iRacing Stock Car Setup Component Guide

version 1.00, February 2010

By Matt Holden

Introduction

In 2008, iRacing hit the scene during a period where sim-racing had become stagnant. Their mission: create the most realistic racing simulation to date. With this mission in mind, the iRacing team created the most complex sim-racing setup garage ever. Older garages had simple settings such as ride height, wedge, springs, etc. Most sim racers are very familiar with this type of garage and are familiar with what each setting does. Opening up the garage in iRacing, most people are overwhelmed with each adjustment. iRacing is the first sim to create a garage system that behaves like a real car should behave, with most (if not all) adjustments changing something else on the car. It is quite overwhelming at first glance, and for those of you who are new to iRacing, it may seem like you'll never understand all this "stuff".

I've written this guide after a year's worth of trial-and-error, research, and a whole bunch of crashed race cars. This is not a guide that will tell you how to set the car up to run competitively, but instead I hope this guide will explain everything. I'll cover just about all the adjustments, and for what I can, I'll add some notes on what the adjustments can do to your car.

-Front End Adjustments-

iRacing's "Front End" section on the car has some adjustments that have been around for quite a while, and there are some that are very new to the sim-racing world.

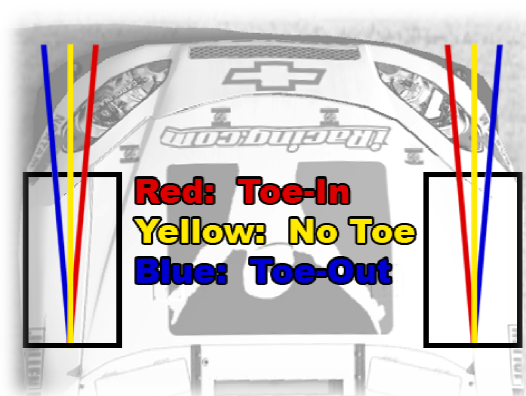
Ballast Forward

Explanation: NASCAR teams often use weights, or "Ballast", to change the weight distribution on the car without altering the setup package. Ballast is usually a Lead or Tungsten brick placed in the outer frame rails and moved fore or aft on the car to make changes in weight distribution.

What does it do: iRacing only offers a "Front end" ballast adjustment, so changes to the ballast will affect the weight distribution on the nose. Moving weight forward (higher values) will increase the nose weight on the car. Moving weight rearward (lower values) will decrease the nose weight on the car. At high-speed tracks, increasing the nose weight will tighten the car, while decreasing the nose weight at high-speed tracks will loosen the car. At low-speed tracks, increasing the nose weight will loosen the car, and decreasing the nose weight will tighten the car. The effect at a high-speed track seems backwards, but it results from the *Law of Inertia* (Newton's 1st law). Moving the ballast forward on the car will move the car's center of mass closer to the nose, and so when you arrive at a corner, that center of mass will want to carry on in a straight line, causing the car to push. If that center of mass is farther back on the car, it will want to pull the rear end around, making the car looser. Inertia won't have as much effect on low-speed tracks, so the lighter end will lose grip sooner than the heavier end.

Front Toe-In

Explanation: The "toe" on a car is very simple. One of the three major alignment options, "Toe" refers to the angle of the centerline of the tire in relation to the centerline of the car. If the front tires are parallel to the centerline of the chassis, the front end is said to have "Zero Toe" (0/16"). When the front of the tire is farther from the centerline than the rear of the tire, the car is said to have "Positive Toe", or "Toe Out" (>0/16"). When the front of the tire is closer to the centerline than the rear of the tire, the car is said to have "Negative Toe", or



“Toe In” (<0/16”). iRacing’s adjustment says “Toe-In”, so the measurement is how much the tires are toed inward. A negative value will mean the front end is toed *out*. For instance, if the measurement reads as -2/16”, then the front tires are toed out 2/16 of an inch. If the measurement reads as a positive value, then the tires are toed *inward*. For instance, if the measurement reads as +2/16”, then the front tires are toed in 2/16 of an inch.

What does it do: The steering geometry in almost all cars creates an effect known as “Ackerman”. This is when the inside steering tire has turned farther than the outside tire. To explain this, think about if you turn the wheel, and instead of both wheels turning 10 degrees, the inside tire may turn 12 or 15 degrees, while the outside tire turns 10 degrees. Increasing the Toe *Out* on the car will magnify this effect, and cause the car to “cut in” harder. However, too much toe and the inside tire will turn so far that it loses grip, and causes the car to be tight.

Steering Ratio

Explanation: Each car has a steering box that can tune how the steering acts upon input from the driver. The ratio is a value of input to output (input:output) on the steering column. The best way to think of this is in degrees. For instance, if the steering box is a “12:1” box, then 12 degrees of input through the steering wheel will show 1 degree of movement on the output shaft.

What does it do: Past sims have flopped back and forth between “Steering Ratio” and “Steering Lock”. While Steering Lock changes how far the wheels actually move, the Ratio changes how quickly they move. For means of example, we’ll use a 12:1 box and a 16:1 box. To steer the tires 1 degree, the 12:1 box will require the driver to turn the steering wheel 12 degrees, while the 16:1 will require the driver to turn the steering wheel 16 degrees. Thus, a steering box with a higher ratio will make the steering less responsive, or “numb”, while a steering box with a lower ratio will make the steering more responsive, or “sharper”.

Tips: This is normally a “set once” adjustment. What I mean by that is drivers usually find a steering box they are comfortable with, and use that everywhere. Adjusting the steering box to cure handling problems will only mask the true problem, and could create issues into the race.

Brake Bias

Explanation: Brake Bias is possibly the simplest adjustment we have on the car. This controls how much of your total braking force goes to what end. Since iRacing has the value as “Front Brake Bias”, then the percentage represents how much of the force goes to the *front* brakes.

What does it do: Since this change affects the brakes, the driver will only feel the change under braking, of course. Moving the brake bias towards the front brakes (more front percentage) will tighten the car up under braking, and moving the bias towards the rear (less front percentage) will loosen up the car under braking.

Tips: It's very easy to mistake a shock absorber problem as a bad brake bias. When setting up the car, it's better to set the brake bias to something standard (55-75%) and tune the car based on that bias. It's best to keep the bias at one setting until the race, and if you change the bias during the race, make a note of it for when you return to the garage and can adjust your setup.

Sway Bar Diameter

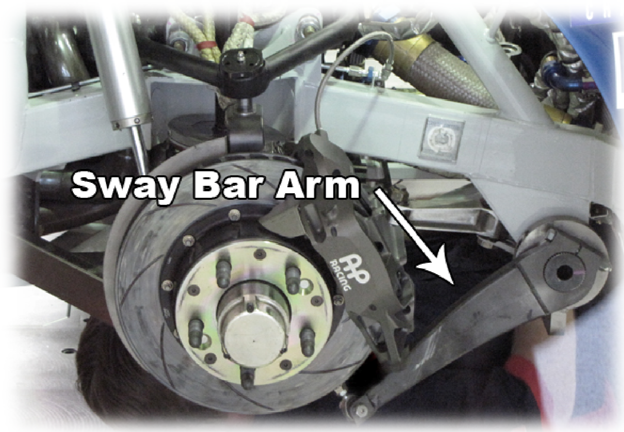
Explanation: If you understand what "Torsion Beam" suspension is, you basically already understand the sway bars on NASCAR-style stock cars. While your passenger cars usually have a single-piece sway bar, the sway bars on these stock-cars are known as "three-piece" sway bars. Instead of a solid bar, the "Three-piece" bar consists of a straight bar and two "arms", which we'll cover later. The "sway bar diameter" adjustment changes the diameter of the "bar" component on the sway bar.

What does it do: Changing the size of the sway bar changes how much force the bar applies to the suspension under loading. When the suspension compresses, it pulls up on the sway bar arms and twists the sway bar. The larger the diameter of the sway bar, the more the sway bar will work to return to its normal state, thus, more force will be exerted on the suspension. A larger front sway bar generally tightens the car up. This will be primarily felt in the center of the corner when the car makes its rotation, and not so much on entry/exit.

Tips: This is another "set once" adjustment. Nine times out of ten, the driver will have a sway bar diameter range he or she likes. This can vary by as little as .125" (2.000"-2.125") or can be a large gap, but it's good to find a sway bar diameter you like and build the car around that. The sway bar diameter also depends on how the front springs/shocks are configured. If you are running a coil-binding style setup, a larger bar (1.750"+) will keep the nose level, and prevent any aero-issues with air getting under the LF corner while in a turn, while a conventional-style setup will generally use a smaller sway bar due to the high rate of the front springs. Enough testing will give you a good idea where to put the sway bar with the springs you've put into the car.

Sway Bar Arm Length

Explanation: On the ends of the actual sway bar itself, there are two arms that lead back to the suspension (see picture). These arms are what impart the twisting force on the sway bar when the suspension travels. Essentially a lever, these arms can be swapped out for different lengths. Depending on the chassis, you can choose from either an 11" or 12" arm, or the 14"-16" arms, but regardless of the lengths, the idea is still the same.

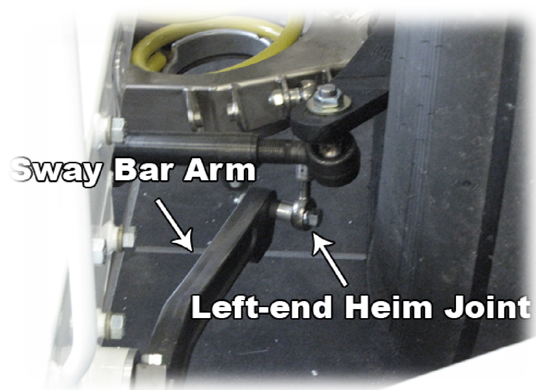


What does it do: The sway bar arm is a very simple component in that it only acts as a lever between the suspension and the sway bar. Changing the length of the bar will change how much force is applied to the sway bar. Say, for instance, that you see 15° of travel from an 11" arm when the suspension is fully compressed. By swapping out the 11" arm for a 12" arm, you will decrease that travel to, say, 10°. Lengthening the arms will cause the bar to exert less force on the suspension and free the car up on entry and exit (when the suspension is moving), and shortening the arms will tighten up the car on entry and exit.

Tips: It's very difficult to distinguish a problem in the shock setup from incorrect sway bar arms. Therefore, it's better to find the sway bar arm you prefer, and then build the car around that setting.

Left Bar End Offset

Explanation: On the ends of the sway bar arms, there is a Heim joint connecting the sway bar arm to the lower control arm on the suspension. This Heim joint is threaded, allowing the length of the Heim to be adjusted. Adjusting the left end Heim joint will load the sway bar, and in turn, the suspension.



What does it do: By changing the length of the Heim joint, you will, like mentioned above, load or unload the sway bar when the car is at rest. As a result of loading the sway bar, you will also see the ride heights change. This will also change the cross-weight in the car. Changing this setting will directly affect the “Left Bar End Clearance” adjustment (below). This will be looked into with greater detail in the “Attach Left Side” section.

Tips: This adjustment will primarily be felt upon corner entry and the initial cut into the corner, and once the springs and shocks have been set, it is a very good way to correct any handling issues on corner entry.

Left Bar End Clearance

Explanation: The best way to think of this measurement is as an indicator of how much load is on the sway bar when the car is at rest. This setting is changed as a result of changes in the End Offset, as this is measured at the left-side Heim joint.

What does it do: Put simply, a setting of 0/16” means the bar is not placing any load on the suspension at rest. This does not include settings of +0/16” or -0/16” because those represent a load from the sway bar (very small values of zero). A *negative* value on the End Clearance represents a *pre*-load on the sway bar, meaning the sway bar is placing a load on the suspension. More preload on the sway bar generally causes the car to tighten up upon corner entry. A *positive* value will be discussed more in the “Attach Left Side” section.

Tips: This is a fine-tune adjustment for when a spring adjustment would be too much, or a shock adjustment would be too little. Increasing the End Clearance will free up the car on entry, while decreasing the End Clearance will tighten the car on entry.

Attach Left Side

Explanation: There are two available types of Heim joints we can place on the car. There is a fixed type where there is no movement allowed and a “sliding” Heim joint in which one end of the Heim joint can move. This sliding type is known as a “detached” linkage.

What does it do: Detaching or attaching the sway bar merely changes the linkage on the left side of the sway bar. By having an “attached” sway bar, any force on the left front suspension will be transferred to the sway bar. By having a “detached” sway bar, you allow some play in the left front suspension before the bar is loaded. This is where your End Clearance comes into play. If you have the bar set as “detached”, then any positive End Clearance setting will mean that much play in the left front suspension. So, if you have +4/16” on your left end clearance, then the left front suspension will move 4/16” (1/4”) before it ever places a load on the sway bar. For these settings, we'll use the same example. You are testing at a bumpy track, such as Atlanta Motor Speedway. Going through the corner, your left front suspension hits a rather large bump. If you had the sway bar set to "attached", then the left front suspension would immediately place the load onto the sway bar and transfer it to the *right* front suspension. This sudden shock to the RF could cause the car to shoot up the track unexpectedly. If you had the bar set to "detached", and assuming you had enough End Clearance, you could potentially hit the bump and the car would just roll right over it, and the RF would see no sudden load.

Tips: Playing with this adjustment is like playing with fire. You can truly ruin the car by either attaching or detaching the sway bar and not compensating for it. If you are at a bumpy track and you are constantly hitting bumps that upset the front end of the car (suddenly really tight), then you might want to go and detach the sway bar, and allow a little bit of End Clearance. However, with the left end detached, if you ever steer to the *right* while going in a straight line, the LF suspension will collapse, unload the RF, and you'll spin off to the right, so it's a feeling you have to get accustomed to. Also, if your End Clearance is a negative value, it makes no sense to have the left end detached, since it's constantly loading the sway bar.

-Front & Rear Suspension Adjustments-

The suspension adjustments of a race car are the “meat & potatoes” of the car’s setup. The suspension is responsible for keeping the tires in constant contact with the racing surface, controlling weight transfer, and maintaining a proper aerodynamic stance for the car. In order to explain the adjustments, I’ve included paragraphs for front and rear adjustments for each component.

Corner Weight

Explanation: Simple. It’s the “weight” of that particular corner of the car.

What does it do: Corner weights basically just show how much load you are seeing on each corner of the car when the car is at rest. These are adjustable by the *Spring Perch Offset*, explained below.

On the Front End: For the front, increasing the left front weight will cause the car to turn better on entry, while increasing the right front weight can make the car more stable on entry.

On the Rear End: At the rear end of the car, increasing the right rear weight will help the car to rotate at the center of the corner and free up the car on exit. Increasing the left rear weight will tighten the car on entry, as well as stabilize the exit of the corner.

Tips: Not something to be overlooked, huge differences between the left and right side corner weights can raise a red flag on a handling issue that can occur during a race. If you have one tire that is wearing particularly quickly, check the corner weights to see if there is a huge difference.

Ride Height

Explanation: Ride Height is the distance from the frame rails to the racing surface. This is NOT a measurement of how far the body of the car is from the racing surface.

What does it do: The Ride Heights just tell you how high the car is off the racing surface. From an aero standpoint, the heights can give a good indicator of how the attitude of the car will be at speed.

Tips: Generally, keep the nose lower than the tail of the car. This will give you a good "rake" on the body and create the most down force on the car. The difference in the left and right heights will vary between tracks, so it's good to experiment. Generally, if the track is smaller with tighter turns, lifting the left side will help the car to turn better in the tight corners.

Shock Deflection

Explanation: "Deflection" basically means how much something has moved under load. In terms of the shock absorber, the deflection is how much it has compressed while the car is sitting still.

What does it do: It really doesn't do much besides show you how much travel you have in the shock. Generally, you'll run out of travel in the spring before you run out of travel in the shock.

Spring Deflection

Explanation: Just like the shock, the deflection in the spring shows how much the spring has compressed when the car is sitting still.

What does it do: This piece of information shows how much travel is available from the spring. The number in the iRacing garage shows how much the spring is compressed while the car is stationary. For instance, if the spring has a deflection of 2.5" of 4", then the spring is compressed 2.5" while the car is at rest, and the spring has 1.5" of travel remaining.

On the Front End: This is important in the front end of the car, mainly by showing you how much the front end has to move before that particular spring is in a "coil-bind" state. Generally, you want more deflection in the left front spring than on the right front. For instance, if you have a deflection of 2.25" of 4.02", then by simple math (4.02-2.25), you end up with 1.77" inches of travel until that spring is fully compressed.

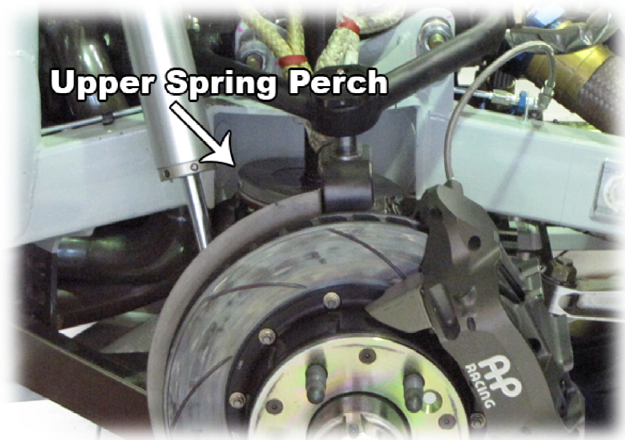
On the Rear End: The rear springs are less likely to bind under normal racing conditions, but it is still possible. Try to keep a decent amount of travel in the spring, otherwise the car will swap ends when the rear springs are bound.

Tips: You'll generally look for less spring deflection on a bumpy track, and more deflection on a smooth track. You can get away with a small amount of travel at somewhere like Lowe's Motor Speedway, but at Atlanta, your car will bounce all over the place from the constant shock to the chassis.

Spring Perch Offset

Explanation: On the three "Big" stock cars (Silverado, both Impalas), the spring is held in the suspension by two "perches". The lower perch is usually fixed to the lower swing arms, and the upper perch is adjustable by means of a threaded bolt that goes through the upper perch and is accessible through the hood opening. When the springs are not exerting any force, they are in "equilibrium", and this is known as their "static length". Spring Perch Offset refers to the distance from static length as a result of moving the upper perch. For instance, if the spring's static length is 6", and the perches are set so that the spring (when the car settles) is still 6" long, then your spring perch offset will be 0.00". If you set the spring perch so that the spring is 4" when the car settles, your spring perch is now -2.00". This is a negative value because you've removed length from the spring.

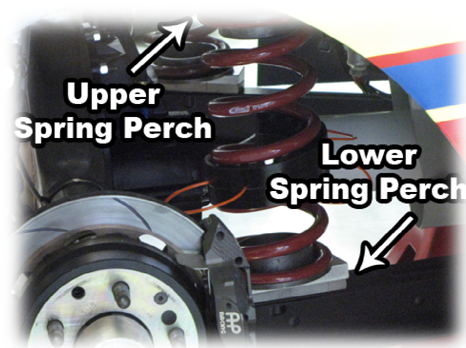
What does it do: The spring perch offset has a multitude of uses, from the ride heights to weight movement. Using the concept "Hooke's Law" (explained later), adjusting the spring perches to a *larger negative* value will compress the spring, and thus move weight towards that corner, and raise the height of that corner on the car. Moving towards a *smaller negative* value will reduce the weight on that corner, and lower that corner of the car.



The lower Spring Perch is hidden behind the brake rotor, and is fixed to the suspension arm.

On the Front End: The front perches have a much different role than the rear perches on these cars. With testing, you'll find a good ride height split that works at each track, and then you will set the perches so the front end is at that split. Generally, you won't see much results from shifting weight on the front with the perches, but you can get some minor results.

On the Rear End: The rear perches are quite possibly the best way to dial a car in, once the springs and shocks are set to where you like themGenerally, if you're a little loose on entry, add some weight to the Left Rear of the car using the Perch Offset. If you're a little tight on entry, remove some weight from the Left Rear. It's the same idea with the Right Rear perch offset: If you're loose in the center of the corner, add some weight to the Right Rear corner with the perch offset.



Spring Rate

Explanation: The spring rate is very simple: how much force is exerted per unit of travel. For instance, a 500lb/in spring will exert 500lb of force for the first inch of travel, 1,000lb of force at 2 inches of travel, 1,500lb at 3 inches, and so forth.

What does it do: The spring rate does one thing, and one thing only: tells you how hard the spring is. A higher rate spring will be stiffer than a spring with a lower rate.

On the Front End: If you're building a coil-binding setup, finding the proper springs for the track will take time. If your front springs are too soft, they won't exert enough force on the front tires, and the car will feel very loose. If the front springs are too stiff, they may not bind, and will cause the car to become very tight.

However, if you're going with a "conventional" setup, using stiffer springs is the way to go. Changing the spring rates on a conventional setup will change the corner weights, and thus change how the car handles.

On the Rear End: Rear springs are a little more complex. They have to somehow balance the car from the force exerted by the front springs. Generally, if you're running a coil-bind setup, the rear springs will be stiffer than the front springs, while if you're running a conventional setup, the rear springs will be much softer than the front springs. The best way to find good rear springs is to run a lot of combinations in testing. You'll find a pair of rear springs that work with the front springs you like, and then you've made a "spring package".

Tips: If you get some time during the NASCAR season, watch a practice or two, and you may hear one of the commentators mention what springs are in the front or rear of the cars. Usually, you'll look for a package to run at each of the three types of tracks: short track, intermediate, and superspeedway. Once you have that package and something that makes the car feel stable, the rest of the setup will be much easier.

Bump Stiffness

Explanation: The shocks on these stock cars are two-way adjustable, meaning "Bump" and "Rebound" are independently adjustable. The "Bump" setting refers to the stiffness rating of the shock when it is in compression. A higher number will mean a stiffer shock under compression, and a lower number will mean a softer shock under compression.

What does it do: Many people use the bump adjustment for many different things. It does control the weight transfer to the front (stiffer bump will resist weight moving to the nose), but it can also be used to control how quickly the suspension travels.

On the Front End: The bump setting on the front will control how quickly the nose "drops" under braking, when the springs bind, and how quickly weight will transfer to the front. Generally, on the left front, decreasing the left front bump will move weight to that corner faster, and help with turn in. Decreasing the right front bump will shift weight to that corner faster, and make the car tighter on entry. Increasing the bump will do the opposite for each corner.

On the Rear End: The rear bump setting will mainly control how the car behaves on corner exit. If you lower the bump on both sides of the rear, the car will have more traction under throttle, but will be tighter on the exit. Separately, the shocks will do the same as the springs: a stiffer right rear shock will loosen the car under throttle, while a stiffer left rear shock will tighten the car under throttle. Lowering the right rear bump setting will tighten the car under throttle, and lowering the left rear bump will loosen the car under throttle.

Tips: It's difficult to explain how the shocks work, I'd need an entire new guide for that. However, testing will show you what works and what doesn't work. If the front end feels really "floaty" when it's moving up and down, increase the bump in the front shocks. If it feels to "rigid", decrease the bump, and the same goes for the rear end.

In addition, shocks can be thought of as "spring fine tuners". If one spring is too stiff, but the next one is too soft, use the softer spring and change the bump until you find a happy medium.

Rebound Stiffness

Explanation: The opposite of "Bump", the "Rebound" refers to how stiff the shock is when it is expanding. A higher number on the rebound will show more resistance to expanding, and a lower number will expand with less resistance.

What does it do: The rebound setting controls how long weight stays on a specific corner of the car. A stiffer rebound will hold weight on that corner longer, while a softer rebound will release that weight faster.

On the Front End: The front rebound is crucial to maintaining a proper aerodynamic attitude. Generally, high rebound settings are desired in order to keep the front end down on the pavement, but too much rebound on a bumpy track could make the car unstable.

On the Rear End: The rebound will control how the rear raises during deceleration. Higher rebound will keep weight on the rear end under braking, and make the car tighter, while less rebound will allow weight to shift up to the front and free up the car under braking.

Tips: Rebound is also a good way to "fine tune" your springs. Each rebound adjustment will basically have the exact opposite of its corresponding bump setting. However, it's extremely easy to mistake a bad rebound setting for something else. For instance, too much rebound on the right front corner could have a similar feeling to a track bar with a large split, so test the settings until you can tell when the shocks have issues.

Camber

Explanation: Camber is the vertical lean of the tire in relation to the centerline of the chassis. Positive camber means the top of the tire is farther away from the chassis than the bottom of the tire, and Negative camber means the top of the tire is closer to the chassis than the bottom of the tire. Positive camber is when the tire "leans out" and Negative camber is when the tire "leans in".

What does it do: Camber is used to control the amount of tire on the surface of the race track while cornering. When the suspension compresses, it goes through what's known as "Camber Gain" or "Camber Loss", where the camber of the tire changes through suspension travel. The goal is to get the camber set so that when the car is under full load, you have 0° of camber, i.e. the tire is completely flat on the pavement.

On the Front End: The front end will go through much more camber gain/loss than the rear end due to the front end being independent suspension. As a result, the left front and right front camber will be very different, so pay attention to your tire temperatures and adjust accordingly. High amounts of camber will help straight-line speed, but will also hurt the cornering of the car. Too much camber also wears heavily on the edges of the tires, and can lower the useful life of the tire.

On the Rear End: The rear end is a solid axle, so the tires won't experience much, if any, camber gain/loss. Thus, the rear camber will be much closer than the front camber settings. On an oval, the right rear camber will be negative, the left rear will be positive. Higher camber will yield more straight-line speed, but could hurt the forward bite under throttle. Less camber will give more traction under acceleration, but will hurt your straight line speed.

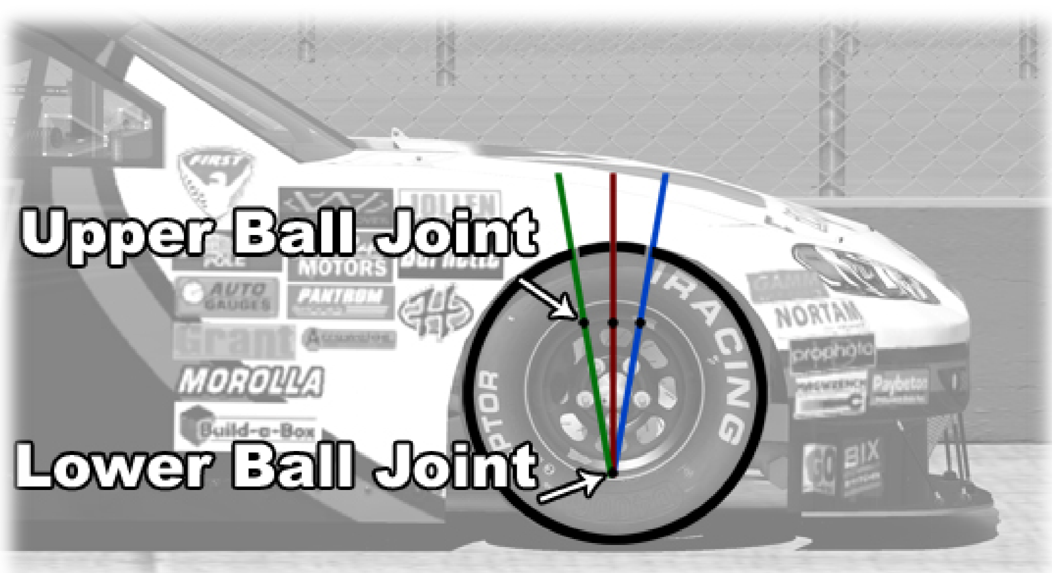
Tips: The general idea is that the LF tire will have positive camber, and the RF will have negative camber. However, that's not always the case. To set the camber, look at your tire temperatures. Generally, you're looking for a consistent range across the tire, with an average in the center. Say the Outside edge and the Inside edge have a difference of 15°, then the middle should be 7° or 8° off of either edge. Don't be afraid to run positive camber in the RF either, it's completely possible that the suspension is set up that way.

Caster

Explanation: Caster is the angle of the upper and lower ball joints on the suspension in relation to vertical. Positive caster is when the upper ball joint is behind the lower ball joint, and Negative caster is when the upper ball joint is ahead of the lower ball joint.

What does it do: Caster controls how the tire steers. Rolling the caster back to a higher positive will reduce the responsiveness of the steering, and increase the turning radius of the car. Moving the caster closer to zero will cause the steering to be "snappier" and decrease the turning radius of the car. (*See picture on next page)*

Tips: Since lower caster decreases the turning radius, it's more common to have less caster on smaller, tighter tracks, and more caster on larger, wider tracks. Any split (less caster on the LF than the RF) in the caster will cause the car to pull more to the left, and create a quicker turn-in. If the track has less banking, that will call for more split in the caster than a high-banked track.



In this picture, the lines represent the caster settings on the car. The Green line represents POSITIVE Caster. The Red line represents NO Caster. The Blue line represents NEGATIVE Caster. The black dots represent the ball joints in the suspension, which are situated behind the wheel and spindle assembly.

Rear Toe

Explanation: The rear toe on these stock cars is something that's a little new to sim-racing. The rear toe is the same as the front toe setting, but on the rear of the car. Unlike the front end, however, each side is independently adjustable.

What does it do: The rear toe controls how much yaw angle the chassis has when traveling in a straight line. Since the toe is only adjustable so that the wheels both point to the right side of the car, adding toe to the car will cause the car to want to turn when the throttle is applied, since the wheels are at an angle to the direction the car is traveling. This will create the "crab" effect that is common with the Sprint Cup cars in NASCAR.

Tips: It's extremely tempting to add rear toe to the car when the car won't turn, and this can be a bad practice. Doing so will only mask what is really going on with the car, and could lead to serious issues late into a run.

Track Bar Height

Explanation: The track bar (also commonly known as a "Panhard Bar") is a simple device used in solid-axle suspension systems to keep the axle in line on the chassis. One end of the bar is connected to the rear end housing (just inside of the LR tire), and the other end is connected to the chassis just behind the RR tire. Both sides are adjustable in the garage, but usually only the Right side is adjustable during a race through a hole in the rear window.

What does it do: I could do a whole guide on the track bar alone, but I'll try to keep it simple, but it will still be a bit lengthy. Like I said earlier, the track bar keeps the rear end in line while the car is in motion. In turn, adjusting the track bar has a great effect on how the rear tires are loaded and unloaded during acceleration and deceleration. Raising the whole track bar will raise the "roll center" of the rear end and thus make the car looser while cornering. Lowering the whole track bar will lower the roll center and tighten the car while cornering.

Aside from adjusting the whole bar, the track bar can be set two different ways: right-side down and left-side down. The "Left-side down" is more conventional, and has been used basically forever. The "Right-side down" setting is relatively new, becoming more prevalent with the new coil-binding setups. Since the track bar is fixed to one side of the chassis, it will create an arc as the rear end moves up and down in the chassis. As a result of the arc, the rear end will also move to the left or right as it moves up and down in the chassis. This creates "rear steer", where the rear end is not straight in the chassis, and has essentially gone into a four-wheel steering mode for that moment. Having one end of the track bar lower than the other will change how that rear steer affects the car. If the track bar is set Left-side down, the track bar will *generally* tighten the car under braking, and loosen the car under throttle. Setting the bar Right-hand down will *generally* loosen the car under braking and tighten the car under acceleration.

Independently, adjusting the ends of the bar will always do the same thing regardless of how the bar is configured. Lowering the Right side of the track bar will tighten the car under acceleration, while raising it will loosen the car under acceleration. Lowering the left side of the bar will loosen the car under acceleration, while raising it will tighten the car under acceleration.

Tips: Track Bar settings are going to rely heavily on your rear springs, rear sway bar, your overall setup configuration. The track bar also creates a "jacking force" on the rear end of the car, and can either raise or lower the rear end of the car under acceleration/deceleration.

-Rear End Adjustments-

We've finally arrived at the last set of adjustments to the car. These adjustments are not really changed much in the garage, but that doesn't make them any less important.

Fuel Level

Explanation: This is how much fuel is in the car when you leave the garage or start the race.

What does it do: Changes how much fuel is in the car. Not much to it.

Tips: You can use this to see what your car may feel like late into a run. Going out with only 9 gallons instead of 18 will give you a good indication of what the car may be doing halfway through a fuel run, so if you're curious, give it a shot.

Cross Weight

Explanation: Everyone knows what this is. In older games and sims, it was known as the "Wedge" adjustment. It is determined by taking the weight on the Right Front and Left Rear tires, and dividing that by the total weight of the car.

What does it do: The Cross Weight is a general indicator of how the car will handle and how the tires will wear, but not always. Generally, more cross weight will tighten the car, and less will loosen the car. This is directly adjustable through the springs and spring perches.

Tips: Your Cross Weight will be determined by what configuration you have the car set up with, and what track. Usually a coil-binding setup will have much more cross-weight than a car with a Conventional setup. While it is true that raising the cross weight will tighten the car, and lowering it will loosen it, the number itself is not always a good indicator. I've seen cars with 55% cross weight that were very loose, and cars with 45% cross weight that were very tight.

Rear End Ratio:

Explanation: This is the only gearing that is adjustable on the car. This is the ratio of gears in the differential in the rear end. The number is a ratio of "teeth" in the differential's ring gear to the number of teeth in the "pinion" gear. For instance, if your pinion gear has 30 teeth, and your ring gear has 95 teeth, then you have a rear end ratio of 3.17.

What does it do: This adjustment directly affects the acceleration and top speed of the car. A lower ratio will yield a greater top speed, but will show lower acceleration. A higher ratio will yield a lower top speed, but will show greater acceleration. A higher ratio will also cause the car to slow down quicker under braking, and can in turn cause the car to feel “looser” under braking, while a lower ratio will cause the car to slow down less, and make it feel “tighter”.

Tips: This is usually the last thing you want to adjust in the car. If you’re not getting the full range out of the engine on the track, it’s possible that there may be a handling issue, and doesn’t have enough room to accelerate down the straights. If the car feels really good, but you’re just not getting enough out of the straights, you may want to look at the gear, but iRacing’s default setups usually have a good gear in them to start with.

Sway Bar Size

Explanation: The “sway bar size” is the same as the “sway bar diameter” on the front end of the car, but this time it’s on the back. For the Truck and the Impala B, this will have no effect on tracks equal to or more than 1.5 miles, and for the “COT” car, it will work everywhere except Daytona and Talladega.

What does it do: The rear sway bar works the same way as the front sway bar, but only backwards. For the rear sway bar, a larger diameter will make the car looser, while a smaller diameter will make the car tighter.

Tips: The rear sway bar can be a little demon. I’ve seen a lot of people have troubles with corner entry that is caused by the rear sway bar, but the drivers mistake it for something like brake bias or a shock issue. If you are experiencing a very loose condition on entry, remove the rear sway bar. If the problem persists, replace the bar and change something else. If you remove the bar and now the car starts to push through the corner, you need to slow down and try not to overdrive the corner.

Sway Bar Arm Length

Explanation: This is pretty much the same as your front sway bar arms. For a more detailed description, see the Front Sway Bar Arm Length above.

What does it do: Just like the front sway bar, the sway bar’s arm length will fine-tune the strength of the sway bar. A longer sway bar arm in the rear will “weaken” the bar and tighten up the car, while a shorter one will “stiffen” the bar and make the car looser.

Tips: The rear sway bar arms make such a minute difference, it really boils down to a driver preference. If the driver feels the rear bar is acting too much, it may be good to go with a longer arm, but if the driver can’t feel the rear bar, move towards a shorter arm.

Left Bar End Offset

Explanation: This adjustment works exactly the same as the front end offset. This adjustment changes the length of the linkage between the left side sway bar arm and it's connection to the rear end housing.

What does it do: This adjustment makes very minute changes to the handling characteristics of the car, but it can fix a big problem with the rear sway bar. I said earlier that a rear sway bar can lift up the left rear tire on corner exit, and this adjustment can fix that. Making the offset higher will alleviate this issue by making the sway bar load the Left Rear tire more than the Right Rear.

Tips: This adjustment won't have a great effect on the cross weight or the overall handling of the car, but it will be present to the driver. If you put a sway bar in the rear of the car, and you are feeling the car get very loose, very quickly on corner exit, lengthen the Bar End Offset. If this doesn't fix the problem, reset the end offset to what you started with, and move towards your rear shocks.

Left Bar End Clearance

Explanation: Again, this works just like the front end Bar End Clearance. It is not directly adjustable, but is dependent on your Bar End Offset setting.

What does it do: Like in the front, the clearance shows how much "free travel" the left rear tire has before the sway bar will act on it if the left side is disconnected. If it is attached, this controls the preload on the left end of the sway bar.

Tips: On a solid rear axle suspension, when the Right Rear tire gets loaded the Left Rear will inevitably get some of that loading, so if you have a lot of clearance in the rear end, it's possible that the sway bar can suddenly act on the Left Rear tire, and you end up getting very tight in an instant.

Attach Left Side

Explanation: For a detailed explanation, see the "Attach Left Side" on the Front Suspension Adjustments.

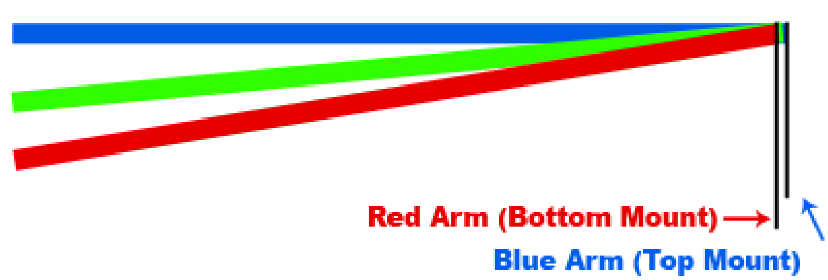
What does it do: Just like the front end, the rear end can also be "disconnected". Doing so will allow the Left Rear tire to move up and down before the sway bar acts on it, set by your Left End Clearance.

Tips: I've found that if you have a rear sway bar, the best thing to do is leave it attached. Since these cars have solid rear axles, most everything that happens to the Right Rear tire is going to happen to the Left Rear, so disconnecting the left end could cause some unwanted results.

Truck Arm Mounts

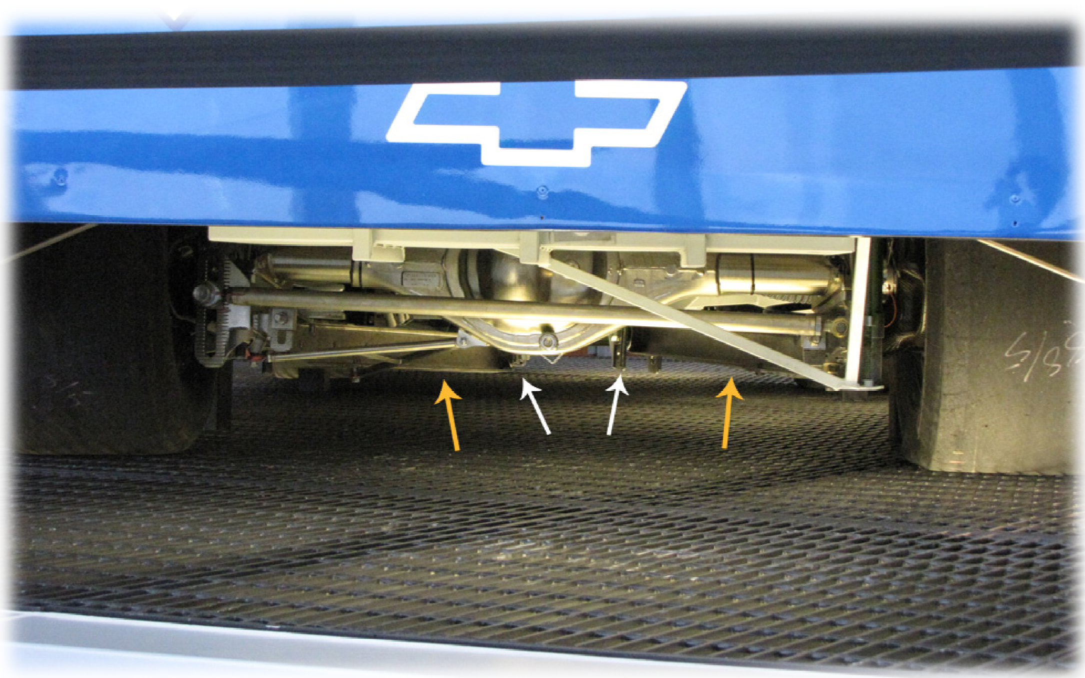
Explanation: On rear suspensions with solid axles, like the stock cars we see today, the axle is held onto the car by a pair of "truck arms". These arms are usually steel beams connected to the chassis at one end and to the axle at the other end. Changes can be made to how the truck arms are mounted to both the chassis and the axle, but as of right now, iRacing only allows adjustment to the chassis mounts in the vertical manner.

What does it do: Since the truck arms are fixed to the rear axle, they also move with the axle under compression and decompression of the rear suspension. Because they are solid, they have to shift the rear axle around when they move. Changing where the arms are mounted to the chassis will change the "length" of the arm when the suspension is compressed. As a result of the "change in length", you end up angling the rear end in the car, creating "rear steer". This picture is crude, but it should get the point across:



In this picture, all three "arms" have been raised to the same point as a result of the rear axle compressing under load. The blue arm represents a truck arm mounted in the "top" position, the green arm is in the "middle" position, and the red arm is in the "bottom" position. As you can see from the guides on the right, even though they are all mounted at the same point on the left, the red arm is shorter, horizontally, than the blue arm. If you consider the “middle” mount as the standard, then the wheel on this side of the car would be moved back with the “top” mount, and pulled forward with the “bottom” mount. Changing the difference in arm mounts from left to right will change how much angle is imparted onto the rear axle. You can use a higher right-side mount to angle the rear axle to the right-side of the car (Left wheel farther forward than the Right wheel), or you can use a higher left-side mount to point the axle to the left side of the car. I’ve heard of both options being used, both in the virtual and real world.

Tips: This is hugely a track-specific option. You’d obviously want as much rear steer as possible somewhere like Martinsville, but may not want as much somewhere like Daytona. The best way to find out how to work with this adjustment is a good test session. You can use this adjustment in conjunction with your track bar setting to change where the axle is in the chassis, and either increase or decrease the effect of the rear steer. You can also couple it with the rear toe in some instances to generate more side force. Here’s a picture of the underside of a 2009 Sprint Cup show car. I’ve highlighted the truck arms with orange arrows, and the truck arm mounts with white arrows, sorry if it’s hard to see, they’re really tucked up in there. For reference, the Right-side arm is in the “middle” position, the Left-side arm is in the “Bottom” position.



-Tire Pressures-

"Tires are perhaps the least well understood parts of road-going vehicles, despite the fact that they are one of the most studied. Obviously, since they are typically the only part of a car in contact with the ground…their behavior is critical in determining how a car handles, how well it grips the road, and so ultimately, how fast it can go."

-Dave Kaemmer

Since Tire Pressures are a different animal than other adjustments on the cars, I'll format this section differently than the other sections. Tires, as Dave Kaemmer said, are immensely important in a race car's handling characteristics, and even a half of a pound of air in a tire can drastically change the handling characteristics of a car.

Getting your starting pressures: In the real world, race teams get the "minimum" tire pressures from the tire manufacturer, but for iRacing, we get most of our "minimum" pressures from the adjustment limits. For a good starting point on tire pressures, you should do two things first:

1. Load up iRacing's default setup for the track you are running. Write down the tire pressures and note the difference between left and right-side pressures. For instance, if the left side pressures are 18psi, and the right sides are 48psi, you have a 30psi difference.
2. Find the real-world counterpart tire data. For the NASCAR stock cars, this can be found at Jayski.com. By going to the track's race page, you can find what's called "Tire Notes". In that section, you'll find the Minimum and Technical Inspection pressures. From these pressures, make note of the difference between front and rear tire pressures. For instance, if you go to the 2010 Daytona 500 race page, the "Minimum" right-side pressures are 48psi for the Right-Front, and 45psi for the Right-Rear, giving a 3psi difference. The left-side pressures are both 27psi, or no difference.

Once you have these numbers, you can get your tire pressures. If the two examples above are from the same track, we'll say Daytona for kicks, then you may want to go for like 25psi on the left, which is between the 18psi from iRacing and 27psi from the tire constructor. If you find those too low, inflate them a bit. For the right-side, I like to keep the Right-Rear tire at the iRacing setting and inflate the Right-Front tire to match the recommended difference. For the example above, that would be a 48psi Right-Rear tire and a 51psi Right-Front tire. This is just a starting point, and you may have to change that after running a bit. Don't ever be afraid to change the pressures!

Tire Spring Rate, Pressure changes: Every tire has a “spring rate”, which causes the tire to act somewhat like a spring. When it gets loaded, the tire will flex to absorb the load, and will rebound to its normal shape under no load. Changes in pressure will change the spring rate of the tire, and thus changing the handling of the car. NASCAR.com once had an article a few years back that said that the tires used in their series change spring rate by about 50 pounds for every 1 pound of air pressure change in the tire. So, let’s say you have a 950 pound spring somewhere. If you increase that tire’s pressure by 1 pound, you essentially have now changed that to a 1,000 pound spring. If you remove a pound, you change it to a 900 pound spring. Having too much pressure in a tire causes tire “chatter” where the car will slide for a bit, regain grip, then slide for a bit again. Having too little pressure in the tires will cause the car to feel “squishy” and will roll over a lot in the corners.

How does pressure affect the car? Tire pressures will affect the mechanical grip in the car without greatly affecting the aerodynamic balance of the car. Therefore, it is a good adjustment to make during a race session. Changing the pressures will make the same change to the car as its corresponding spring. It’s important to change the pressure in the *correct* tire for the handling issue in order to not create any massive issues. If you were loose off the corner, you’d have a better effect if you lowered the Right-Rear pressure and increased the Left-Rear pressure than if you were to increase the Right-Front pressure.

-Appendix-

While I tried to make this guide as simple to use as possible, I still feel some things need to be explained further to fully understand.

Ackerman

In almost all modern steering setups, the tires never turn the same amount when any steering input is applied. ***Ackerman* is where the inside tire turns farther than the outside tire**. For instance, if you make a left-hand turn, the outside tire may turn 15° to the left. The inside tire, on the other hand, may turn 20° or 25°. Toe adjustments can magnify or weaken this effect.

Hooke's Law

Hooke's Law is a concept in Physics stating that **a spring's compression is proportional to the force exerted by the spring**. This law is where we get the units for "Spring Rate". Hooke's law states:

> ***F = k*x***
>
> ***F*** is the force exerted by the spring
> ***k*** is the spring rating
> ***x*** is the amount the spring is compressed, or it's "deflection".

Almost every spring you'll come across will obey *Hooke's Law*. This applies to the springs on a race car. Let's look at an example, using information from the iRacing Garage area:

> The front spring on a race car is rated at 450lb/inch and has 4.02" of allowed travel from its static length until it is in a "bound" state. We want to know what force this spring exerts on the suspension and tires when it is bound, so we look at Hooke'
>
> **F = kx**, so **F =** (450lb/in)*(4.02"). **F = 1,809lb**
>
> When this spring has reached a "bound" state, it is exerting 1,809lb of force on the suspension and the tire at that corner.

This law is also why the corner weights change on the car when the spring perch offset is adjusted. Since the force from the spring is directly related to its length, making the spring shorter or longer will change the force it exerts on the suspension, and thus change the "weight" on that corner of the car.

Split

The term *Split* is common in suspension settings, especially in oval cars. *Split* is very simple, it is the **difference in settings from one side of the car to the other**. The most common reference to *split* is in the rear springs, track bar, and the caster in the front. If you have a right-rear spring of 1000lb/in and a left-rear spring of 800lb/in, then you have a "200lb split" in the rear springs.