Making Progress
A guide to GT4 suspension & brake tuning

Scaff

Welcome to what I hope is an informative and useful guide to suspension and brake tuning with Gran Turismo 4.

This guide started life as I began typing out and clearing up my own notes on tuning; it has gained a life of its own and I wanted to share what I had put together with others.

What you are now reading is basically the product of the last 9 months of my life with GT4, combined with my years of work in the motor industry and driving.

The notes and techniques for tuning contained within this guide are not 100% real life, but rather the effects I have found from tuning in GT4. While a large amount of this does meet with real world practice, it is not a guide to tuning real cars and should not be taken as such.

In addition to the tuning guide for suspension and brakes, you will also find information relating to tyre selection and the fitting of racing brakes. While not strictly speaking tuning information I have included these sections as I have found them to be extremely useful when tuning.

I have obviously not covered every tuning option in GT4 in this guide and I hope to find the time to write future guides on the areas I have not covered here.

In closing I hope that you, the reader, find this guide as useful and enjoyable as I found writing it to be.

Regards

Scaff

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Real Vs GT4

Tuning in GT4 is not the same as tuning in the real world, a number of distinct differences can be seen between what is real and what is simulated in GT4.

The principal distinction is in how real world tuning practices relate to GT4 tuning practices; while the general approach and theory of real world tuning can be applied to GT4 with similar results, they are not exactly the same.

The changes made in GT4 tuning do not have the same level of effect that they would in the real world, so for example if the rear springs of a car are stiffened they will increase the tendency to oversteer, both in GT4 and the real world. However the GT4 car would not be subject to the same level of oversteer as the real car.

As a result while real world practice and theory can be applied in GT4, exact real world values can not be used.

One important aspect of real world settings that is carried over to GT4 is that every set-up is individual to the driver; even in the same car, set up for a single track, settings that work for one driver will not be ideal for another driver. Sometimes only minor changes will be needed; in other cases the settings may require a major change.

The reason for this is differences in driving styles, while one driver may prefer a car to be set up stiff; another may have a preference for a soft set up. Neither driver nor set up is right or wrong, just suitable for the individual. As a result any printed set up you see should always be tested and tweaked to meet your own driving style. In some cases the changes will be small, in other cases you may need to start from scratch.

Understeer and Oversteer

Ask car enthusiasts to explain understeer and oversteer and most will describe understeer as when the car looses grip at the front before the rear and oversteer as when the rear looses grip before the front.

Now there is nothing wrong with these descriptions and for general discussions they are more than adequate. However once we get into describing a cars handling characteristics with regard to tuning they are a little basic, as they only describe the situation once grip has been lost.

For a more detailed description of over and understeer I turn to the excellent book 'Going faster - Mastering the art of race driving' the handbook of the Skip Barber racing school.

This describes handling characteristics in much more expansive terms,

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Redefining Attitude

Up to now we defined understeer and oversteer in terms of which end of the car 'slides' first. While this is an OK conceptual way of describing the sensation it not really true. A car does not need to slide to exhibit understeer or oversteer. A tyre does not have to be at its cornering limit to encounter slip angles.

Even at low speeds and cornering loads, cars develop slip angles at the front and rear tyres. Consequently the car as a whole develops a yaw angle. At low loads the slip and yaw angles are small, but they're there. A more accurate way of defining a cars cornering attitude at both low speeds and high is to compare the slip angles of the front and rear tyres.

'Going Faster' then goes on to use this to describe different attitudes a car can take.

A 100 foot radius arc is used, with a Yaw of 8 degrees required to travel the arc.
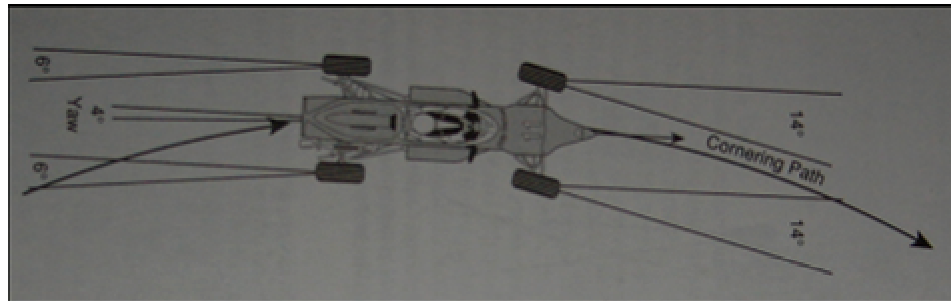
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Understeer

Front Slip Angle - 14 degrees

Rear Slip Angle - 6 degrees

Yaw - 4 degrees

The yaw of 4 degrees is lower than that of the yaw required to travel the arc and the car will push forward and wide.

Oversteer

Front Slip Angle - 10 degrees

Rear Slip Angle - 16 degrees

Yaw - 14 degrees

The yaw of 14 degrees is greater that that required to travel the arc and the car will take a line that is too tight. If the Rear Slip Angle increases the Yaw will increase dramatically and the car will over rotate (Power Oversteer), however if the fronts have also exceeded their Slip Angle then the car will push wide while over rotating (Power Understeer).
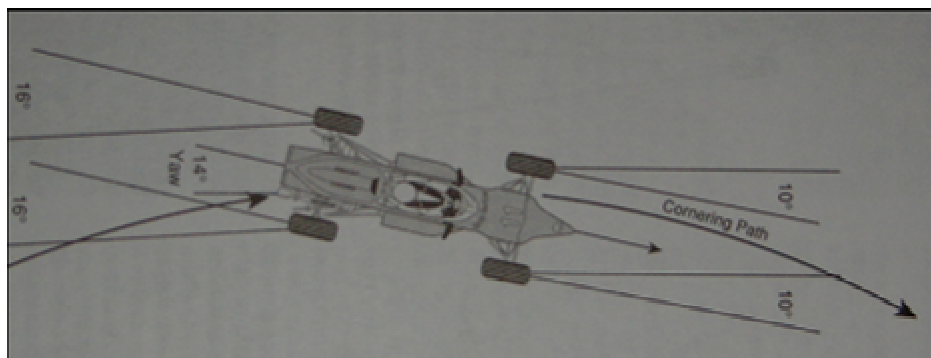
Neutral
Front Slip Angle - 10 degrees
Rear Slip Angle - 10 degrees
Yaw - 8 degrees

The yaw of the car matches the yaw required to travel the arc.
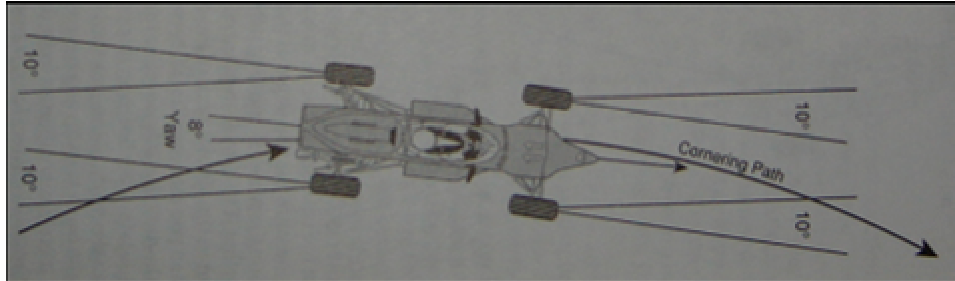
As the above examples show, understeer and oversteer are characteristics that occur at any speed and both with and without a loss of grip. This means when we are looking at changing a setting that would increase or reduce oversteer, it does not mean that grip has to be lost to feel the effect; just that the balance between the front and rear slip angles of the tyres will change.

How to Tune

Many different approaches to tuning have developed over the course of the Gran Turismo series of games, some of these involve applying a tuning 'formula', and others adopt a more methodical approach.

I personally believe that with GT4 a formula based approach will rarely give totally satisfactory results, and have always approached tuning with a much more considered approach.

What I have outlined here are the main areas that I consider when tuning a car, and how I identify the areas that require attention. Please do not consider this a doctrine on how you must tune; rather helpful and useful advice that you can pick and choose from.

Car layout
One of the first areas that must be considered is the nature of the car to be tuned, and principally its size, weight, and weight distribution and drivetrain layout. All of these factors determine how weight will be transferred during acceleration, braking and cornering. How cars of differing types should be tuned is a personal subject as it can depend as much on your style of driving as much as anything else.

I would however recommend that you take the car out for a test drive before doing anything, as without an idea of the starting point you will have no idea of how to proceed.

The Track
This first test drive should be carried out on the track you wish to tune for, as the nature of the circuit will have a big influence on how you tune the car. Is the track smooth or bumpy? Does it have high curbing or low rumble strips? Does the camber change on any of the bends? The list goes on, and these points and how the car responds to them should be noted down and used as a base line.

Acceleration and Deceleration
Often forgotten, it is important to discover how the car responds to acceleration and braking. This may well be determined by the drivetrain of the car in question and be easy to spot, for example front wheel drive cars often has problems developing traction out of corners, as the weight shifts to the rear under acceleration the front tyres loose grip. Meanwhile mid engined cars can often have issues with braking deep into corners causing instability, particularly if the car's wheelbase is short.

Again, these areas should be noted and used as the base point for tuning.

Corner Breakdown
Things can get a little more complicated when it comes to the corners, because we need to break it down into two or three sections depending on the nature of the corner. As the forces operating on the car differ in each of the sections it is vital to look at each section and how the car handles and tune as needed.

Corner Entry

Every corner has an entry point and this section is itself broken down into two areas, the initial turn in and the entry itself.

Turn-in

This is the moment that the wheel is turned and the front tyre nearest the corner apex must grip and provide the initial change in direction. It is one of the trickiest areas to tune in GT4, as other that front toe settings, the effects of changes can be difficult to predict.

Entry

After the turn-in the car's weight will transfer to the front tyre furthest away from the corner apex, for the vast majority of cars the natural balance at this point is understeer.

Settings that can be used to effect how the car handles here are the Spring Rate, Ride Height, Dampers, Camber, Brake Balance and Anti-roll bars.

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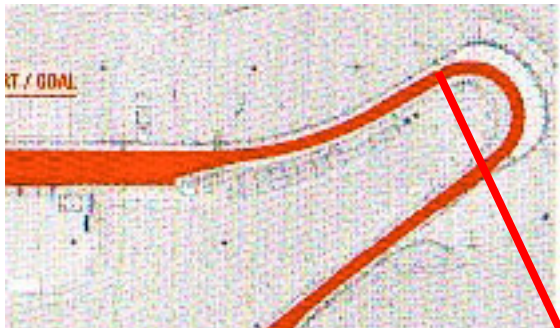
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Constant Radius section

The point when after the entry the car has settled to its balance, and is cornering on a steady throttle. Not every corner features this section, for example 90-degree corners in city circuits such as New York will have an entry section followed by an immediate exit section. Other corners will have very long constant radius sections, examples of these are the final corners at Tsukuba and Grand Valley Speedway. The natural tendency here will vary very dramatically dependant on the car.

Settings that can be used to effect how the car handles here are the Spring Rate, Ride Height, Camber and Anti-roll bars.
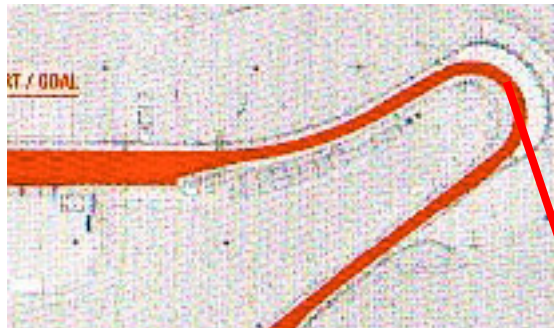
Corner Exit

This section starts as the throttle is opened as the apex of the corner is passed and causes a shift in weight towards the rear of the car, the rear tyre furthest from the corner apex will carry the greatest load here. The natural tendency here will depend on the car with cars driven by the rear wheels normally settling into slight understeer that turns to oversteer, and cars driven by the front wheels normally settling into understeer. Four wheel drive cars can vary depending on how the power is distributed between the front and rear, the majority will feel similar to front wheel drive cars.

Settings that can be used to effect how the car handles here are the Spring Rate, Ride Height, Dampers, Camber, Rear Toe and Anti-roll bars.
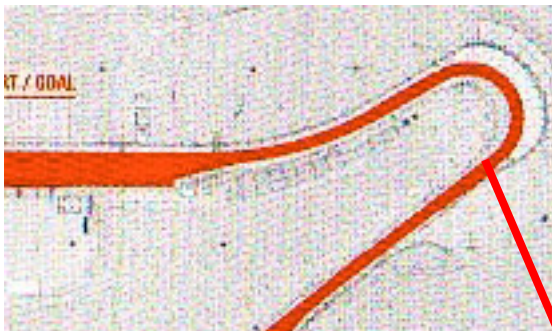
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The Tune

One the base lines for the various areas have been established I would then start to tune the various areas one at a time. Personally I never change more than one setting area at a time and then test drive the car again, noting the point that have improved and those that have got worse. From here I tweak and test until I reach a point that I am happy with, I don't have any formal document I use for these notes preferring to work on rough paper. You may prefer to develop an Excel or Word document to note changes on, I personally find this to be too time consuming. I do however have an Excel document that I use to record the final settings on, an example of which is shown below.

These tweaks and changes to the set-up may be constantly evolving, as you change for each track, modify the car or adapt to a slightly different driving style.

Two important mantras I follow with every tune and set up keep me focused on what I am aiming for, and what is possible, these are:

All tuning in GT4 is a relationship between what the front and rear of the car are trying to do. They work in relationship to each other as the car moves and weight transfers.

Tuning is always limited by the car's basic layout and chassis, you can only do so much if the car is a bad 'un to start off with.

Car	Caterham Seven Fireblade
Bhp	225 @ 10,450rpm
Torque	121 ft/lbs @ 9,500rpm
Weight	335kgs
Lap Time	1'16.339 @ Deep Forest
0 - 30 mph	1.88
0 - 60 mph	3.92
0 - 100 mph	9.5
1/4 mile	12.394 @ 117mph
V Max	170.47 mph

Modifications	
Exhaust	Racing
Racing Brakes	Fitted
Brake Controler	Fitted
N/A Tune	
Port Polish	Done
Engine Balance	Done
Increase Displacment	Done
Chip	Fitted
NO2	
Transmission	Fully Cust
Clutch	Triple Plate
Flywheel	Racing
LSD	Fully Cust
AYC	
Carbon Propshaft	Fitted
Turbo	
Intercooler	
Supercharger	Fitted
Suspension	
Front Tyre	R5
Rear Tyre	R5
VCD	
Weight Reduction	Stage 3
Rigidity	Done
Refresh Chassis	
Wing	
Oil Change	Done

Tune

	Front	Rear	Gear Ratios	
Spring Rate	7.5	6	Gear Ratios	
Ride Height	85	90	First	
Damper			Second	
- Bound	1	1	Third	
- Rebound	2	2	Fourth	
Camber	2.5	1.5	Fifth	
Toe	1	1	Sixth	
Roll bars	1	3	Seventh	
			Final Drive	
Brake Balance	5	3		
			Auto	12

NO2	

Downforce			Comments

LSD		
Initial Torque		10
Acceleration		20
Deceleration		20

VCD		

Ballast		
Weight		0
Position		0

ASM O/Steer		0
ASM U/Steer		0
TCS		0

Spring Rates

The springs fitted to a car control the amount of movement the car goes through under weight transfer, springs do not however have any effect on the amount of weigh that is transferred.

When setting spring rates one of the first considerations that needs to be made is the weight of the car itself, as what would be considered a 'soft' spring on a 2,000kilo car would feel very 'hard' when fitted to a 500kilo car.

After this the front to rear weight distribution of the car should be accounted for, as the heaviest end of the car will require a stiffer setting than the lighter end of the car. For example a car with 50% front and 50% rear weight distribution could run equal spring rates front and rear, but a car with 60% front and 40% rear may require a slightly stiffer front end setting.

Consideration should also be given to the track, as a nice flat racing circuit will allow a car to run much stiffer rates than a bumpy, uneven track. Finally the required ride height of the car will also have a bearing as running a low ride height with soft springs may cause the car to bottom out.

Overall Spring Settings

Setting	✔	✘
Soft (lower values)	Allows car to react to bumps and track imperfections without losing traction.	Requires a ride height tall enough to ensure that the car does not bottom out.
Stiff (higher values)	Minimises roll under weight transfer allowing a lower ride height to be used.	Can cause car to skip or jump over bumps and imperfections resulting in a loss of traction

Once the initial setting for the car's weight distribution and the track have been taken into account, the rates can then be used to trim under and oversteer. The guides below give an indication of the effect, however great care should be taken when changing spring rates.

To give an example of a potential problem, you may be tuning a front wheel driver car to reduce understeer. This can be done by making the front spring rate softer than it was; it does not mean that the front spring rate should be set softer than the rear.

Front Spring Settings

Setting	Effect
Front Stiffer (higher value)	Increases understeer
Front Softer (lower value)	Decreases understeer

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Rear Spring Settings

Setting	Effect
Rear Stiffer (higher value)	Increases oversteer
Rear Softer (lower value)	Decreases oversteer

Note: Great care should be taken with extreme spring rate settings as they can have unexpected results. Very soft rear settings can, for example, effect the tyres contact patches to such a degree that it results in greater oversteer rather reducing oversteer.

Why stiffer springs give less grip.

The following is an excellent explanation of the effects of spring stiffness and weight transfer, written by 'Greyout' it can be found in the GT4 Tuning and Settings forum at gtplanet.net. I have updated the pictures, but the text is all Greyout's work.

Spring Stiffness and Weight Transfer by Greyout

Imagine the 4 tires of the car are fixed to an imaginary sled with no suspension. As you go around corners, the inertia causes weight transfer, even though there is no leaning of the solid sled.

For a given CG height, track width, and cornering force, you will have the same weight transfer regardless of spring stiffness. Its simply centrifugal force at work.

The body of the car is suspended above the suspension, and is free to flop forward, back, left and right.

To keep the body off the tires, we require springs stiff enough to support the car. Look at the outside of the car in a turn, with a stiff rear spring. The outside rear spring is going to hold the body off the tires with more force, reducing the amount of body weight that would otherwise be supported by the outside front. You still have the same total weight transfer to the outside, but the rear spring is holding up the body more then the front.

With pure lateral acceleration, there is no front/rear weight transfer, so that results in more weight being kept on the inside front.

Static:
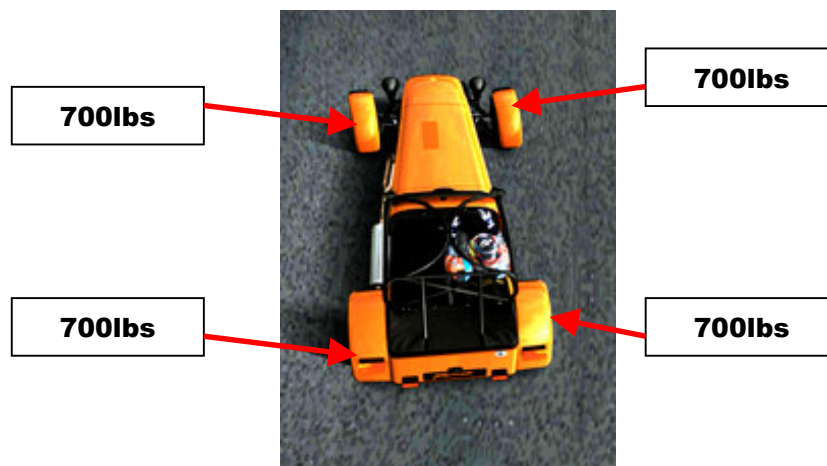
TOTAL:..1400 lbs..1400 lbs

When at rest, this car has equal weight all the way around (must be nice...). Maximum traction is available because each tire is sharing exactly 1/4th of the weight, any bias of weight results in less then optimal Coefficient of friction.

Dynamic (right turn) with equal springs
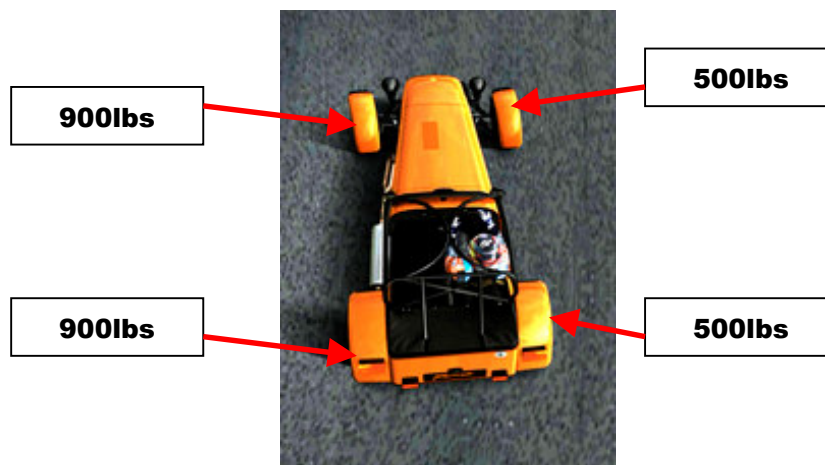
TOTAL....1800 lbs.1000 lbs

in this right turn, we have 200 lbs shifted off each end, for a total weight transfer of 400 lbs off the right and onto the left (800 lbs difference between right and left). This could be with any spring, or none at all. Each axle's traction is reduced by the same amount, as the bias of weight on each end is the same.

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[Dynamic (right turn) with stiff rear

750lbs — 650lbs — 1050lbs — 350lbs

TOTAL..1800 lbs..1000 lbs

Here we stiffened up the rear springs. Note that the total weight of the car, and the total weight transfer from right to left, is the same. The weight on each axle is the same.
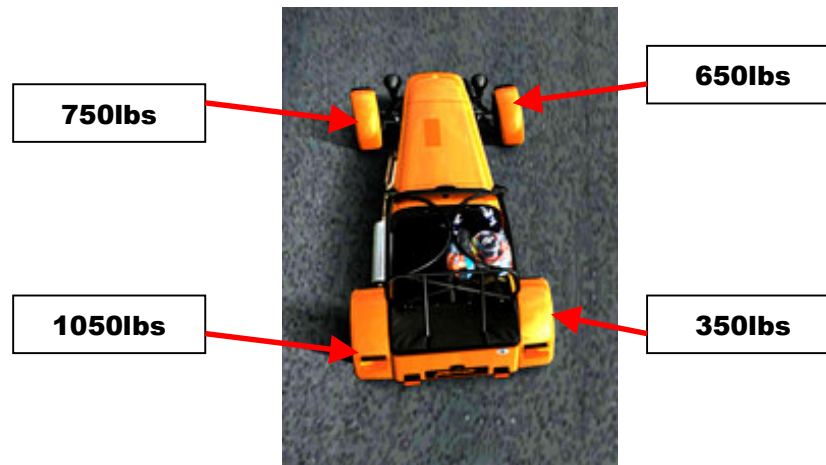
As the body rolled to the left, the rear spring, being stiffer, held up the body more then the outside front. This produces an equal and opposite force downward, forcing the tire into the ground more. This also REDUCES the body's weight over the front left, because the back left is doing some of the work the front left would have been doing. This results in some of the body weight being shifted toward the INSIDE FRONT (this is where corner weighting, or wedge, comes into play). These results in the total weight supported by each axle remaining the same. Because the front tires are closer to an even bias of weight, they are closer to their optimal traction, and can produce more lateral force then the rear.
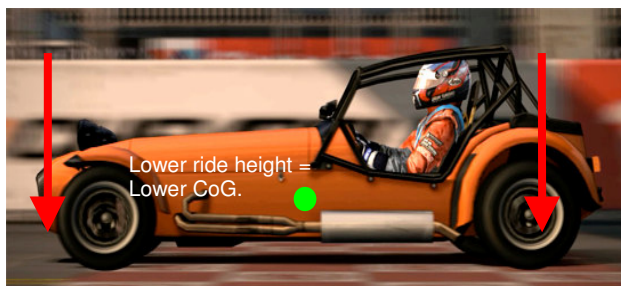
Oversteer ensues.

Ride Height

Ride height or to put it very basically, how far off the ground is you car running. Often seen by many as one of the most straightforward of tuning options, it offers a number of different ways of totally changing the characteristics of a car.

For many the simple ride height rule is to slam the car as close to the ground as the track will allow, and while you should always try to ensure that the car is running as low as possible. It's a good idea to understand why and what effect changes will have on the car's balance, as ride height is also the most common change made to a car to adapt it to different tracks.

Spring rate should always be taken into account when setting ride height, because as mentioned in the section on Spring rates, they control how much the car moves in relation to weight transfer. Softer springs allow the car to move more, meaning you will have to run with a higher ride height to avoid bottoming the car out. Harder springs will have the opposite effect.

Changes to the ride height is unique among suspension settings, as it is the only one that will effect the amount of weight being transferred while the car brakes, accelerates and corners. Raising the overall ride height will increase the amount of weight transfer and lowering the ride height will reduce the amount of weight transferred.

Lower ride height = Lower CoG.

Reducing Overall Ride Height

Lower CoG = Reduced weight transfer

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Raised ride height = Rasied CoG.
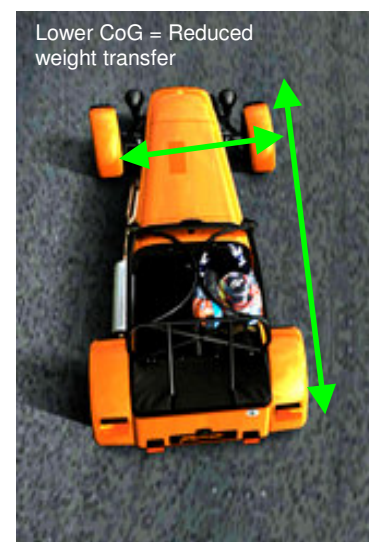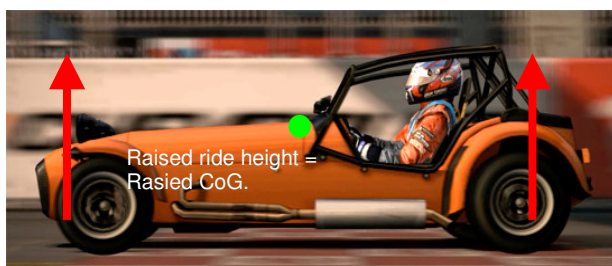
Increasing Overall Ride Height

Raised CoG = Increased weight transfer

Running with the lowest ride height that is suitable for the spring rates, car and track ensures that the centre of gravity on the car is kept as low as possible, minimising the amount of weight transferred as the car accelerate, brakes and most importantly corners. This minimised weight transfer helps to ensure that the car is as stable as possible when cornering, particularly when moving from one corner to the next.

Raising one end of the car more than the other will result in a change to the handling balance of the car, as the roll centre of each end (the point about which the car rolls) changes. This can be a useful characteristic to exploit at times, both to trim under and oversteer, and to increase front to rear weight transfer.

For example if a race series does not allow the use of the Brake Balance Controller and you wish to bias the front brakes more than normal (often required in mid or rear engined cars), simply raising the rear a little more than the front. This will result in an increase in the weight transferred forward under braking, you just have to watch for the increased tendency to oversteer caused by raising the rear.
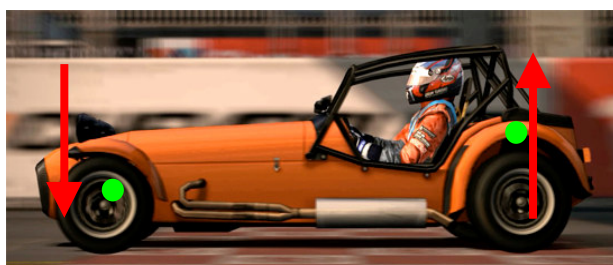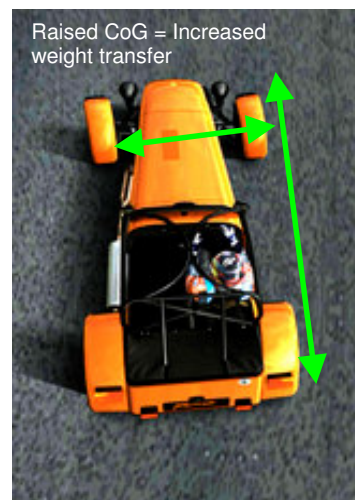
Increasing Rear Ride Height

Raised rear CoG = Increased rear to front weight transfer
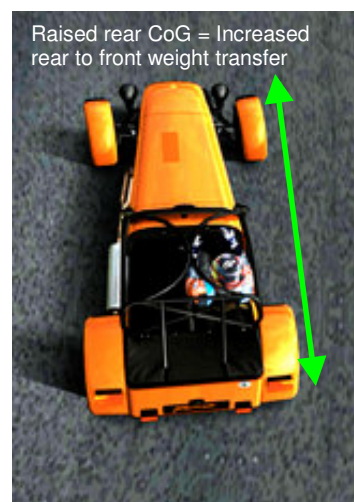
Be very careful of extreme differences between the front and rear ride height as the extreme differences in roll centres can have very unexpected results (apart from situations when cornering is not an issue – such as Drag racing).

Overall Ride Height Settings

Setting	✔	✘
Low (lower values)	Reduces weight transfer under braking, acceleration and cornering.	Increases risk of bottoming out the car, particularly if spring rates are not stiff enough.
High (higher values)	Ensures car does not bottom out over bumpy surfaces. Allows the use of softer spring rates.	Increases weight transfer under braking, acceleration and cornering.

Front Ride Height Settings

Setting	Effect
Front Higher (higher value)	Increases understeer
Front Lower (lower value)	Decreases understeer

Rear Ride Height Settings

Setting	Effect
Rear Higher (higher value)	Increases oversteer
Rear Lower (lower value)	Decreases oversteer

In very general terms lowering the ride height on one end of the car would be like softening the anti-roll bar or softening the spring rate at that end.

Increasing the ride height is like stiffening the anti-roll bars or going to a stiffer spring rate.

Damper Settings

Dampers (or Shock Absorbers as they are sometimes known) perform an often misunderstood role within the suspension system. They do not support weight or control how much the car moves under weight transfer as the springs do, but they do work directly with the spring. Without dampers when a spring encountered a bump it would not simply expand and then return to it normal state in a single movement, but rather would continue to expand and contract as the energy from the bump was dissipated.

Dampers control how quickly the suspension reacts to load being applied (bound) and how quickly it reacts to loads being removed (rebound). The stiffer a damper is set, the more it slows down the movement on its corner and speeds up the load transfer to the contact patch. A softer setting does the opposite; it allows the suspension to move faster and spreads the changes in load to the contact patch over a longer period of time.
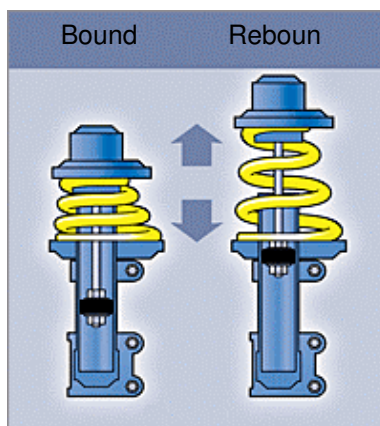
Racing suspension allows the values for Bound and Rebound to be set independently and again this can cause problems when trying to figure out settings. As a general rule of thumb you should set rebound higher than bound, I generally find that rebound being around 1 to 2 'clicks' harder than bound suits my own driving style. Testing is the only way to be sure; running over rumble strips is an excellent and very quick method of getting a rough feeling for the setting. However only good test runs will allow you to get the most out of the dampers.

The track surface will also play a major role in damper settings, as the bumpier a track is the softer the dampers would normally be set. These softer settings ensuring the suspension can react quickly enough to the surface changes and keep the contact patch in contact with the road.

Damper are also at their most effective when during weight transfer (as they are going into bound or rebound) and as such will have a much greater role to play during corner entry and exit. By contrast in constant radius corners (particularly big sweepers) they

have less effect as the weight transfer has already occurred and

Overall Damper Settings

the damper neither in bound or rebound.

Setting	✓	✗
Soft (lower values)	Allows suspension to react quickly to bumpy surface, retaining traction.	Speeds up transition to over/understeer. If set too soft can cause problems as the suspension carries on reacting after a bump.
Stiff (higher values)	Slows down transition to over/understeer.	Skips over bumpy surfaces, as suspension can't react quickly enough. Can cause the suspension to be bypassed completely if set very stiff.

Front Damper Settings

Setting	Effect
Front Stiffer (higher value)	Increases understeer
Front Softer (lower value)	Decreases understeer

Rear Damper Settings

Setting	Effect
Rear Stiffer (higher value)	Increases oversteer
Rear Softer (lower value)	Decreases oversteer

Note: Remember when using damper settings to tune under and oversteer characteristics the changes will be much more noticeable in corner entry and exit.

With the Racing suspension modification fitted Bound and Rebound must be set separately, which can cause a whole series of problems. While the information above can be applied to both bound and rebound you may find the following method helps.

The very first thing I do is reduce both the front and rear settings (bound and rebound) as I find the GT4 default settings far to high for most cars. I generally start with a setting of around 3 to 5 front and rear, depending on the car and track. Practice will soon start to give you an idea of your own starting points that match your driving style and desired feel. You will also need to keep in mind the weight distribution of the car, particularly for corner entry. Many front engined cars will need a slightly stiffer set-up at the front to allow for the additional weight, conversely some mid or rear engined cars may need stiffer rear damper settings.

From here I then start with the rebound rate, test drive the car, if it

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feels unstable, bouncy and loose then increase the rebound rate. If the car is hard and bumpy, particularly over a series of bumps, then reduce the rebound rate. Test drive the car again and adjust by 1 – 2 each time.

With the rebound rate set, the bound setting can now be tuned. If the car feels soft and surface irregularities are hardly noticeable then the bound rate should be raised. If the car feels harsh and hard over surface irregularities then the bound rate should be reduced. As with rebound this should be adjusted by

1 – 2 each time and the car test driven.

I generally find that this results in rebound being, on average, 1 to 2 'clicks' harder than bound. Which if you are in a hurry can be used as a starting point.

The final thing would be then, if required/desired, to adjust the front or rear settings for under or oversteer. I personally always keep the ratio between bound and rebound the same at this point. For example if I was stiffening the rear from 5/6 bound and rebound, by one 'click'. The final setting would be 6/7 bound and rebound.

Note: As damper settings have as much of an effect on how the car 'feels' as its handling balance, it is perhaps one of the most personal of all the suspension settings.
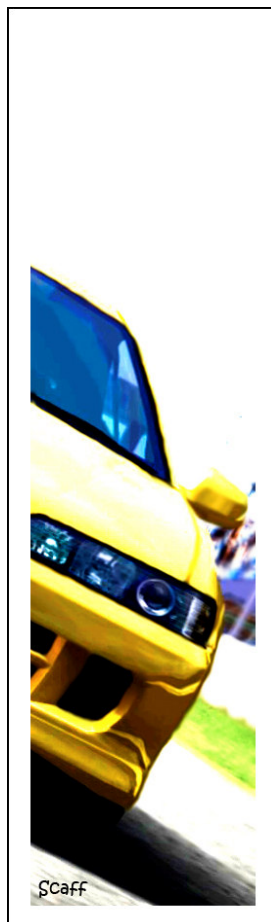
Camber Settings

Camber is the angle of the wheel relative to vertical, as viewed from the front or the rear of the car. If the wheel leans in towards the chassis, it has negative camber; if it leans away from the car, it has positive camber.

GT4 only uses negative camber, as positive camber is very rarely used on cars set up for racing or track work, its function being limited to the set-up of production road cars.

The principal purpose of setting camber is to ensure that the maximum area of the tyres contact patch is used during cornering. As a car corners the suspension and movement of the tyre cause the contact patch to change size as the car rolls.

The downside is that with negative camber the contact patch is minimised when the car is not turning which can reduce straight-

line traction for the driven wheels and stability. Also setting too extreme a camber value may mean that the full contact patch of the tyre is never used even during hard cornering.

As camber settings will affect the level of grip at the front and back of the car, it can be used to trim under and over steer if required. Personally I would rarely do this as my main aim with camber is simply to maximise traction while cornering. The rest of the suspension settings can be used to help control under and over steer characteristics. This is however a personal choice based upon the tuners driving style and sometimes the demands of a particular car.

Setting camber is something of a black art as it is only possible to estimate the effect and only through testing will the correct setting be discovered.

Camber set to 0

Camber set to 12
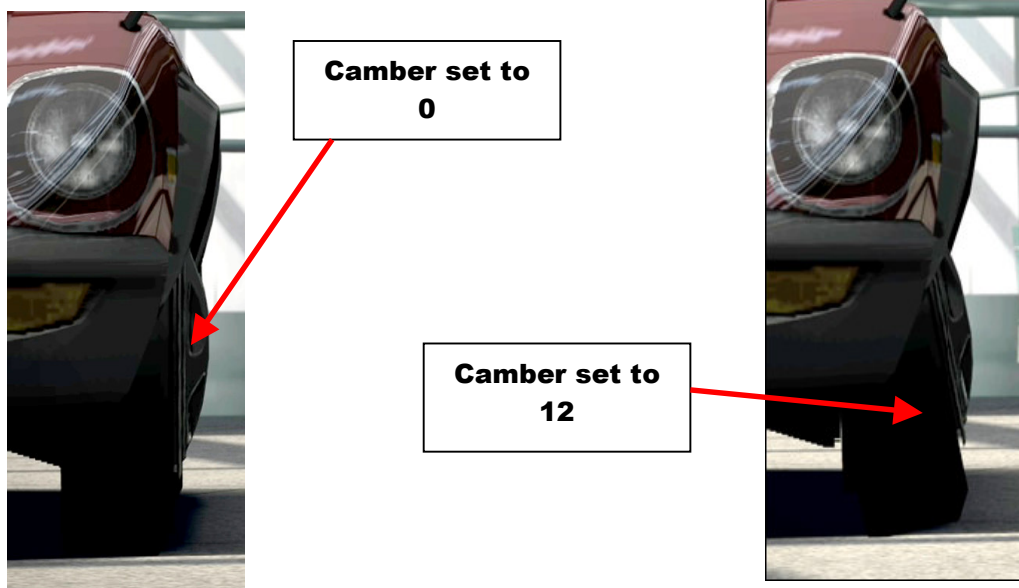
Making Progress

Setting	✓	✗
Front Camber	Increases cornering grip for the front tyres up to a point after which grip will reduce. Reduces understeer.	Reduces straight-line traction (for FWD/4WD cars) and stability. Braking distance increases and stability reduced. Very high settings can reduce initial turn-in.
Rear Camber	Increases cornering grip for the rear tyres up to a point, after which grip will reduce. Reduces Oversteer.	Reduces straight line traction (for RWD/MR/4WD/RR cars) and stability. High settings can increase oversteer as the contact patch is distorted. Less warning when the limited is reached.

Toe Settings

Toe settings affect the angle the front and or rear tyres are aligned to the car and road, as can be seen below.
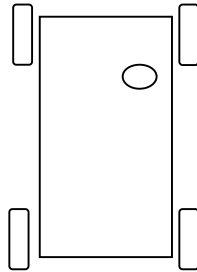
Zero Front & Rear Toe
The front tyres are aligned in the direction of travel.
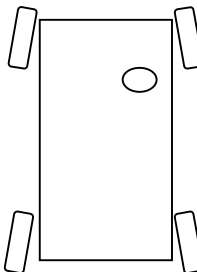
Front & Rear Toe-in (- values)
The front tyres are aligned inwards with the leading edge of the tyres closer to each other
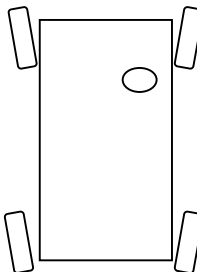
Front & Rear Toe-out (+ values)
The front tyres are aligned outwards with the leading edge of the tyres further away from each other

Toe adjustment is always very slight, as extreme settings play havoc with the tyres contact patch. They serve as a very useful tool for adjusting how a car reacts at turn-in and the extent of lift-off and power oversteer a car generates. GT4 does not allow the settings of extreme values (although –4 or +4 is extreme enough for toe), but large toe in or out would not be used in the real world either. The diagrams above are exaggerated to clearly show the difference between Toe in and out; however the effects are rarely visible to the naked eye. Consider that most road cars have a slight toe-in to encourage stability at speed, yet this is not noticeable when looking at the car.

Personally I use front toe to match turn-in to my driving style as corner grip can be tuned through so many other factors (camber, spring rates, dampers, etc) and straight-line stability is rarely an issue within GT4.

Making Progress

As the rear wheels do not steer the car rear toe settings will generally have a more noticeable effect on the cars handling than front toe settings (which can be very subtle). High rear Toe-out values can help with a drift set-up, and are very useful on front wheel drive cars where the increased lift-off oversteer can help get the rear of the car rotating.

Toe settings are set separately at the front and rear of the car and have the following effects.

Front Toe Settings

Setting	✔	✘
Front Toe-in (- values)	Better straight-line stability. Increases grip slightly during cornering.	Reduces grip on initial turn-in.
Front Toe-out (+ values)	Increases grip on initial turn-in.	Car wanders more at high speed (reduced straight-line stability). Reduces grip slightly during cornering

Rear Toe Settings

Setting	✔	✘
Rear Toe-in (- values)	Reduces Lift-off and Power oversteer	Reduces Lift-off and Power oversteer
Rear Toe-out (+ values)	Increases Lift-off and Power oversteer	Increases Lift-off and Power oversteer

Anti-roll Bars/Stabilisers

The purpose of Anti-roll bars (or Stabilisers as they are also known) is to control the amount of roll that occurs during cornering, as such they are very well named. By effectively tying the left and right suspension units together at the front and back of the car, they resist roll as the car turns.

As Anti-roll bars are connected side to side and not front to rear they do not have any effect on longitudinal weight transfer, so they do not impact on acceleration or deceleration.

Front Anti-roll bar Location

Squat and Dive under acceleration and deceleration are not affected

Rear Anti-roll bar Location

Roll under cornering load is controlled
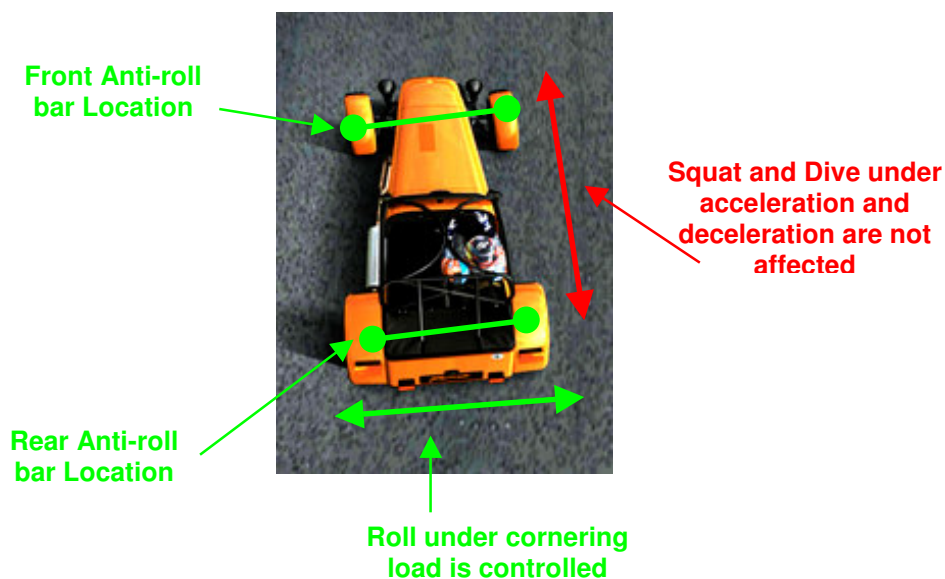
In many ways they can be thought of as springs that only work when the car rolls, and can add to the effect of the spring rates during cornering. As with springs, while they do have an effect on how much the car moves under weight transfer, they do not effect the amount of weight that is transferred.

Anti-roll bars are a very effective method of controlling understeer, as they only act when cornering, they can also be used to control how the car responds to mid-corner bumps. As with springs consideration must always be given to the amount of

travel they allow, particularly with regard to ride height.

When setting initial Anti-roll bar values consideration should always be made to the track, as very bumpy tracks do not suit high values. As they tie the left and right side of the car together any bump or shock that one side of the car encounters will be transferred in part to the other side. This can lead to a very agitated ride which can make it both car to handle the car and difficult to get the power down.

As a general rule of thumb, use softer settings for bumpier tracks

Making Progress

and harder settings for smoother tracks. Even on the smoothest tracks, if your style involves using the rumble-strips and curbs, then this should be considered when setting the Anti-roll bars up. Test driving the car on the track and tweaking the settings is the only way to be sure that the car is set-up right.

Overall Anti-roll Bar Settings

Setting	✓	✘
Soft (lower values)	Manages bumps in corner well. Improves feel as car corners (less darty).	Can cause the car to bottom out during corner roll, may require a higher ride height or stiffer spring rate.
Stiff (higher values)	Reduced risk of bottoming out during corner roll, may allow a lower ride height to be used (but be aware of dive/squat as this is not effected by the Anti-roll bars).	Loss of traction if corner is bumpy. Car feels dartier in corners. Extreme settings can reduce the cars ability to turn-in.

Front Anti-roll Bar Settings

Setting	Effect
Front Stiffer (higher value)	Increases understeer
Front Softer (lower value)	Decreases understeer

Rear Anti-roll Bar Settings

Setting	Effect
Rear Stiffer (higher value)	Increases oversteer
Rear Softer (lower value)	Decreases oversteer

Note: Great care should be taken with extreme Anti-roll bar settings as they can have unexpected results. Very soft rear settings can, for example, effect the tyres contact patches to such a degree that it results in greater oversteer rather reducing oversteer.

Brake Balance Controller

The Brake Balance Controller allows both the level of braking force and the ratio of front to rear braking to be controlled.

It should also be remembered that adjusting brake bias allows you to maximise the grip of your tyres for deceleration, you can not shorten braking distance below that which the tyre can offer. However, get Brake Bias wrong and you can increase them dramatically.

The purpose of brake bias settings is to ensure that all four tyres are doing an equal share of the work when braking, any time this is not happening; you are going to increase your braking distances. Also important is which end of the car will 'lock' first when braking exceeds the tyres limit, ideally this should be the front (but not always - see later), as if the rears lock first the car will become unstable at the rear and a loss of control may occur. Remember normally you don't want either end to lock as it will increase your braking distance, but if it does happen you want to remain in as much control as you can.

This second benefit of brake bias is to ensure that the car is stable while braking, this is particularly important when braking from very high speeds and/or in a car in which a lot of weight is going to transfer from the rear to the front.

Starting Out - Static Weight Distribution.

If the aim of this is to ensure that all four tyres share the braking load equally the first place to start is the static weight distribution of the car.

If Car A has 50% : 50% static weight distribution then to begin with we would look at the same Front/Rear ratio for the brakes, say 3/3

If Car B has 60% / 40% static weight distribution then to begin with we would look at the same Front/Rear ratio for the brakes, say 3.6/2.4

Now don't worry about the decimal points at the moment as this is just on paper, but it does illustrate an issue I have with GT4's Brake Balance settings, as it does not allow as much fine tuning as I would like.

Now we have a base set of value we need to look at the issue of weight distribution under braking.

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Weight distribution under braking - Adjusting the Brake Balance

As static weight distribution is only correct when the car is experiencing no accelerative forces (either acceleration or deceleration) we have to try an take this into account

The amount of weight transferred from the rear to the front is not measurable in GT4, but is determined by the following:

Static Weight Distribution - Provides the base starting point

Car A

Centre of Gravity Height - the higher the more weight will be transferred to the front under braking.

Wheelbase - the shorter the wheelbase the more weight is transferred to the front under braking.

You have to estimate how much is being transferred in order to set the brake balance correctly.

If our two cars from above both weight 1,000 kilos and transferred 250 kilos front to rear under optimum braking then the following is happening.

Weight Distribution Static = 50% : 50% = 500kg : 500kg

Front
50% / 500 kilos

Rear
50% / 500 kilos
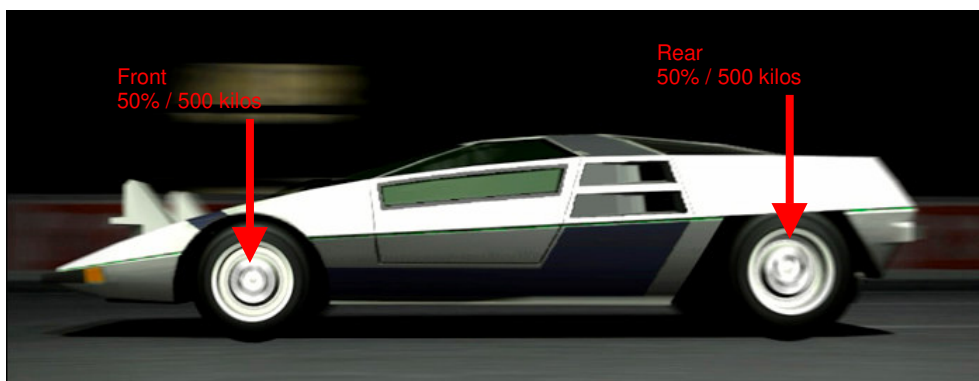
Under Braking = 750kg : 250kg = 75% : 25%

Front
75% / 750 kilos

Rear to Front
Weight Transfer
250 kilos

Rear
25% / 250 kilos
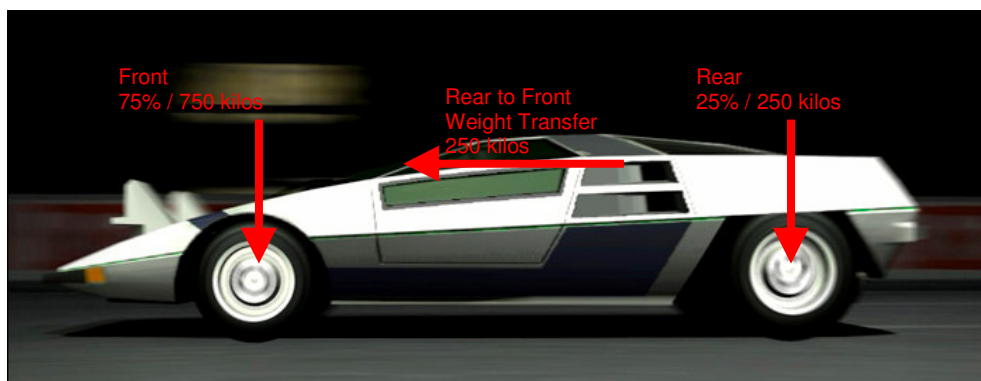
So the brake bias would go from our static setting of 3/3 to a setting of 4.5 / 1.5

Car B

Weight Distribution Static = 60% : 40% = 600kg : 400kg

Under Braking = 850kg : 150kg = 85% : 15 %

So the brake bias would go from our static setting of 3.6 / 2.4 to a setting of 5.1 / 0.9

Damn Decimal Points

Once again we have decimal points getting in the way of things; only trial and error will show which way around to 'round the values to.

With car A above I would try both 4/1 (80%:20%) and 5/2 (71%:29%) to see which one worked best.

With Car B I would try 5 / 1 (83.3% : 16.7%) and 6 / 1 (85.7% : 14.3%)

Making Progress

So why not just increase the values until you get a ratio that is right? For example Car A could run with a brake balance of 9 / 3, which would give 75% : 25%, however this may or may not work, depending on the tyres and the driver.

As has been discussed above the brake balance controller does not just control the ratio, but also the level of force applied. Set it too high and the ABS will kick in and you will end up increasing you braking distances. You may be able to control this through good brake modulation (use the brake force indicator in the HUD as a guide).

Once again trail and error is one of the best ways of determining what the setting should be, for example our car B may have the following setting dependent on tyre.

N's = 6 / 1 (85.7% : 14.3%)

S's = 11 / 2 (84.6% : 15.4%)

R's = 17 / 3 (85% : 15%)

The Importance of Testing

Now the above is just the theory and advice to give you some basic settings to start with, but as with all things in tuning, the only way you will know what works is to play around with the car and the settings.

Remember that the above is a guide only and the most difficult thing to judge is going to be the amount of weight transferred. Keep in mind that the only adjustments in GT4 that will effect the amount of weight

transferred are the following:

Weight Reduction 1 - 3
Ride height adjustment
Ballast

Keep brake balance in mind if you change any of the above.

For testing I would recommend using the data-logger to check on braking distances on a variety of circuits, I tend to use the Test Course a lot as it allows around 5 - 6 stops from 100mph to be analysed in a single lap.

What the Brake Balance controller is not for.

With a few exceptions I would never recommend using the brake balance controller to trim understeer or oversteer (despite what the GT4 screens say). Use of the brake balance controller to do this can and does have a serious effect on braking distances.

You have plenty of other tools to manage under and over steer in the spring rates, ride height, damper and roll-bar settings. These give you more then enough to do what you need, leave the brake balance to maximise your braking performance and ensure stability under braking.

The only exception to this would be in setting a car up to drift, here outright lap-times are rarely an issue and a high rear bias will cause the rears to lock first making it easier to initiate a drift. Once again, however, care needs to be taken with the settings

Racing Brakes

The fitting of racing brakes in GT4 is one that has caused some concern, as at times the effects of the upgrade are hard to detect. In extensive testing with Normal and Sports tyres the fitting of racing brakes makes no difference in the straight-line stopping distance of the car.

I ran a series of 100mph to 0mph brake tests, twelve runs on each of the five racing tyres, six of the runs with the racing brakes fitted and six without. The average of the runs is then used for comparison. The car used is a stock (apart from the tyres and brakes) BMW M3.

Its also worth noting that all the figures below should be viewed with a margin of error in mind, a speed difference of 1mph can mean a 0.2 meter difference in stopping distance. And while I am quite happy with the figures an acceptable margin of error would be around 0.1 meter.

R5 Racing Tyres

Without Racing Brakes = 52.4m
With Racing Brakes = 51.5m
Difference = 0.9m

R4 Racing Tyres

Without Racing Brakes = 56m
With Racing Brakes = 55.3m
Difference = 0.7m

R3 Racing Tyres

Without Racing Brakes = 59.1m
With Racing Brakes = 58.6m
Difference = 0.5m

R2 Racing Tyres

Without Racing Brakes = 62.8m
With Racing Brakes = 62.6m
Difference = 0.2m

R1 Racing Tyres

Without Racing Brakes = 67.9m
With Racing Brakes = 67.9m
Difference = 0.0m

Conclusion

Well quite a different set of results from the previous tests, it does appear that the additional grip of some of the racing tyres does warrant the use of racing brakes.

Now the above tests would indicate that a benefit can be seen on tyres of R2 or softer compound, the R1 - super hard tyres showing no difference at all. However the advantages are small until you get to R3 tyres or softer and it should also be remembered that a small margin of error will always exist in these tests and that the results are only indicative for this car.

So an amendment to the racing brakes don't have effect statement, its now 'Racing Brakes may have an effect, but only if you are running racing tyres and even then it depends on the compound you are using.

My recommendation, don't bother with the Racing Brakes unless you are running racing tyres and even then it may depend on the compound you are running.

Tyre Selection

Often a forgotten area of tuning, the correct tyre choice can make a huge difference to all areas of the car.

With this in mind, along with the regularly asked question 'which tyres are most like real ones', I set about putting together a number of tests that could then be compared to real world test data. Whatever you choose to do with the following information (a helpful basis for tuning or just setting up the car as close to real both spring to mind). You should always keep in mind that the results I have provided only apply to one car (BMW M3) and are purely indicative, as a margin for error certainly exists within these tests.

I will not be taking about the characteristics of each tyre type, as this is a very, very subjective area. By dealing with the data below I hope it will allow for a slightly more analytical look at this subject.

Even given the above, I hope that you find the results as interesting as I found the testing.

Lateral G Tests
Using a scale map of the Grand Valley speedway and a lot of patience I have mapped out approximate radiuses for three of the main corners on the circuit. These three are the two main hairpins and the sweeper after the bridge.

The approximate radius for each of these corners is:

1st Hairpin 193 ft
2nd Hairpin 110 ft
Sweeper 359 ft

Once the radius of each corner was found it was possible to calculate the cornering speed for a 1g car. From this the lateral g of a GT4 BMW M3 with a range of tyres fitted could be calculated.

The formula I have used is taken from Skip Barber's book 'Speed Matter' and is a slightly simplified version of the one found in the Physics of Racing series.

The formula is

$15 * G * R = MPH2$

G = lateral G and R = Corner Radius in feet
MPH2 = Cornering speed in MPH, squared.

For example a 1g car in a 100 foot radius corner, would have a maximum cornering speed of:

$15 * 1 * 100 = 1,500$

$1,500 = 38.73$ mph

This calculation actually gives an accurate indication of a cars maximum cornering speed for a corner of a given radius.
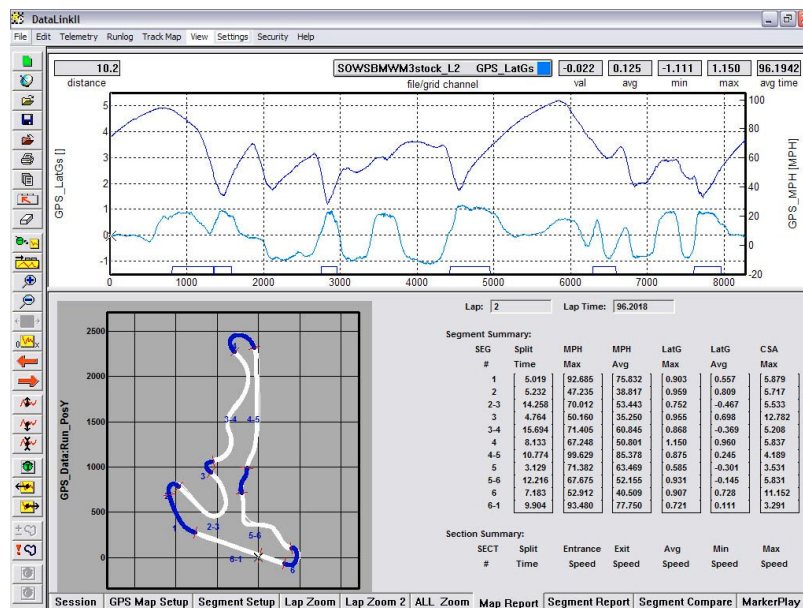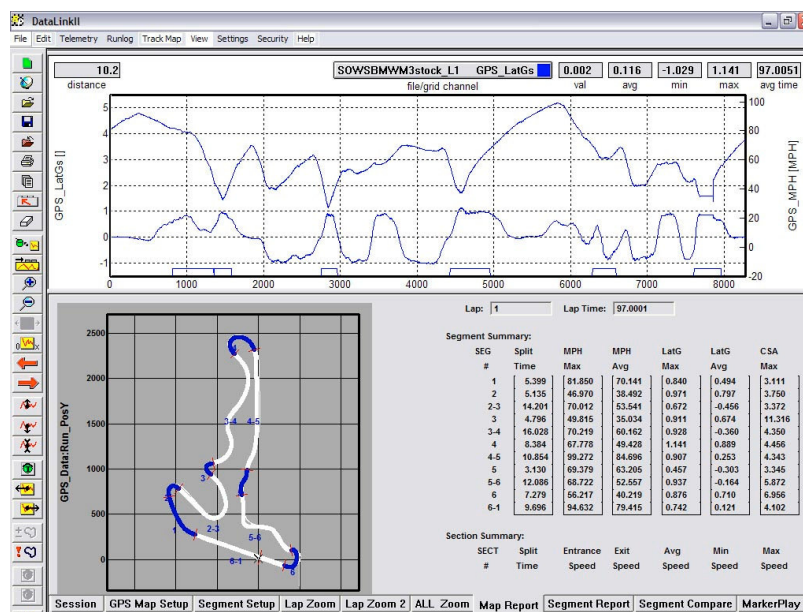
When looking at the results below you should always keep in mind that while the calculation above is very valid, the corner radius figures are approximate calculations and the speeds taken from the data logger as a high average cornering speed.

Additionally while lateral g figures are a very useful indicator of both a cars cornering ability and the tyres level of grip, they are not easily transferable. Just because an M3 corners at Xg around a certain corner does not mean another car can on the same tyre type. As I mentioned above, they results will be indicative, not absolute.

For comparison I have found actual test telemetry data for a BMW M3, now while the radius of the corners is not shown in this data, taken over two laps the results are linked below.

Lap: 1   Lap Time: 97.0001

Segment Summary:

SEG #	Split Time	MPH Max	MPH Avg	LatG Max	LatG Avg	CSA Max
1	5.399	81.850	70.141	0.840	0.494	3.111
2	5.135	46.970	38.492	0.971	0.797	3.750
2-3	14.201	70.012	53.541	0.672	-0.456	3.372
3	4.796	49.815	35.034	0.911	0.674	11.316
3-4	16.028	70.219	60.162	0.928	-0.360	4.350
4	8.384	67.778	49.428	1.141	0.889	4.456
4-5	10.854	99.272	84.696	0.907	0.253	4.343
5	3.130	69.379	63.205	0.457	-0.303	3.345
5-6	12.086	68.722	52.557	0.937	-0.164	5.872
6	7.279	56.217	40.219	0.876	0.710	6.956
6-1	9.696	94.632	79.415	0.742	0.121	4.102

Section Summary:

SECT #	Split Time	Entrance Speed	Exit Speed	Avg Speed	Min Speed	Max Speed

Lap: 2   Lap Time: 96.2018

Segment Summary:

SEG #	Split Time	MPH Max	MPH Avg	LatG Max	LatG Avg	CSA Max
1	5.019	92.685	75.832	0.903	0.557	5.879
2	5.232	47.235	38.817	0.959	0.809	5.717
2-3	14.258	70.012	53.443	0.752	-0.467	5.533
3	4.764	50.160	35.250	0.955	0.698	12.782
3-4	15.694	71.405	60.845	0.868	-0.369	5.208
4	8.133	67.248	50.801	1.150	0.960	5.837
4-5	10.774	99.629	85.378	0.875	0.245	4.189
5	3.129	71.382	63.469	0.585	-0.301	3.531
5-6	12.216	67.675	52.155	0.931	-0.145	5.831
6	7.183	52.912	40.509	0.907	0.728	11.152
6-1	9.904	93.480	77.750	0.721	0.111	3.291

Section Summary:

SECT #	Split Time	Entrance Speed	Exit Speed	Avg Speed	Min Speed	Max Speed

Making Progress

The main corners of interest here are 2, 3 and 4; which indicate that a stock BMW M3 has a peak Lateral g of 1.15 and can maintain an average g as high as 0.96. It's these two figures I will mainly be looking at for comparison.

Acceleration and Deceleration Tests

The second set of tests will be looking at the standard test data from the UK magazine Autocar; it covers a range of acceleration and decelerations tests, some through the gears and others in a set gear.

The Autocar test in question was carried out on 14.02.01, which can be found on the Autocar website.

In addition I also used the 0-100-0 test figures from the 2003 Autocar 0-100-0 tests, links to this can be found on the first page of the GT4 & Brakes thread.

These tests will be carried out with the tyres from the first test that most closely match real world figures for lateral g.

Results – Lateral G

Table 1 (below) shows the details of the Lateral G results for each tyre type tested, along with the corresponding speed (in MPH), lap time and average speed.

BMW M3 Stock - Grand Valley Speedway

Tyre	1st Hairpin Speed	1st Hairpin Lat. G	2nd Hairpin Speed	2nd Hairpin Lat. G	Sweeper Speed	Sweeper Lat. G	Lap Time	Av. Speed
N1	48.4	0.81	37.5	0.85	65.9	0.81	2.26:722	75.33
N2	53.9	1.00	42.6	1.10	72.9	0.99	2.19:214	79.39
N3	55.4	1.06	43.3	1.14	73.2	1.00	2.16:042	81.24
S2	59.6	1.23	44.9	1.22	75.8	1.07	2.11:211	84.23
R1	62.5	1.35	47.2	1.35	78.3	1.14	2.07:251	86.85
R5 (qual)	69.8	1.68	52.1	1.64	91.9	1.56	1.59:279	92.66
1g Car	53.8	1.00	40.62	1.00	73.38	1.00	NA	NA

The tyre type that most closely matches that of the real world test data are the N2 tyres, with a Lateral g range of 0.99 & 1.1.

N1 tyres grip level was well below that of the real test data, and while the N3 tyres were close, they remain a little on the high side. One thing that is of interest, that some may not be aware of, is how much of a difference in overall laptime a small increase in cornering speed gives. Over the three corners measured, the N3 tyres increased cornering speed by 1.5mph, 0.7mph and 0.3mph respectively, but in total the reduction in laptime was 3.172 seconds.

The S2 tyres take the level of grip in the realm of track-only tyres, while the R spec tyres increased the cornering forces and speeds to very high levels. This is particularly clear to see in the R5 tyres, which recorded a high of 1.68g, which for a stock M3 is amazing.

To put into context, on the final sweeper the cornering speed difference between N2 and R5 tyres is an astonishing 19mph.

The two tyres I took forward to the second set of tests are the N2 and N3 tyres, so let's have a look at what happened here.

Results - Acceleration and Deceleration

The two sets of tests are both taken from the UK magazine 'Autocar', and consist of the figures from the original roadtest (dated 14/2/01) and the 2003 0-100-0mph test.

The two sets of data were obtained from a number of separate runs, and conducted with all driver aids switched off. The two tyre types used were the N2 and N3 spec, and the results compared with the actual Autocar figures. Obviously some margin has to be allowed with regard to the results, to account for the differences in real world conditions and GT4 conditions.

BMW M3 Stock Roadtest Data

	RL	N2	N3
0-30mph	2.00	2.34	2.16
0-60mph	4.80	5.78	5.48
0-100mph	11.50	12.52	12.16
30-70mph	4.10	3.94	3.92
0-400m	13.4 / 107mph	14.215 / 106mph	13.975 / 106mph
0-1,000m	23.7 / 139mph	25.043 / 139mph	24.59 / 140mph
30-50mph (3/4)	3.00 / 4.50	3.40 / 5.74	3.40 / 5.66
40-60mph (4/5)	4.10 / 5.40	5.00 / 7.16	5.00 / 7.04
50-70mph (5/6)	5.40 / 7.70	6.64 / 9.76	5.76 / 9.34
60-0mph	2.60	2.70	2.50
Top Speed (mph)	160.00	182.59	182.76

BMW M3 Stock 0-100-0 Data

	RL	N2	N3
0-30mph	2.01	2.32	2.10
0-60mph	5.00	5.86	5.58
0-100mph	12.12	12.54	12.18
Reaction Time	0.31	0.60	0.32
100-0	4.61	4.16	4.14
Total	17.04	17.30	16.64
-RT	16.73	16.70	16.32

Starting with the through the gears roadtest results, the N2 tyres posted times slower that the Autocar figures, with the N3 tyres posting closer times. The difference between the N3 and Autocar figures could be improved on by cleaner launches (no driver aids remember), as the 30-70mph through the gears figures are very close.

The 60-0mph brake test figures are almost exact matches with both the N2 and N3 tyres, while the top speed test is a bit misleading as a standard M3 is limited to 155mph (although BMW speed limiters are always a bit generous) GT4 does not 'limit' any cars top speed.

The set of figures that differ the most are the in-gear acceleration results, in each and every case the GT4 M3 is slower. Now it's interesting to note that in-gear acceleration of this type is not something you would normally do on track. It really is a representation of a drivetrain's flexibility when driving on-road in the real world.

When racing and in GT4 you would not accelerate from 50 to 70 mph using only fifth or sixth gear. As a result it is unlikely to effect driving in GT4, but it does appear to be an area that was not considered to be 'important' in GT4.

Making Progress

It is also important to remember that at present I only have data for the M3 with regard to this; further testing will be required to see if this is a common issue.

The 0-100-0 mph tests were carried out separately from the roadtest results. The two tyre types both performed well in the run through the gears to 100mph, with the times at each increment being close to the Autocar results, again with the N3 tyres being the closest to 100mph, better launches may improve on these.

The 100-0 times for both tyres easily beat the real world times, and these back up my finding from past 0-100-0 tests I have carried out (see the GT4 & Brakes thread). The N3's creeping slightly ahead here.

If the reaction time is removed from the times, it can be seen that overall the N2 tyres are very close to the final Autocar time, with the N3 tyres ahead slightly.

Conclusion

Given the above I would say that the N2 tyres seem to be the closest match for real world M3 figures, for the majority of the tests, and better launches on my part may improve on this. The N3 tyres on balance have just slightly too much grip in the lateral G tests and while close on the Roadtest, I feel that the difference it makes in average speed and laptime is just too great.

Example of a Tune

This final section is an example of how I go about creating a set-up, it is not meant to be a step by step guide, more to prove an idea of how tuning can be achieved.

I am more than aware that many people reading have their own method, and this is not meant to replace or critique those methods. More to provide those who have no idea how to start with an example of how tuning can be approached.

The car in question is a BMW M3 CSL, and apart from the fitting of Fully Customisable Suspension and a Brake Balance Controller, the car is totally 'stock'. It will be running on S2 tyres, as supplied with the car, and the track for this set-up will be the Grand Valley Speedway.

Grand Valley Speedway is an excellent track for practising set-up work as it is smooth, with low curbs but an excellent mixture of corners. Also thrown in are some very challenging braking sections, particularly at the end of the start/finish straight.

The initial run on default settings indicates a car that is well balanced, with fair turn-in, an understeer bias in both corner entry and constant radius corners. Corner exit is biased towards oversteer and the car does feel a little stiff.

The Brakes

I almost always start with the brakes, and a number of runs down the straight with some braking from around 130mph allowing me to set the front bias higher (from 3 to 5). I also raise the rear bias (from 3 to 4),

as the CSL has good control of weight transfer under braking, mainly due to the 'intelligent weight reduction' that BMW carried out when designing this car. The fitting of a carbon fibre roof was inspired in this regard, significantly lowering the centre of gravity.

Once happy with the brakes (for now – I almost always end up changing then as I go along) I move onto the second stage.

The Track

The track is the next area for my attention, and dampers always my starting point here. As I discussed in the Damper section, in my opinion GT4's default damper settings are normally too high, in this case I started with a drop to 6 (from 8) both front and rear, and bound and rebound.

Testing this resulted in a much better feel, the rebound felt very good, the car was however still a little harsh over the rubble-strips. A quick tweak of the rebound to 5 improved things a little. Another 'click' softer to 4 and I was happy, with the CSL running well over the curbs and rumble-strips.

Given the flat nature of the circuit and the low curbs and rumble-strips I then played with the Ride Height, dropping it in stages and testing until I got to 79 (from 84). This helped with the weight transfer and still allowed the car to make use of the curbs when needed without bottoming out.

On testing this did however reveal that the brakes had started to

Making Progress

become a little snatchy, possibly a result of the ride height drop playing with the weight transfer. Lowering the brake bias to 4/3 (from 5/4) solved this one.

The springs also felt a little to hard, the CSL's default settings are hard to start with, and while the car can handle a high spring rate, they were a little much for my liking. Again in stages I softened them to 13.4/11.6 (from 14.4/12.6)

Moving On

It may have come to your attention by now that I have not attempted to resolve any of the car's issues with understeer, oversteer, turn-in, etc. Out of habit I always tune the cars brakes and set it up for the track first, I find that this allows me to totally concentrate on tuning the handling, only needing to tweak for the track surface and brakes from this point on. This is the reason I have, to this point, changed front and rear settings by the same amount.

I also do not discuss lap times, as I believe that a good set-up is best developed by consistent lap times. This allows me to know what has worked and what has not from how the car handles each corner. A good setting could be lost in a rushed lap filled with mistakes, in my mind its better to get the set-up right and I find the speed will come from this.

Tuning for Handling

Happy, for now, with the brake and track settings, I now moved on to look at the handling. The changes made during the track set-up had already slightly reduced the corner entry understeer and corner exit oversteer, again a reason why I turn for the track first.

The front end still felt stiff and a little reluctant to turn-in, I started with the stiff feel and softened the front Anti-Roll Bar from 5 to 3, on testing this helped on the corner entry, but the now much stiffer rear was kicking the back end out. Softening the rear Anti-Roll Bar to 4 (from 5) helped bring this back in check.

This had also helped with the initial turn-in a little, but grip was still lacking a little, so I popped on a +1 front toe setting. The toe-out here did just the job, helping with the grip on the turn-in.

I still felt that the car has a little too much understeer on corner entry, so I softened the front springs, first to 13 and then to 12.5 (from 13.4). Again testing each setting to get a feel for what was needed.

While this had helped it still retained a touch too much understeer, mainly under weight transfer, so the dampers seemed to be the place to look. I was reluctant to soften the rear anymore, so I tried the front with a setting of 5/7 (from 4/6), which seemed to do the trick. Now this last step may seem a little strange as I have stiffened the front to reduce understeer! Fear not; remember that in corner entry the weight of the car has moved forward, so the front may need to be a little stiffer anyway.

I have not touched the camber settings, as the default values seemed idea for me, remember you don't have to change a setting from default just because you can. If it works leave it as it is.

The table below shows how the car started and the final settings from the above tune.

Default		Setting	Scaff's set-up	
Front	Rear		Front	Rear
14.4	12.6	Spring Rate	12.5	11.6
84	84	Ride Height	79	79
8	8	Bound	5	4
8	8	Rebound	7	6
2	1	Camber	2	1
0	0	Toe	+1	0
5	5	Anti-Roll Bars	3	4
3	3	Brake Bias	4	3

In closing I hope that you find the above example of a set-up interesting, and while the final settings will not suit everyone, nor would I expect them to, I do hope that they have a least been a good read.

Please take what information you need from this guide and if only one small section is of interest to you; then I have achieved my aim.

Regards

Scaff