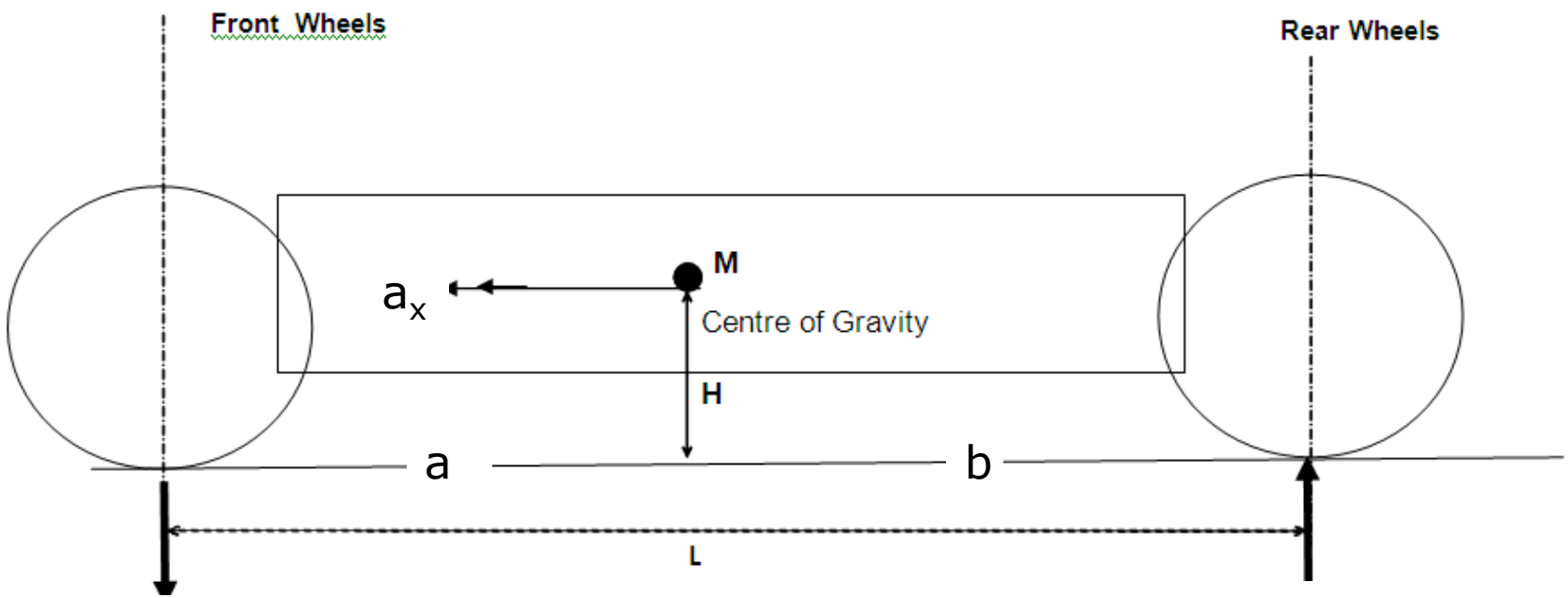
Finding μ from a track test

To find μ we need to:

- Calculate tyre loads from static load +/- weight transfer = Wfb and Wrb

- Measure rate of deceleration and hence calculate longitudinal force Fx

Tyre loads when braking with simple rigid model



Wfb = Static load (Fzfs) + WT

Wrb = Static load (Fzrs) - WT

Finding WT

Over turning moment = $Ma_x H$

Reaction moment = $WT \times L$

For equilibrium:-

Reaction = Overturning moment

$$WT \times L = Ma_x H$$

Giving

$$WT = \frac{Ma_x H}{L}$$

Example 1

Data:

- $L = 2.5m$
- $a = 1.344\ m$
- $b = 1.156\ m$
- $M_{tot} = 800\ kg$
- $H = 0.355m$
- $a_x = 1.4g$

Example 1 Static tyre load

$$Fzfs = 800 \times 1.156 \times 9.81$$
$$= 3628.9 \text{ N}$$

Similarly :

$$Fzrs = 4219.08 \text{ N}$$

Example 1 Weight transfer

$$WT = \frac{Ma_x H}{L}$$

So

$$WT = \frac{800 \times 9.81 \times 1.4 \times 0.355}{2.5}$$

$$= 1560 \text{ N}$$

Example 1 Total tyre loads

$$Wfb = Fzfs + WT$$

$$Wfb = 3628.9 + 1560$$

$$= 5189.1\ N$$

$$Wrb = Fzrs - WT$$

$$Wrb = 4219.08 - 1560$$

$$= 2659.08\ N$$