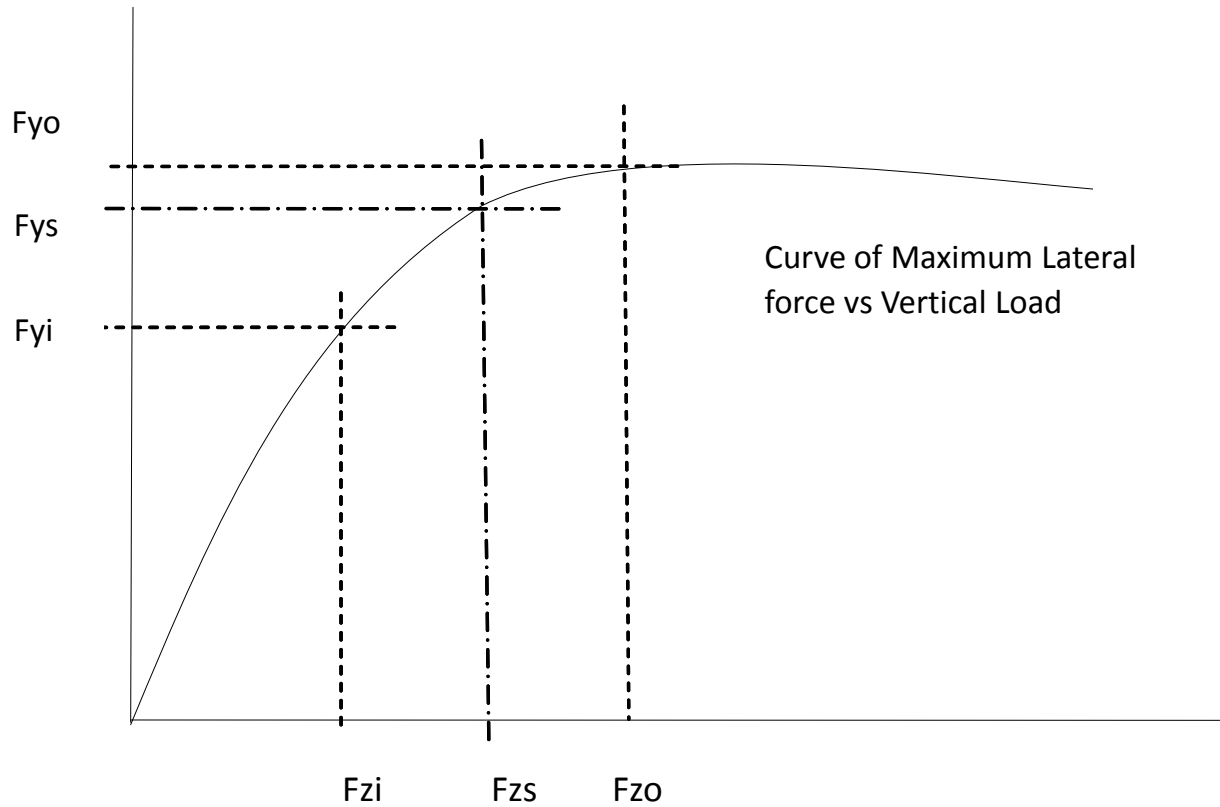


Vehicle Dynamics

Steady State Handling

Balance

Typical Tyre Behaviour



Basic Definitions

$$\text{Overall Steering Ratio} = \frac{\text{Steering Wheel Angle}}{\text{Road Wheel Angle}}$$

So

$$\text{Road Wheel Angle} = \frac{\text{Steering Wheel Angle}}{\text{Overall Steering Ratio}}$$

Neutral Steer

The SAE defines neutral steer as :

A vehicle is neutral steer at a given trim if the ratio of the steering wheel angle to the overall steering ratio [ie the actual steered wheel angle] equates to the Ackerman steering angle for a given radius of turn.

Ackerman Steering

Ackerman steering angle δ (*delta*) is the geometric steered wheel angle required for a car of wheelbase L to track round a turn of radius R at low speeds where the external forces due to accelerations are negligible so $\delta = L / R$ for small angles.

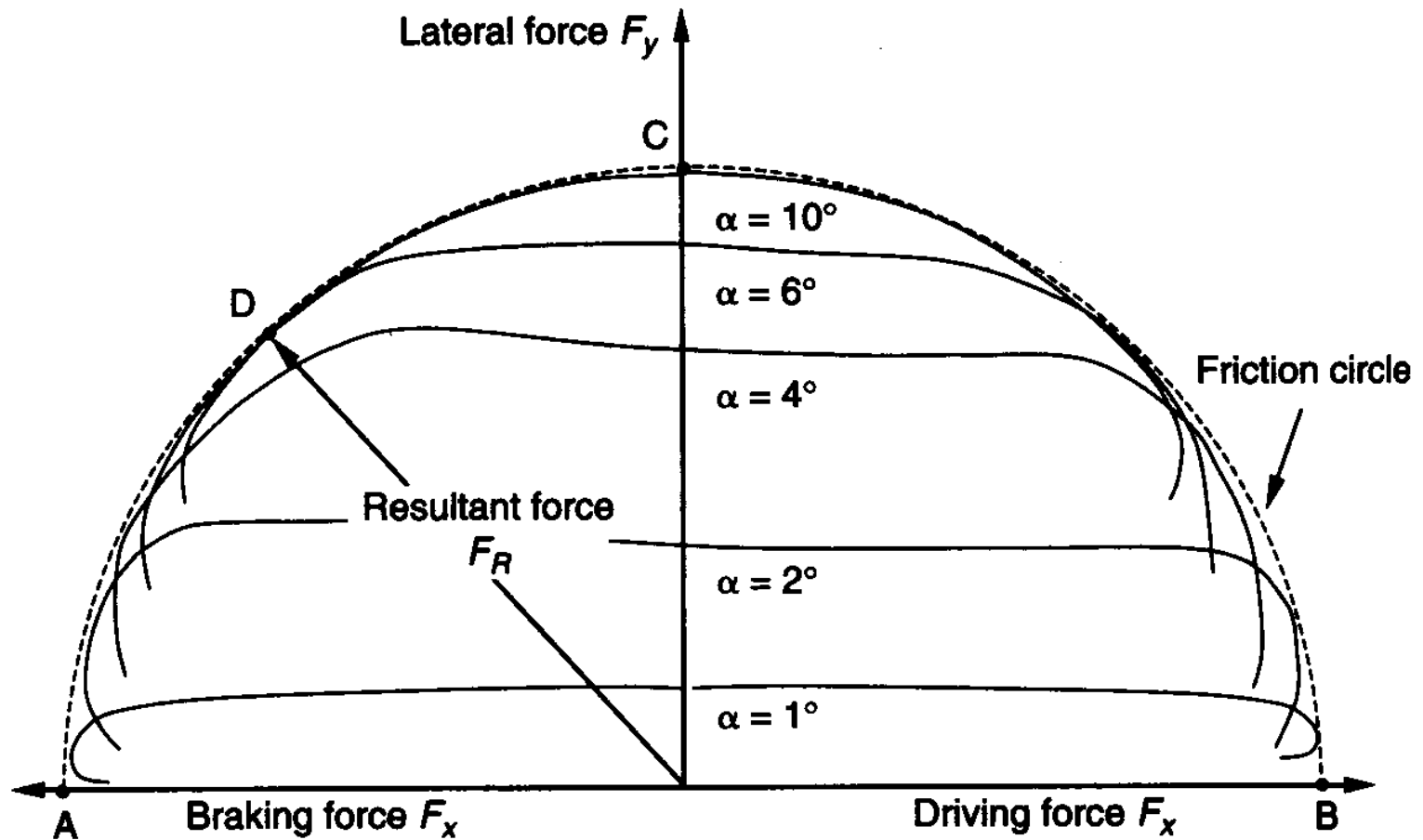
Understeer

A vehicle is understeer at a given trim if the ratio of the steering wheel angle to the overall steering ratio is greater than the Ackerman steering angle for a given radius of turn

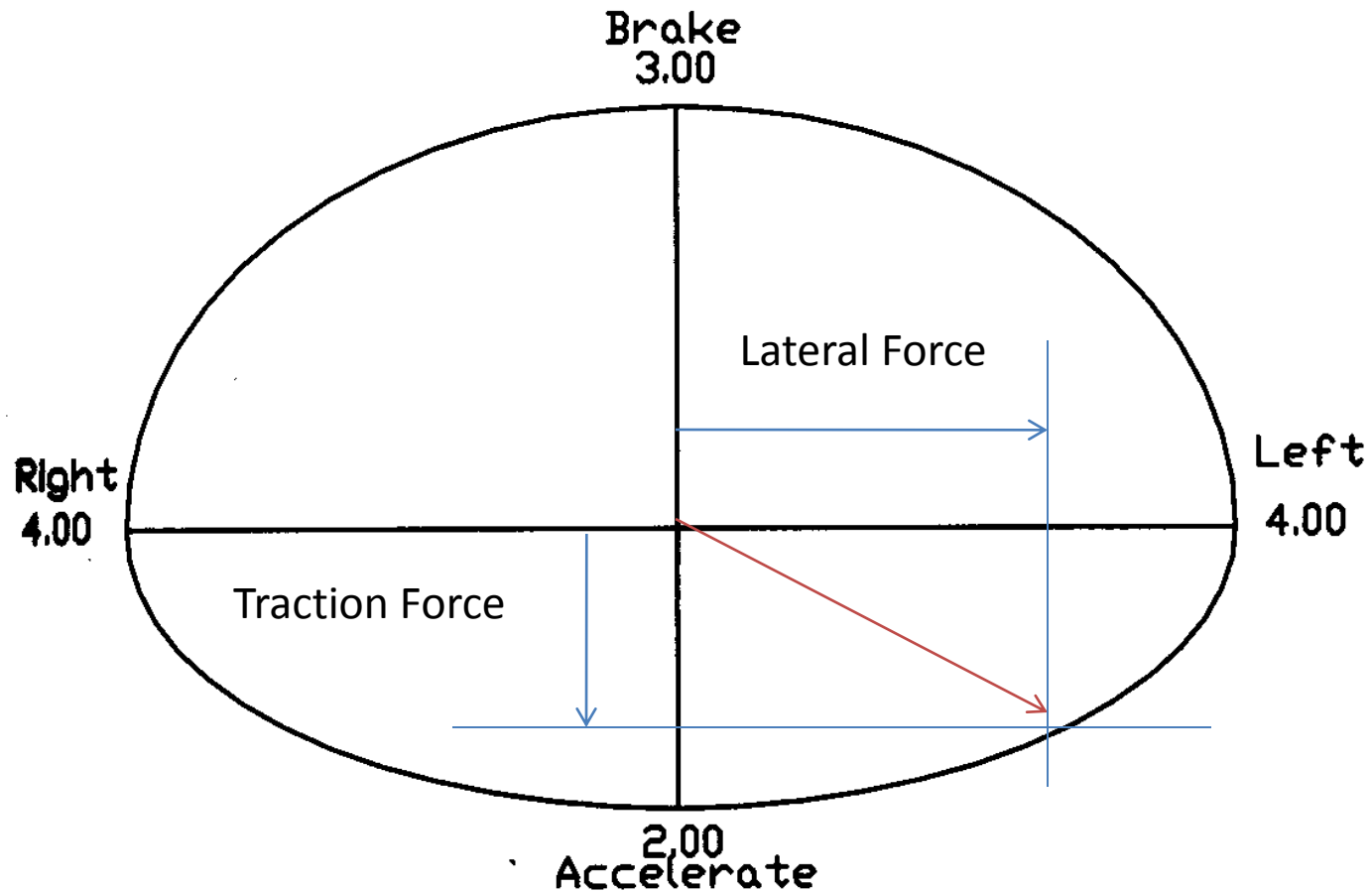
Oversteer

A vehicle is oversteer at a given trim if the ratio of the steering wheel angle to the overall steering ratio is less than the Ackerman steering angle for a given radius of turn

Traction Circle

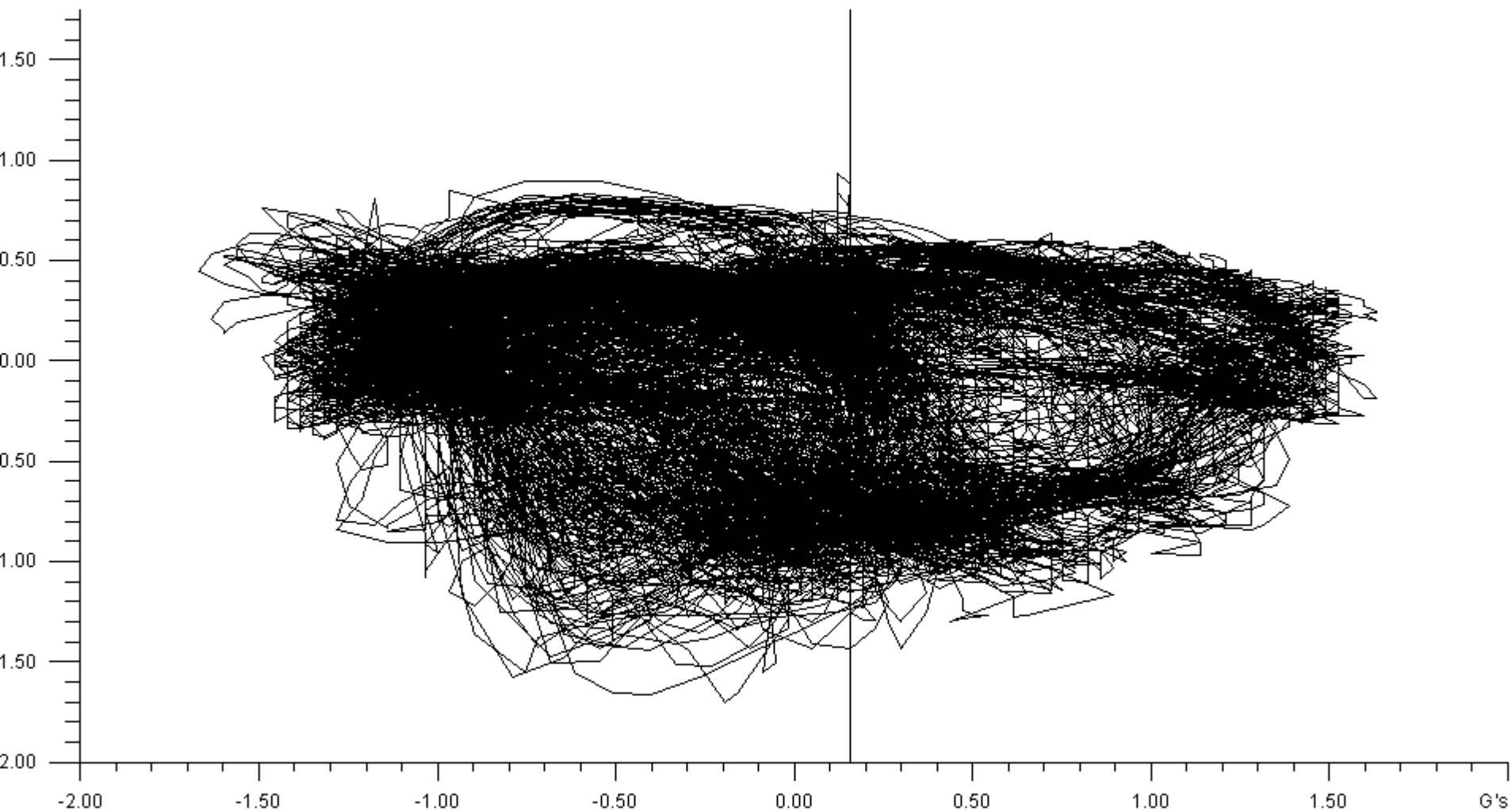


Traction Circle (another version)





G's

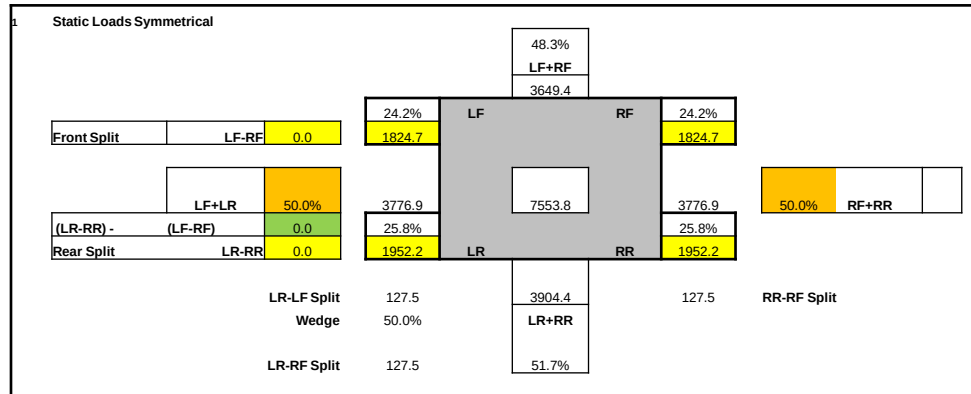


Time 0.000 (secs) Lateral Accel -0.23 (G's) Inline Accel 0.00 (G's)

042:002:001 - 034 59:45.76 MATT GT 2

Inline Accel (G's)
Brands Indv

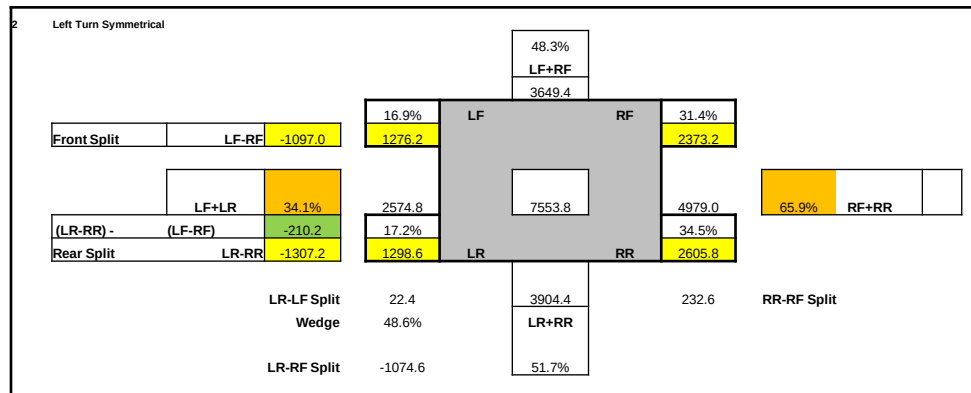
Case A Load Distributions Symmetrical Load



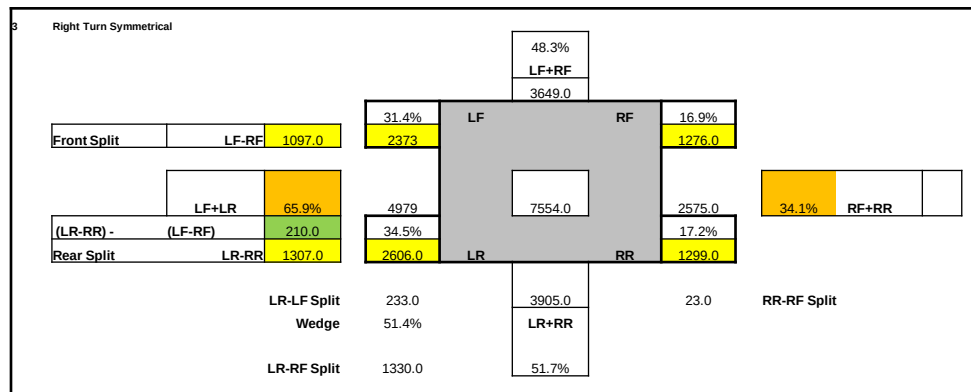
The car behaves in the same way on left and right hand turns

Straight line braking and acceleration are achieved best due to equal wheel loads

The handling balance of the car will be influenced by the difference between Front and Rear Splits

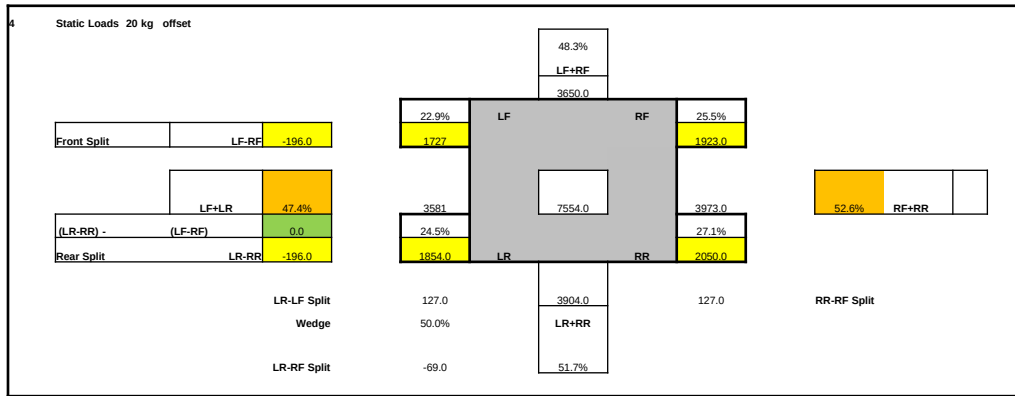


In this symmetrical case the Front Split is 1097 N and the rear Split is 1307 N for both left and right hand turns. The difference between front and rear splits is 210 N in each case indicating **oversteer**.



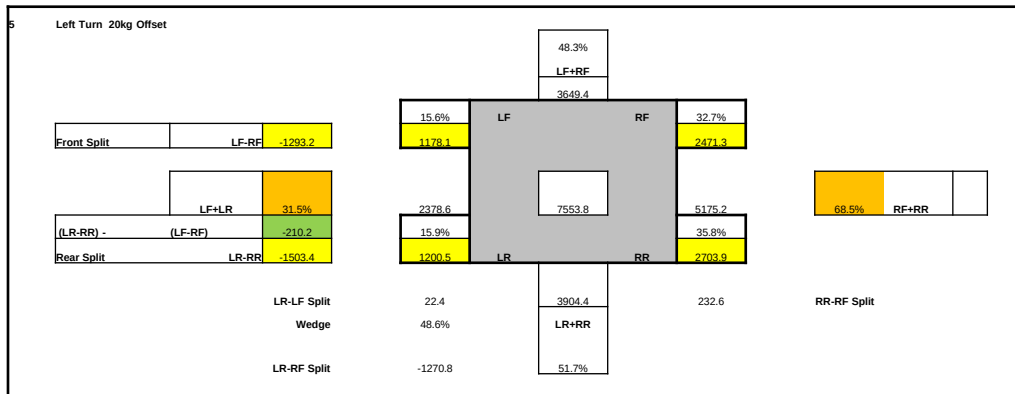
The overall grip of the car will be influenced by the magnitude of the difference between Left and Right splits. In this case the difference is **31.8 %** (34.1% and 65.9% in each direction of turn)

Case B Load Distributions Offset Load with 50% Static Wedge



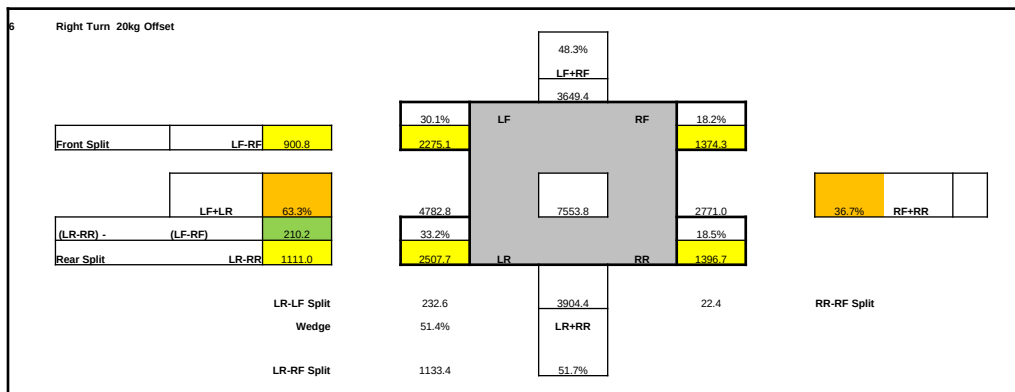
The car behaves differently in left and right hand turns.

The initial loading is not symmetrical but the Wedge is still 50%. The handling balance will remain the same as the difference between front and rear splits is still 210.2 N in each direction of turn.



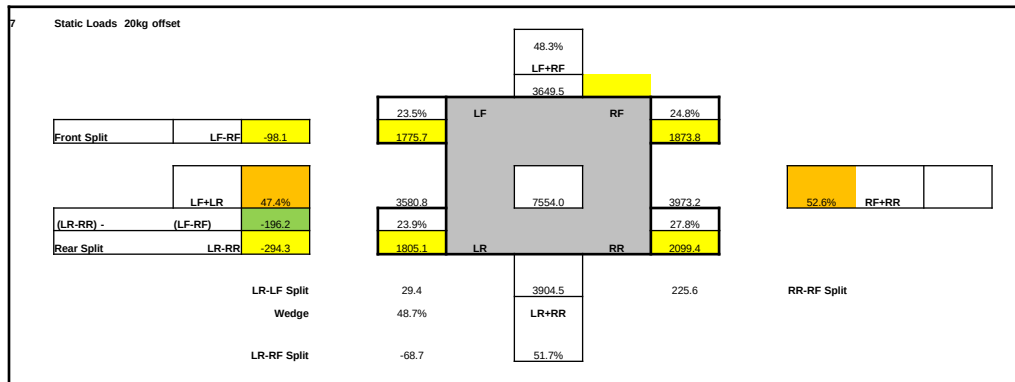
But ,

In Left turns, the overall grip of the car will be worse than the symmetrical static load case as the difference between the total Left Split and Right split is now greater at **37%** (with 31.5% for LF + RF and 68.5% RF + RR)

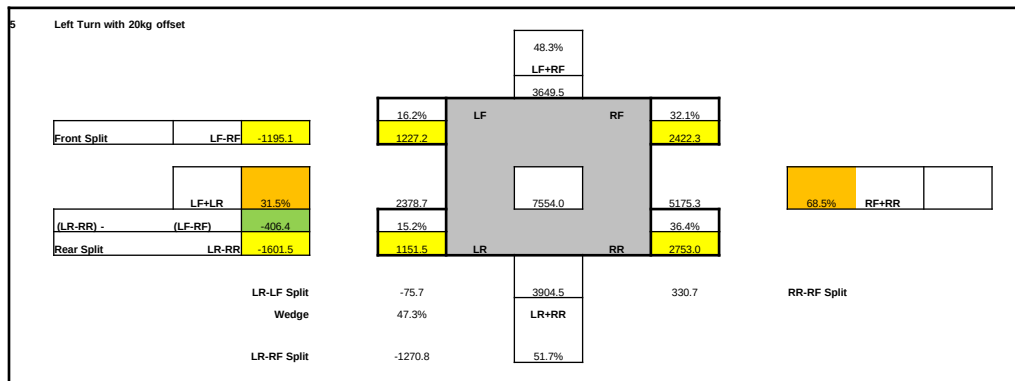


On Right turns, however, the overall grip should be better as the difference between the total Left Split and Right Split is less at **26.6%** (with 36.7% for RF + RR and 63.3 % for LF + RF)

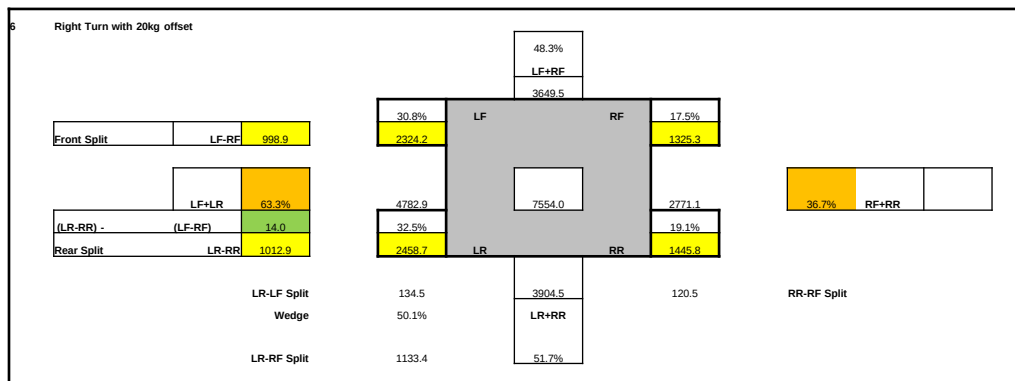
Case C Load Distributions 48.7% Static Wedge



The initial loading is not symmetrical but the Wedge is now 48.7% and so the handling balance will be different in each direction of turn.



In left turns the difference between Front and Rear splits is now 406.4 N (in this case the front is greater than rear so significant **understeer** would be indicated.



In right turns, however the opposite occurs with the rear greater than the front by only 14N so marginal neutral /oversteer is indicated.

The overall grip of the car will be the same as in Case B in each direction of turn as the total static load difference is the same with 52.6% on the right.