When I started iRacing I had an extremely rudimentary understanding of race car technology and how to properly set up a car. What little I did know was totally wrong. The first few months of my iRacing experience proved that I had absolutely no knowledge of what I needed to do in order to properly set up a car so I could be competitive.

I am, quite plainly, a perfectionist and a rather competitive person which, when applied to racing, means I have a profound desire to excel (…and a daunting propensity to drive myself insane while trying). In order to figure out how to be competitive on the track I needed to learn and in order to learn I had to research, ask questions and scrounge the internet for anything that would be helpful.

So right out of the box let me say that everything I describe in this guide is something I learned from someone else along the way. There’s too many sources to name but here’s a few: a bunch of guys around the forums; David Cater (his tutorial videos and numerous chats in sessions); Circle Track articles by Bob Bolles and others; the internet; Google; Budda (for the patience to learn all this crap); et al.

One of the first things I heard about was the “Coil Bound” suspension set-up. I started to research and found several articles on Circle Track and one that featured a previous engineer at Hendrick Motorsports who described the sport’s transition from larger spring rates to softer spring rates. I found it interesting that they went from a 500 – 700 lb front split (this meaning the right spring was 500-700 pounds stiffer than the left) down to very soft 300 – 400lb springs across the front with minimal split.

Somewhere I stumbled over the reason: Maximizing the time the most effective contact patch of the tire is gripping the track.

Race teams are most concerned with what the contact patch is doing through the corner. From the time we lift off the throttle for corner entry until we unwind the wheel for the straight away, we want that effective contact patch engaging the track as quickly as possible and working as long as possible. In doing that we maximize the grip through the corner which allows the car to go faster without sliding. And the speed you have through the middle of the corner carries all the way to the end of the next straightaway.

We know that there is a lot of camber dialed into the car’s four corners (we do have more adjustability in the front than rear) which allows the contact patches to engage as dynamic weight shift occurs on corner entry. Essentially the vertical angle of the wheels change as weight moves and the chassis rolls over into the turn (in case you are not aware). We can look at the cambers on the static car on pit road or even as it travels down a straight and see the wheels are tilted vertically.

But, like I said, we aren’t really concerned about the front wheels on the straight. We are concerned about the corner and the real advantage of coil binding or running on the bumpstops is limiting the amount of travel the suspension has to go before we can fully engage the effective contact patch. In doing this, we reduce the time it takes between the tire being “fully cambered” on the straight to fully engaged for transitioning the turn.
With conventional setups that use stiff springs it would take much longer to compress a 1100lb spring to full compression and, thus, more time before the tire transitioned from “cambered” to engaged. Now bear in mind that, here, “full compression” does not mean coil bound where the coils are touching. It means that after corner entry and dynamic weight shift the weight of the car on that particular corner has reached its limit and that increased weight will compress that spring a certain amount. Huh…?

Let’s say that the static weight (Car sitting in the garage) on the RF is 950lb. For simplicity sake (more goes into how much a spring will be compressed but we’ll just use weight), we’ll say we are using a 950lb spring. That means the spring will be compressed 1 inch. For those who may not know spring rates are an indication of how much weight is needed to compress the spring one inch. In the A, B and C Cars, we have available compression of 4.57” (more on that later) so statically, we have 3.57” of travel left before the spring’s coils touch with this 950lb spring.

Now let’s go out on the track. We are traveling down the straight at 100% throttle and we reach our lift point and turn-in. Weight begins to transition forward and towards the right front corner of the car. Let’s say that we are at a low-banked track (there’s a difference between low-banked tracks and high-banked tracks that I’ll describe later) like New Hampshire where there is a lot of chassis roll and another 500 pounds of weight gets transferred to the right front upon corner entry. (This is where you can imagine David Cater’s excellent “marble moving around the car” imagery).

With the dynamic weight shift of 500lbs to the right front, the dynamic weight on the RF is now 950+500=1450lbs. That will now compress the RF spring 1.3” (1450lb of dynamic weight / 950lb spring rate). Well, we have 4.57” of potential travel and we’ve only compressed the spring 1.3” leaving us with 3.27” of travel.

Now that transition took a little bit of time and it will change as that spring allows for movement from bumps in the track and whatnot. So the effective contact patch took a while to engage and may change throughout the turn. You get a smoother ride but it’s slower.

Let’s look at the big-bar, soft spring (BBSS) setup. The same car with 950lbs of static weight on the RF and a 325lb spring will be statically compressed 2.92” (950lbs / 325lb spring rate). If we take the same dynamic scenario and put 1450lbs of dynamic weight on the RF, the spring will be compressed 4.46.” Wait… That’s not coil bound. We still should have 0.11” left. Well, we aren’t taking into consideration the Front Preload or Aerodynamic downforce, etc. so after those other factors are involved, yes, we will coil bind that corner. This can be verified in telemetry.

Now the amount of travel from static to dynamic is much shorter so it will happen faster and remain coil bound (effectively forming a solid cylinder with little movement) thus maintaining the effective contact patch through the corner.

Well, I introduced the term “Big-Bar.” Let’s take a quick look at a totally different subject that needs to be mentioned in this discussion if you are going to use a coil-bound set-up. The term “Big Bar” refers to the size of the front Anti-Roll Bar (ARB). We say “big” because with soft springs, the nose of the car will really want to twist and roll over through the turn (especially on corner entry where you really want to get maximum grip out of both front wheels) and the ARB needs to be much larger than conventional spring set-ups to counter this roll and hold down the left front tire to get the maximum grip out of it. On iRacing the largest front ARB diameter is 2.75” (The larger the diameter of the bar, the stiffer it is and resists chassis twisting) and we need that maximum ARB (or pretty close to it) for these types of set-ups.
PART 2: The Springs

Now that we’ve looked at the “whys” of coil binding, let’s take a look at some springs: Figure 1 shows a typical Front Spring and Figure 2 shows a typical Rear Spring. The front springs are usually shorter and fatter because the area where the springs must be installed in the front suspension doesn’t have as much clearance as where the rear spring is installed. This is the reason that the maximum deflection in the iRacing garage for the rear springs is much higher than the front springs. The figures are not to scale but resized for formatting sakes. The rear is much taller. Trust me.
Let's take a quick look at where the Spring Deflections in the iRacing Garage come from. Figure 3 shows the same front spring as above sitting on the floor of the garage and I've labeled the areas of possible travel.

FIGURE 3: AVAILABLE TRAVEL EXAMPLE
Figure 4 is a coil bound spring. After compression, it essentially forms a solid cylinder which “sets” the nose of the car; limits roll; establishes and maintains the effective contact patch to the track. **Pardon my rudimentary Photoshop skills. Graphic designer, I am not...**

In the real world, it is possible to coil bind the rear springs as well however I have not seen this possible in iRacing.

There is a deal of confusion as to what the Deflection numbers in the iRacing Garage mean. Here is the translation: You will see: Spring Deflection: x.xx” of x.xx” The second number is the total amount of travel available before the coils touch while the first number is how much the spring is currently compressed. So if you see 2.50” of 4.57” that spring is already compressed 2.50” just sitting still. To determine the available amount of travel, you should: 4.57” – 2.50” = 2.07” available. (This difference is very important as you will see later) This is the same for examining Shock Deflection except the difference is how much travel you have before the shock housing engages the Packer. (Also important)
Below is a screen capture I took at this year’s, if memory serves me correctly, spring Bristol race. You are looking back from the nose of the car at the left front suspension. (Credit for the video goes to NASCAR and thelp2008.com for making the races available. This is a great site that provides videos of a lot of professional races)

What I would like to point out is that these are not “coil-over” shocks. If you are not aware, “coil-over” means the springs and shocks are one unit with the coils of the springs slid over the shock. This is important because this coil-over configuration will give you a 1:1 motion ratio between the spring and shock. So if the spring compresses one inch, the shock will also compress one inch.

That is not the case with the A, B, and C cars (I’m not sure what the street stocks or late models are, but if you want to coil bind them, it’s the same principle). As you can see, the springs and shocks have different mounting locations.

![Figure 5: The Gen 6 Front Suspension](image-url)
This difference in mounting locations of the shocks and springs are what enables us to decide, for the A Car, whether to coil bind the car or to run on the bumpstops. If you pay attention in the iRacing garage, you can change the spring rate and then re-adjust the spring perch on a corner to reset the ride heights which changes the Spring Deflection while maintaining the Shock Deflection.

This is because when you put in a different spring rate, the chassis will raise or lower appropriately depending on if you put in a stiffer or softer spring. When you move the Spring Perch to reset the ride heights to what they were before the spring change, you are compressing the spring between the Spring Perch Collar and the Lower Control Arm. The shock, however, is connected to the Lower Control Arm and the chassis’ front clip and, since the ride height is measured on the frame rails (which are connected to the chassis) you return the spring back to its original deflection. (there… clear as mud)

This means we can choose a specific spring rate that gives us a certain Spring Deflection in the iRacing garage while maintaining the same Shock Deflection at a given ride height. More on that later.

The shocks help control how quickly weight is moved around the car. They determine the time it takes for dynamic weight transfer to occur; not how much dynamic weight is transferred. This is just a quick point and a topic for an entirely different tutorial.

Figure 6 below shows a typical Penske Racing shock. This one is actually a coil-over as it has an adjustable Spring Collar but it is good for an example.
In real life applications packers are simply shims (a piece of metal of a particular thickness). Figure 7 below shows a shock packer.

![Figure 7: Typical Packer Shim](image)

As far as iRacing Packer modeling is concerned, think of the packer for a particular shock as a lock-ring that you can move up or down the shaft of the shock. You have a neutral position which is reflected in the iRacing garage as .000” and the ability to raise and lower that “lock-ring” to adjust where along the shaft the shock housing will make contact with it which determines the amount of overall shock travel available.

Figure 8 below shows the difference in iRacing’s packer positions

![Figure 8: Different iRacing Packer Positions vs. Available Shock Travel](image)
Bumpstops are used to provide a buffer between the shock body and the Packer and, more importantly, control the “binding” (for the lack of a better word) of the shock. Figure 9 shows some typical bumpstops. You will see they come in different sizes however iRacing’s model can more easily be thought of in terms of “squishiness.”

Bumpstops, as the iRacing Garage help text indicates, act like miniature springs. So think of them as a fine spring adjustment. In my experience they also can provide fine control of the ride height. Just as you can have spring split (the difference between left and right springs) you can also have bumpstop split. I have not experimented with this much but I’m sure I’ll get around to it.

Bumpstops rest on top of the Packers (Figure 10) and under the shock’s housing which is why you can manage ride heights after dynamic weight transfer with them. A softer bumpstop will “squish” more which will allow the nose to drop a little further while a stiffer one will hold the nose a bit higher.
A lot of iRacers get overwhelmed with the addition of these two front suspension adjustments from the B or C Car to the A Car. However once you see how these all work together, it really gives you much more control over how well you can get the front splitter sealed off to the track. And that is the ultimate goal in these cars.

Part 4: Putting It All Together

Firstly, let’s put one thing out there: making a set-up is like getting fitness or golf advice. There’s some real, measurable things that you can adjust to (tire temps and wear) and a lot that is driver feel. The following is just how I personally decide on whether I will choose to coil bind or ride the bumpstops.

So, let me explain my personal philosophy as whether to coil bind or ride the bumpstops: For me, it’s all about chassis squat versus chassis roll. On relatively flat tracks (< 10 degrees or so) the chassis will roll over more to the outside of the turn while higher-banked tracks will cause the car to squat down more. Figures 11 and 12 show the differences (The figures accurately depict the degrees of banking, by the way☺).

![Figure 11: Low Banked Tracks Squat vs. Roll](image-url)
For slower tracks with low banking, I tend to lean toward coil bound set-ups because with less banking to give grip from centrifugal force I want more control over the chassis roll in order to achieve the most mechanical grip I can by getting the nose to set as quickly as possible and engage that effective contact patch for as long as possible.

When I run on larger tracks with higher banking, I will set the car up so it rides on the bumpstops because using them allows me more options to seal off the front splitter as well as fine control over that last instant of dynamic weight transfer (I believe that is also known as “landing”).

So how are these two conditions obtained? I mentioned above that the differences in the available travel between the Shocks and Springs are the key. If you want a corner of a car to coil bind you make sure the difference between the Spring Deflection is less than the difference of the Shock Deflection. Here’s an example on the right front (the packer is set at -0.188”):

Shock Deflection: 3.11” of 5.11” gives you: 5.11” – 3.10” = 2.00” Available Travel  
Spring Deflection: 2.90” of 4.57” gives you: 4.57” – 2.90” = 1.67” Available Travel

As you can see, the springs have less travel than the shocks which means that the springs will coil bind before the shock engages the bumpstop. Let’s look at what it would look like if we wanted to run on the bumpstops. I’ll raise the RF Packer up to a +0.500”:

Shock Deflection: 3.11” of 4.42” gives you 4.42” – 3.10” = 1.32” Available Travel  
Spring Deflection: 2.90” of 4.57” is the same as above: 1.67” Available Travel
In this case, simply by moving the packer up and limiting the amount of travel of the shock, you can change between coil binding and running on a bumpstop. Now, getting the set-up to the point where you can change between the two this easily is a large balance between selecting the proper Crossweight, spring package, Front ARB Preload, ride heights and more.

Some like a more visual depiction of what these two different conditions look like:

**COIL BOUND SET-UP**

![Figure 13: The coils are bound while the shocks still have travel](image)

**Bumpstop Set-Up**

![Figure 14: The coils still have available travel and the Shock Housings are on the Bumpstops](image)

So how are these different Spring Deflections obtained? I vaguely described the procedure above but I'll try to be clearer.

You adjust the desired Spring Deflection by choosing different spring rates and moving the spring perches. If you want to run coil bound, it is a process of choosing a softer spring that will
compress further under the same corner weight, resetting the desired ride heights, and checking the
difference between the Shock and Spring deflections until the Spring has less distance to travel than
the shock does before it engages either the other coils or the bumpstop respectively.

If you want to run on the bumpstops it is a bit more complex because the springs are attached
to the chassis and how much weight is on the particular corner does affect the compression of the
shock more than it does the spring.

This is why my first steps in setting up a car are: a) getting a ballpark front spring package in
place and b) focusing on getting the right side tire temps and wear even by adjusting cross weight.
Getting the weight distribution correct, in my opinion, is the most important foundation for setting up
the rest of the car, including the process of setting up where the bumpstops are going to engage.

For the sake of simplicity, let's just say that we have set the crossweight. Then we simply
increase the spring rates so the springs have less static compression until the shock available
deflection is less than the spring available deflection. I like to have the shocks engage just before the
springs do as this gives me the full effect of the springs and the bumpstops on the dynamic weight
transfer.

I will stop here because going any further will head very far away from the intent of this basic
tutorial and head into the very complex arena of setting up the nose of the car (perhaps another
tutorial down the road).

I hope this cleared up some of the confusion. See you on the track!