How to optimise your Clubman's handling

Reprinted with kind permission of Mark Stanton, Westfield Club United Kingdom

Setting-up the suspension on your Westfield makes for safer, more enjoyable high performance driving. The reason why the correct set-up is so important is so that the largest type footprint is in contact with the road. The tyres allow the car to accelerate, corner and brake, after all, they are the only contact with the road, and its the suspension that controls this contact.

The typical footprint of a tyre, regardless of size, is the equivalent to the area the size of a postcard. That's something for you to think about next time your out in the car.

The best handling attitude for the car is neutral (i.e. with neither marked understeer nor oversteer) where the tyres are achieving optimum grip and performance.

Tyres and suspension systems work on and though each other. They interact to create a 'handling system'. But it's easier to understand by looking at them individually and considering how they react to the various forces involved.

Lateral Force
Lateral force, or centrifugal force, is the one you're probably more familiar with. It's the force that wants you to keep going in a straight line (through the hedge), the force pulling you away from the centre of a turn.

Cornering Force
Opposing lateral force is cornering force which the tyres create when you turn the wheel into a corner. By completing the turn, cornering force has overcome lateral force. The important thing to remember is that tyres and only tyres can generate cornering force, suspension systems can only affect how tyres generate and share that cornering force.

Slip Angle
Tyres can only generate cornering force in two ways. The first is through slip angle, this is simply the difference between the direction the tyre is travelling and the direction the tyre is pointing. The greater the slip angle (the more you turn the steering wheel) the greater the cornering force (up to a maximum point, after which it decreases.... the cars in a skid).

Camber Thrust
The second way the tyres generate cornering force is by camber thrust. Positive camber is when the top of the wheel leans outwards; negative camber is when the top of the wheel leans inwards. Camber thrust is the force that moves the tyre in the direction its leaning. Like slip angle, the greater the camber angle the greater the camber thrust (cornering force) generated in the direction the tyre is leaning.

Areas of Adjustments
There are several areas of adjustment we can make but, remember to stay within the factory defined limits which are printed in the build manual.

Camber
Camber is a big factor in the performance of suspension systems and, for optimum handling a car's outside tyres should have zero camber during cornering, so that the total tyre footprint is in contact with the road.

Modern suspension systems are designed to help keep the tyre tread flat to the road even during suspension movement, with the aim of keeping camber near zero under normal driving conditions. Since the suspension is jointed to the chassis any body roll causes a tilting of the suspension and results in camber change.

This change, if not counteracted by suspension geometry, results in positive camber on the heavily loaded outside wheel during cornering, with a subsequent loss in the amount of cornering force generated. If this loss is greatest at the front, an understeer effect occurs (we go through the hedge front first). If greatest on the rear, the result is oversteer (we go through the hedge rear first). The only way to counteract roll induced positive camber, without modifying the suspension system, is to start with sufficient static negative camber (i.e. then the car is stationery on level ground) to end up with near zero camber at maximum cornering levels. But beware setting up with excessive static camber as it can cause a serious reduction in straight line braking performance, a tendency to high speed wander, and excessive bump steer. What's more excessive negative camber will seriously accelerate wear on the inside tyre shoulder in everyday driving.

Toe
Toe is highly critical suspension setting, and has a significant effect on handling. It is the measurement between a pair of opposite wheels - front or rear - as seen from above Zero toe is when the wheels are parallel, toe-in is when the front of the wheels are closer together, toe-out when they are further apart.

Ideally, maintaining zero toe would allow the suspension to do its job correctly. However, there is a certain amount of compliance built into the suspension system, which allows movement of the suspension components within the bushings to absorb shocks, and static toe is added to compensate. As a rule, less toe-in or even slight toe-out on the front will improve the way the car turns in, inducing an oversteering condition on entering the corner. However, it will tend to adversely affect straight line tracking. Less toe-in on the rear of independent rear suspension cars can also improve turn-in and reduce understeer. However, be warned that less toe-in can also lead to abrupt oversteer, especially in power off conditions. For this reason avoid toe-out at the rear.

Corner Weights
Big improvements have been made to a cars handling when the corner weights have been set correctly. This is when you equalise the cars weight of each wheel with the car loaded normally (driver, half a tank of fuel, correct ride height, etc...). You do this with the help of a friend using a corner weight gauge with the car on a flat surface (the club has several gauges for members use, on Westfields only, not your tin-tops. - see your area organiser). The idea is to balance the weight across the same axle using the spring platform on the shock absorbers to adjust the weight on each wheel. The platform needs to be raised to increase the weight on a wheel and lowered to reduce the weight, bearing in mind to keep the ride height as low as possible to reduce roll induced positive camber.

Tyre Pressures
Tyre pressures will also have a substantial effect on handling and should always be at least the minimum recommended figure, start with 18 psi. and refer to build manual. Again, contact you Area Organiser for use of club equipment.

Springs
Fitting stiffer springs will reduce the cars body roll and the need for large amounts of static negative camber. A maximum of 25% uprating from standard is a good compromise between improved handling and a reduction in ride comfort. After a change of springs you will need to adjust the damper settings to find the optimum setting.

Summary of adjustments

Area of adjustment		**To decrease understeer**	**To decrease oversteer**
Tyres	Front pressure	Increase	Decrease*
	Rear pressure	Decrease	Increase#
	Front section width	Increase	Decrease
Area of adjustment		**To decrease understeer**	**To decrease oversteer**
Wheels	Front wheel width	Wider	Narrower
	Rear wheel width	Narrower	Wider
Toe	Front wheel toe	Toward toe out	Toward toe in
	Rear wheel toe	Toward toe in	Toward toe out
Camber	Front wheel camber	More negative	More positive
	Rear wheel camber	More positive	More negative
Spring Rates	Front	Soften	Stiffen
	Rear	Stiffen	Soften

* Never reduce below the recommended pressure.
# Increase in increments of 2 psi.

With fully adjustable Westfield suspension systems we should have many hours of fun trying to set up our cars to suit our individual driving styles, but don't forget to do all your testing on a closed circuit and not on the public highway. Think safety !

Article prepared by Dave Drew Westfield Club United Kingdom