Hi everybody,

no surprise, this is a long one again.

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1 Foreword

As the title suggests, this guide is equally aimed at drivers who never thought about a suitable car setup and drivers who aim for a sophisticated setup that serves their specific needs and driving style. I'll focus in the first paragraphs mainly on exposition and explanation, chiefly because I got feedback from my first post on this topic (see Changelog at the very bottom) that some drivers never realised car setups had such a big influence on handling. Further, I intend this to be structured, perspicuous and informative, just like my article about the performance of AA and AF in Assetto Corsa. The assertions in this article are based on three things: empirical evidence, my personal opinion I formed from 15 years of driving experience beginning with Gran Turismo 1 and many hours tweeking setups for a particular car & track combination in Assetto Corsa itself. Whereas bullet points are factually accurate, the prosa

text, maked as "**Notes**" after each point of interest, is comprised more of my opinion, obersevation and cross-connections rather than undisputable facts. The "Notes" also contain more detailed information and may serve more intermediate or advanced drivers. Although, to my knowledge, these settings are applicable to real-life cars as well, I'm not a professional racing driver or a racing engineer by any means - this article is designed for a racing-simulation after all. All adjustable settings in Asetto Corsa are represented. Finally, this article is primarily intented for (RWD) race cars with fully adjustable suspension and the lot (not for Drift mode), although basic settings for street cars are still valid.

2 Setup goals

Simply put, the goal of a good setup is to configure a particular car for a particular track - to convert all available power and performance a car has to offer into specific criteria that you and/or the track demand to be competetive. This setup is conditional upon three factors: track, car and the driver itself.

2.1 Track

As examples, the Autodromo Nationale di Monza demands high top speed, because of the long straights this track features. If you don't setup your car accordingly, you are going to be slow and prone to being overtaken by your fellow competitors. Conversely, the Circuit de Barcelona-Catalunya in Spain demands high downforce and a balanced car, because of the numerous and elongated corners with high lateral G-forces. With a setup designed to gain an advantage in certain areas of a track, for instance high speed corners, you may facilitate yourself more chances to overtake someone: higher speed through T1 on Silverstone GP may grand you overtakes in T3.
Inform youself therefore about the features of a track by doing some quick research and/or drive a couple of laps and use your judgement.

2.2 Car

Has the car its engine in the front, middle or like a RUF in the back? As the heaviest part of a car, the placement of the engine dictates the inherent driving characteristics of a certain car. A front-wheel-drive/front-engined Abarth 500 will have inherent understeer and the front wheels are taxed with both steering and putting the power down. A rear-wheel-drive/front-engined BMW will have inherent oversteer, but good traction out of the corners. A rear-wheel-drive/rear-engined RUF will have loads of mechanical grip, because its engine will press the rear wheels into the ground. A rear-wheel-drive/mid-engined McLaren will be inherently twitchy, but has more balance than the others.
Be conscious of the basic layout of your car, play to its strenghts and limit its weaknesses to gain an advantage over your rivals.

2.3 Driver

The debate that's been going on in Formula 1 over the decades, whether the driver makes up 10, 20 or 22,6 percent of the package is really superfluous. Even if the true percentage were to be the former, it is still a sizable chunk of performance. In the GT classes or the BTCC, where cars are homogenised, driving prowess and style is even more important.
This is probably worth a new article about driving technique, however be advised to do the following:
Be aware of your personal attitude: are you comfortable with a twitchy but agile car and are able to catch slides quickly and reliably? Then you would have less trouble with oversteer. Do you value consistency and stability above all else? Then look for a compliant, neutral handling car or with slight understeer. Talk to your fellow sim-racing drivers, watch cockpit

views from professional racing drivers like Rene Rast on Youtube and others.

3 Setup criteria

The following criteria list serves as a reminder what a driver may obtain and what a track/situation may demand from a car. Important criteria are key for overall drivability and whether a driver has confidence in the bahavior of a car. Optional criteria are 'quality of life' features that make a driver's life 'easier'. This list may not be complete.

3.1 Important

- Suitable gear ratios (track dependant)
- Braking stability
- Turn-in willingness
- Prevention of sudden change from under- to oversteer mid-corner and vice versa
- High-speed corner balance
- Prevention of snap-oversteer on turn-in
- Prevention of lift-off-oversteer
- Reliability of steering precision and agility
- Traction on corner exit
- Stability and agility through chicanes
- Weight transfer stability though S-corners and chicanes
- Stability during slides
- Evenly distributed tyre degredation (e.g. over a race distance)

3.2 Optional

- Top speed
- Lateral grip mid corner
- Prevention of oscillation of suspension/dampers after bump
- Optimal tyre temperatures
- Optimal braking distance
- Bottom-out of car

4 Adjustable settings

4.0.1 Important clarification on nomenclature and symbols

If not otherwise stated by heading or caption, bullet points take effect if the corresponding value is increased, like with **4.4 Camber** or **4.3 Damper** settings.
Example: the front bound rate is (symmetrically) increased, the effects are:
"+ Increases precision and agility on steering imput (important for chicanes)"
"- Chance to unreliably loose lateral grip resulting in understeer, if set too high"
The "+" indicates a positive effect, a "**-**" a negative effect.
The following setup options are in no exact order, however those high on the list (4.1, 4.2, ...) have generally a bigger influence on overall handling.

4.1 Spring Rates

Soft
+ Allows the car to react to bumps and track imperfections without losing traction
+ Generally, increases grip in all circumstances

- Requires a ride height tall enough to prevent bottom-out of car
Stiff
+ Minimises roll under weight transfer allowing a lower ride height to be used
- Can cause the car to skip or jump over bumps and imperfections resulting in a loss of traction

Overview
-> Front stiffer - increases understeer | Front softer - decreases understeer
-> Rear stiffer - increases overstreer | Rear softer - decreases oversteer

Notes: Spring rates have the biggest effect on a car's handling. Set these first and work with other values around them. Keep in mind, that changing the spring rate will effect the ride height. A swtich from soft tyres for Qualifying to a harder compound for the race may just need other spring rate values - most other characteristics of the car may not vary.

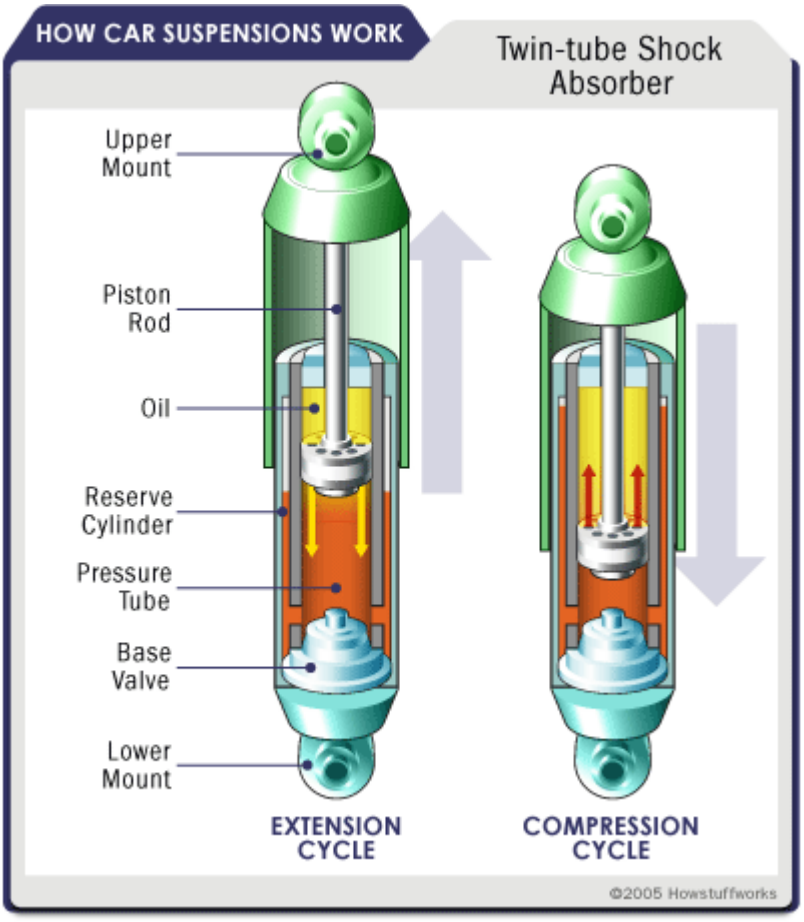
4.2 Ride Height
Low
+ Reduces weight transfer under braking, acceleration and cornering, allows stiffer springs
+ Generally makes you faster
(be advised of dive and squat of the front suspension)
- Increases risk of bottom-out of the car
High
+ Ensures car does not bottom-out over bumpy tracks, allows softer springs
- Increases weight transfer under braking, acceleration and cornering

Balance
-> increase in height front / decrease rear
+ stability on brake lift-off
- understeer

Overview
-> Front high - increases understeer | Front low - decreases understeer
-> Rear high - increases oversteer | Rear low - decreases oversteer

Notes: A level car at stand still reacts more naturally. Is the rear higher than the front, the car will be more prone to oversteer - vice versa for understeer. Seek a level and straight road for ride height setups. Remember to empty the fuel tank before tweeking. For endurance races with high fuel load, consider driving characteristics at the start of the race with ones at the end. Go from min to max fuel and watch the change in height and height balance to figure out where the fuel tank most likely sits and take action accordingly.

4.3 Damper settings



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4.3.1 In general
High
+ Allows the suspension to react quickly to bumpy surfaces, retaining traction
- Speeds up transition to over-understeer
Low
+ Slows down transition to over-understeer
- Skips over bumpy surfaces as the suspension can't react quickly enough

Overview
-> Front stiff - increases understeer | Front soft - decreases understeer
-> Rear stiff - increases oversteer | Rear soft - decreases oversteer

4.3.2 Specific

4.3.2.1 Bound (Bump in AC)
Front
+ Increases precision and agility on steering imput (important for chicanes)
- Chance to unreliably loose lateral grip resulting in understeer, if set too high
+/- Increases tyre tempereatures slightly
Rear
+ Increases precision
+ Increases braking stability

- Car will be more prone to oversteer under acceleration (snap-oversteer) and braking (lift-off-oversteer)
- Car will be more susceptible to inertia movements
+/- Increases tyre temperatures slightly

4.3.2.2 Rebound

Front
+ Increases stability under acceleration and fast direction changes (chicanes)
+ Increases grip under acceleration
- Decreases agility on fast direction changes
Rear
+ Gives faster turn-out of tight corners (faster and easier to drive)
- Decreases stability on initial turn-in

4.3.2.3 First Bound

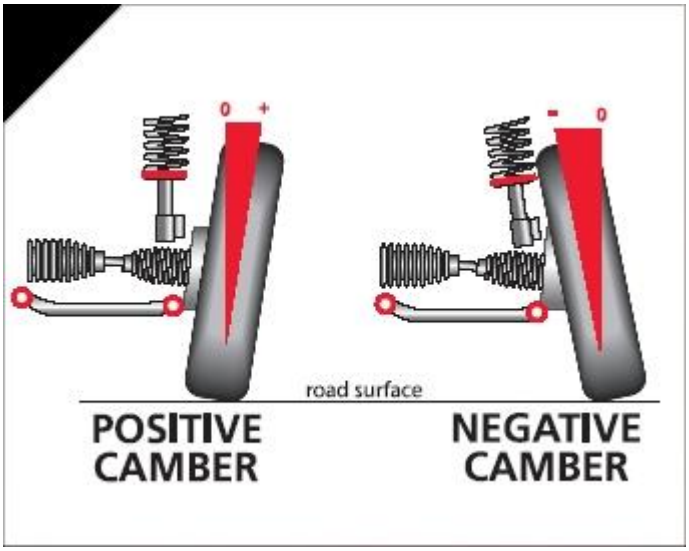
Front / Rear
+ Increases tyre contact on bumpy tracks (Nürburgring) and therefore grip
+ Only a correct value will mostly negate undesirable oscillation of entire suspension after hitting a (high) curb
- Decreases grip on mostly smooth tracks (Vallelunga, Silverstone) -> decrease First bound rate to gain grip on smooth tracks

4.3.2.4 First Rebound

Front / Rear
+ Value eligible to delicately balance over- and understeer on corner entry and -exit
- Must be adjusted in concert with First-bound rate

Notes: Be delicate with Damper settings. One value plus or minus will have a tangible effect - less for First bound and -rebound values. The rebound rate should always be higher than the bound rate. The First bound and -rebound rate is a seperate thing, test it at high curbs, e.g. at Turn 12 on Nürburgring (fast right hander just before the chicane). If you change the bound rate, consider changing the rebound rate accordingly, or the car will be prone to unwanted oscillation of the entire suspension. 'First' -damper settings are suitable to mostly negate undesirable handling changes caused by tyre degredation.

4.4 Camber settings



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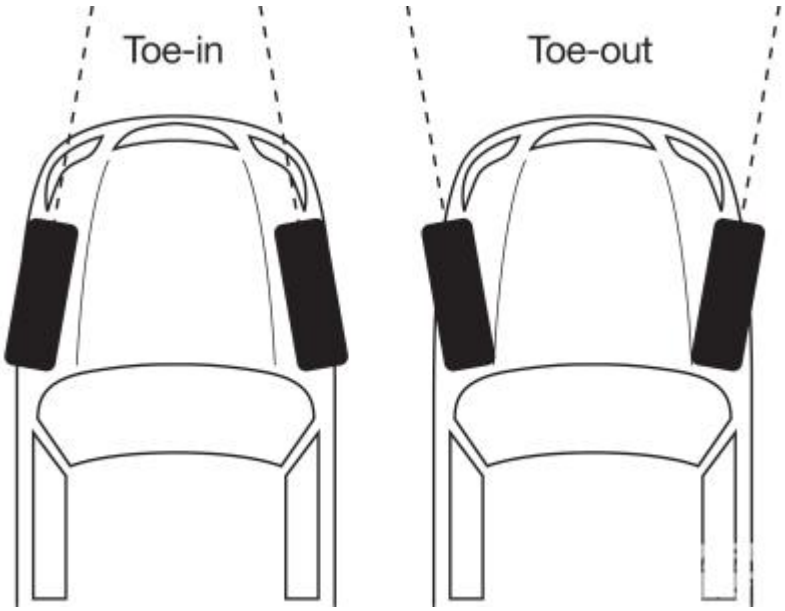
(for more negative camber)
Front
+ Increases cornering grip up to the lateral grip threshold
- Reduces straight-line traction (only for FWD cars) and stability (for all)
- Increases braking distance and instability under braking
+/- Increases tyre temperatures
Rear
+ Increases cornering grip up to the lateral grip threshold
- Reduces straight line traction (exept for FWD cars) and stability (for all)
- increases braking distance and instability under braking
+/- Increases tyre temperatures

Overview
-> Front more - reduces understeer | Front less - increases understeer
-> Rear more - reduces oversteer | Rear less - increases oversteer

Notes: In general, start with low camber values and work your way through. After a certain point, no further lateral grip can be gained - even more camber will result in greater braking distance, -instability and higher (thermal) tyre degredation. Camber settings are great in tuning stability and balance mid-corner, especially through high speed ones. Be careful with increasing rear camber for endurance races - tyre degradation will cause oversteer near the end of the race. Front camber has greater influence in braking distance and stability - even greater for more front brake bias. Don't be fooled by asymmetrical camber values in the right window during stand-still in pit lane - the car sits not level then: e.g. on Silverstone and Nürburgring.

4.5 Toe settings



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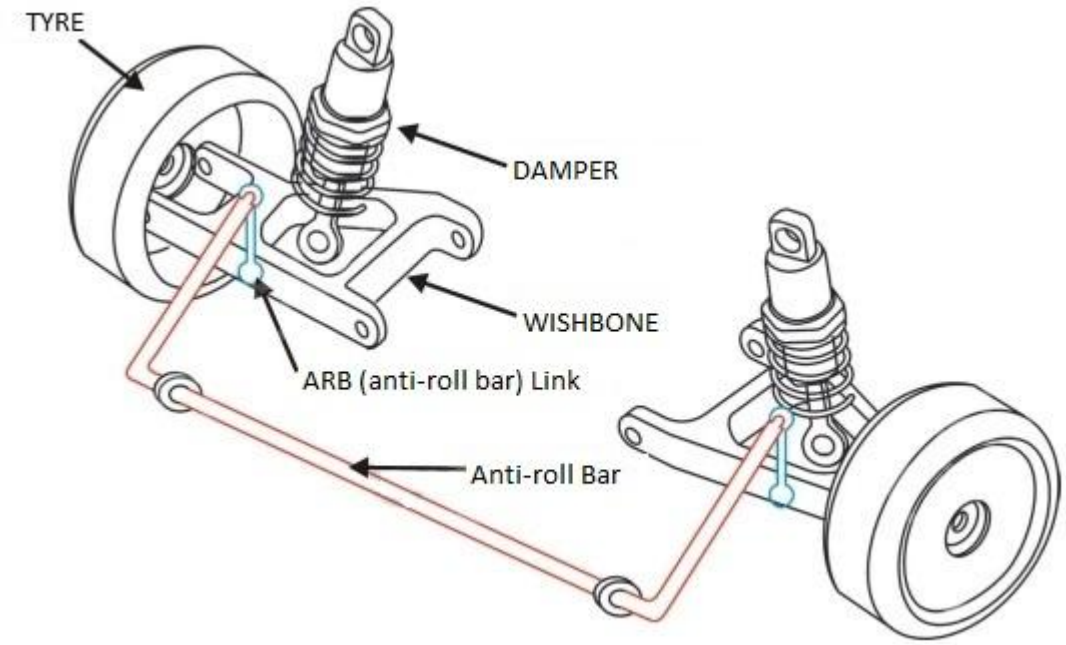
Don't mess with Toe.
Toe values away from zero will make you slower.

Front
Toe-Out (negative)
+ May help to compensate for negative camber on the inside wheel during cornering
+ Increases grip on initial turn-in
- Reduces lateral grip mid corner
Toe-In (positive values)
+ May stabilise the car during lift-off and turn-in
- Reduces grip on initial turn-in
Rear
Toe-Out (negative)
+ Don't bother
- Increases lift-off oversteer
- Makes the car prone to snap-oversteer
- Dangerous
Toe-In (positive)
+ Increases stability under braking and straight line
- Increases turn resistance and understeer

Notes: Toe values away from zero create an artifical slip angle. Increasing Toe-In (positive values) at the rear is a common and effective practice to increase stability under braking. Generally, the rear toe values have a much higher impact on handling than the front ones.

4.6 Anti-role bars



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Naturally, anti-role bars only come into effect during cornering.

Soft
+ The car may manage bumps well
+ Improves feel and complience of the car
- Can cause the car to bottom out during corner roll
- Soft role bars may require greater ride height or stiffer springs in order to work properly

Stiff
+ Reduced risk of bottom-out of car
+ May allow for lower ride height
+ Increases stability
- May result in loss of traction
+/- Car feels dartier (reacts faster to steering input)

Overview
-> Front stiff - increases understeer | Front soft - decreases understeer
-> Rear stiff - increases oversteer | Rear soft - decreases oversteer

Notes: Be gentle with Anti-role bars. Set them low first and work your way through. Be wary with the ratio 'front to rear' ARB settings. This is most evident through high speed corners. A well tuned ratio will give you stability and predictability and therefore faster lap times.

4.7 Brake bias
Overview
-> More bias at the rear - increases oversteer
-> More bias at the front - increases understeer
-> Correct bias results in stability and predictability during braking and turn-in

Notes: The default values for the brake bias in Assetto Corsa follow the natural driving

characteristics of a particular car. The Z4 GT3 for instance has great front brake bias, because of the long bonnet and heavy front structure. Don't mess with the brake bias too much. You may shift the brake bias towards the rear in an attempt to decrease braking distance. Do so one point at a time, until you experience instability under braking. After, apply one point bias to the front for stability and reliability. You may apply more Toe-In (postive) in order to increase braking stability, albeit sacrificing performance during cornering.

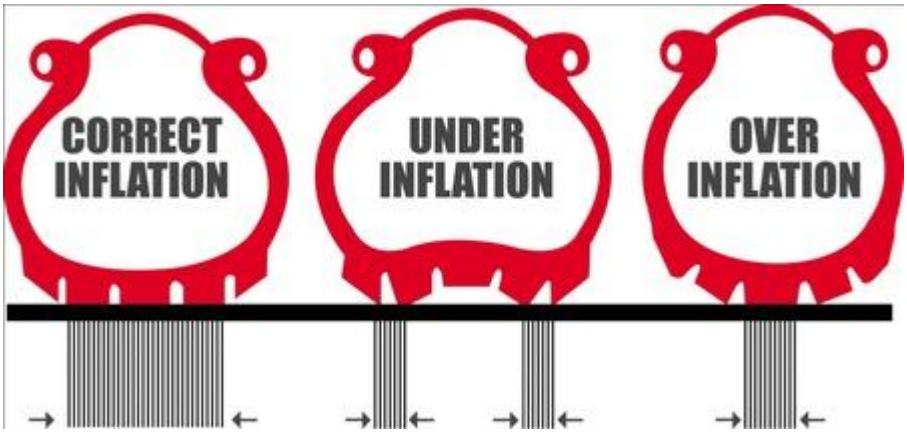
4.8 Gear ratios

Correct gear ratios are achieved following these steps (use pen and paper to write down speeds):

1. Write down your gear ratios (including final ratio), gears and their corresponding top speeds you have at hand.
2. Drive down the longest straight of the track until you hit the rev-limiter in top gear (adjust top gear if needed) right at the end of the straight (just at the braking point).
3. Apply one tick plus at your top gear (for room to gain higher speeds in slipstream) - write down your maximum speed (Vmax).
4. Look at maximum speed detlas between the gears, except 1st and 2nd, and adjust them for the lowest variance - the deltas should be as even as possible - better still if the deltas of high gears are lower than the ones of lower gears. Play with the final gear ratio to optimise the delta variance.
5. Drive a couple of laps on the track - pay attention if you have to shift either mid corner (which in general should not happen) or just before a braking point.
6. Decide which gear to use in what corner and shorten / lenghten your ratios - repeat step 4.
7. If the speed deltas are too great, consider using another gear.
8. If you cannot find the right ratios or you run out of adjustable space, change the final gear ratio - repeat step 5, then step 6.
9. Concerning 1st gear: put on the tyres you want to use during the race and practice starts from standstill with cold tyres - the revs shouldn't tank and shouldn't hit the limiter immediatly after the start - adjust your 1st gear accordingly.

Notes: The reasons for all this are manyfold: to avoid changing gear mid-corner, which upsets the car in one way or the other - to gain enough top speed down the longest straight, but not waste performance - to avoid changing gear just before a braking point, which costs you time on track and may divert your concentration from the important braking point and eventual steering corrections you have to apply - to have a clean getaway at the start (1st gear), where places can easily be gained or lost.
Concerning gear delta variance: you want to hold the revs of a car in the optimum range for best power and torque (prime example is the heavily turbocharged Ferrari F40). Look at the corresponding curves in the car info screen.

4.9 Tyre pressure / Tyre temperature



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Pressure values
+ Increases precision and agility
+/- Increases tyre temperatures
- Too much or too little pressure reduces contact patch of the tyres (see graphic on top)

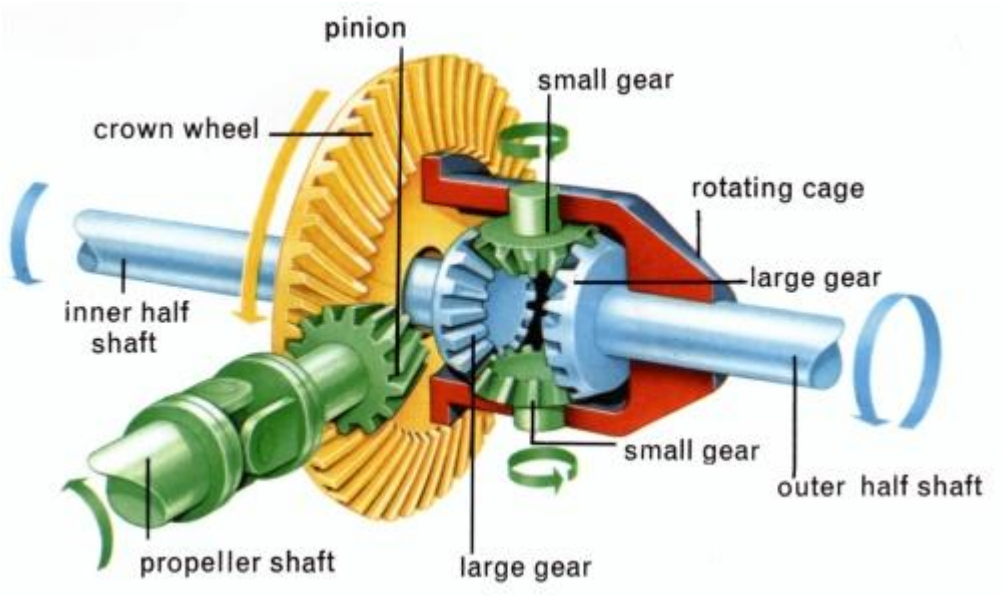
Overview
-> more pressure front - increases understeer | less - increases oversteer
-> more pressure rear - increasses oversteer | less - increases understeer

Notes: Oftentimes, changing the tyre pressure shouldn't be necessary and may be considered if other settings are exhausted or are undesirable to change. Different pressures in the front than in the rear change the handling noticeably. Keep in mind, that the combined surface area of the tyres that is actually touching the road is quite small - all the power, suspension, differential, camber and so on goes though there.

4.10 Tyre compounds and optimal tyre temperatures (Source)

- Road legal tyres: mainly affected by thermal degredation, no exact value applicable
- Street tyres: 75 - 85°C, easy to overheat
- Semi-Slicks: 75 - 100°C, keep in that range for optimal performance, have gradual wear
- GT2 Supersoft: 90 - 105°C, super fast wear, keep in that range
- GT2 Soft: 90 - 105°C, fast wear, keep in that range
- GT2 Meduim: 85 - 105°C, gradual wear
- GT2 Hard: 80 - 100°C, after some laps stay stable for a long time
- GT2 Superhard: 80 - 100°C, same as Hard
- GT3 Soft: 80 - 110°C, super fast wear
- GT3 Meduim: 75 - 105°C, linear wear
- GT3 Hard: 70 - 100°C, same as GT2 Hard
- Hypercar tyres (Zonda R / 599XX), no exact value applicable
- Vintage F1 '67 tyres: 50 - 90°C, gradual wear

4.11 Differential (Increase = more lock)



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Differential on acceleration (Diff: Power)
+/- Decreases understeer, especially out of tight corners
+/- Increases oversteer
+/- Decreases spin of the tyre without grip
+/- Lowers tyre temperatures slightly

Differential during braking (Diff: Coast)
+ Increases braking stability, effective
- Decreases willingness to turn
+/- Increases understeer

4.12 Travel range
By decreasing it, this value negates suspension travel and numbs down suspension and dampers. Keep it close to maximum. Slightly lower values at the rear may grant you better traction, though.

4.13 Front and rear wing values
Generally, the rear wing should be as low as possible to gain higher top speed and yes, in contrast to some other games (Gran Turismo, F1 2012) this setting has a measurable effect in Assetto Corsa. However, you should start with a low value and increase it to gain stability through high speed corners and S-corners, if needed. For instance I found the rear wing to be much too high on the Z4 GT3 at default, which is surprising, because it's prone to oversteer. If possible, the front splitter should always be on/engaged - more front end grip with no tangible detriments.

4.14 Fuel load (informative thread here)
This is straightforward: look how much fuel you as an individual driver use with a particular

car & track combination, multiply by the amount of laps you want to go or have to race and there you go. Don't cut it too close, all the setup work, preperation and your race performance is for not, if you run out of fuel just before the last couple of corners.

5 Final notes
Slower cars, like a Abarth 500, may be faster with an appropriate setup for a particular track, because the time delta between a faster 'small' car and a slow 'small' one is greater than a faster 'big' car and a slow 'big' one.
It's vital to alter only (symmetricaly) one value at a time (drive one/two laps afterwards) - you will see and feel the changes right away and able to take action accordingly. More experienced users are able to change more values at one go, because they know what settings fit their driving style and can judge the characteristics of a new car very quickly.

6 Conclusion
In the grand scheme of things, with only a reasonable amount of effort you'll gain many benefits from a good and well-rounded car setup. If you run a particular car & track combination for fun or you decide to participate in one of the well-organized Club- or League-events here at RaceDepartment, you will have a more enjoyable driving experience and can be even prouder of of your achievements, if you put some thought and work into it.

As always, leave your comments, ideas, (furious rebuttles) below.

I think I went overboard. 12 hours work. 3548 words.

Cheers,
George

Changelog:
05.14.14 - original release (heavily modified from 1st post on 04.24.14) - e.g. Toe negative, positive adjusted
05.14.14 - edited info on Acceleration Differential, corrected a few spelling mistakes, added '4.12 Travel range' section