

Hi Ross. If you're old enough to remember the old E.F. Hutton commercials, then you'll remember the key line in the ad: "When E.F. Hutton talks, people listen."

When **Jeff Braun** talks shocks, people listen!

So, when a subscriber who had recently gotten a car with adjustable shocks asked, "Is there a formula/protocol one should use in order to figure out the right balance for the car? Where should I start? Should I learn the car first and then start making small adjustments? Make big adjustments?" I knew I need to go to Jeff for the answers.

By the way, Jeff posts all sorts of great tips, advice, and information on his Facebook page, [Auto Racing Tech Tips](#). Check it out.

Enjoy!

P.S. - Warning! I've been wanting to write a sidebar about how you can adapt your driving to suit the handling of your car, and that's what I did this week. But it's long....

The Secrets To Setting Up Your Shocks by Jeff Braun

Well, the bad news is there is NO secret. The good news is there are a few simple guidelines that you can use to help you get dialed in and more importantly, understand what your shocks do and how they affect the handling of your car.

Many high performance cars have adjustable shocks now, some even electronically adjustable from inside the car. I am going to focus on those that can be adjusted on the shock with some sort of "clicker" – from outside the car. Even if your car has no shock adjustments, this may be worth a read to understand the dynamics of your car and how the

"A racing car is an animal with a thousand adjustments." - Mario Andretti



Improve your adaptability through knowledge and practice.

One of the key areas that separates good drivers from great drivers is their ability to adapt their driving to suit the car's handling, or from one type of car to another.

Some drivers, despite how the car is handling, will only drive it one way – with their style. And guess what? A driver's style will never suit every handling characteristic. If you cannot adapt your style to suit the car's handling, a change in track conditions, a mechanical problem, or a different type of car, you'll never be the best you can be.

Although it would be impossible to list every potential problem scenario you may someday face when driving, I'm going to attempt to identify the most common ones. Then, I'll give you some suggestions as to what you may be able to do to adapt your driving to

shocks contribute to the handling. You may figure out what sort of changes you want to make to the stock shocks, based on what you learn here



I'm going to keep this simple. If you really want to dig deeper on this stuff, that's easy. Just get the eBook, *Shocks for Drivers*. I had the pleasure of helping with this and it will really give you a good understanding of shocks and how the driver feels what they are doing. But let's hit the high points, now.

Shocks move in two directions: Bump (shock getting shorter) and Rebound (shock getting longer). Many shocks have an adjuster to change the force it takes to compress the shock (bump adjuster) and change the force it takes to pull the shock apart (rebound adjuster).

Shocks also move at different speeds, depending on the input to the tire. A big bump or curb hit moves the shock fast (high speed) and braking dive, cornering roll, or accelerating squat moves the shock slow (low speed).

help the situation.

My overall objective is to give you some knowledge about what you might do to reduce the effects of the problem. In other words, what can be done so the problem has the least effect on your lap times?

Corner Entry Understeer:

If your car is understeering in the entry portion of a corner, consider what you can do to induce some forward weight transfer and what you can do to lessen the weight transfer to the rear.

To increase the forward weight transfer, you can increase or lengthen the amount of time spent trail braking into the corner. That means not trailing, or easing off the brake pedal so quickly, keeping a little more pressure on the pedal for a little longer. And, if it is a corner that requires little-to-no trail braking, then it may be a matter of waiting a little longer – being more patient – before beginning to accelerate; or, squeezing on the throttle a bit more gently.

The key, then, is to be patient. You will probably end up entering the corner a MPH or so less. If you focus on increasing the forward weight transfer, and decreasing the weight transfer to the rear, you will be able to get the car rotated (turned) earlier in the corner and get back to throttle solidly – without having to come back off it to control the understeer. That will improve your acceleration out of the corner and down the straight.

Avoid the temptation to turn in a little earlier. If anything, you want to turn in a little later, opening up the exit line so that you can focus on the acceleration phase of the corner.

If the weight balance of the car is not the cause or the cure of the understeer, then you have to consider one other thing. It doesn't matter where in the corner the

More expensive shocks have an adjuster for low-speed bump and high-speed bump as well as low-speed rebound and high-speed rebound. These are called 4-way shocks. It gets more complicated at the top end with 5- and 6-way shocks and inerters and G valves, but we are not going there.

If you have adjusters on your shocks (no matter how many), start with them set in the center of the adjustment range. Go drive the car and feel what it does. Now sit down with a track map and write down how the car "feels" in each corner. Remember there are three parts to the corner that shocks can affect: The braking dive, the cornering roll, and the acceleration squat. Write down how it feels in each phase of the corner. That's a lot of work, so just pick the one corner that frustrates you the most and do it for that corner, only.

Now, a little common sense thinking will come in handy. Let's pick one issue you may have from your map notes, as an example of the thought process.

THE CAR DIVES TOO MUCH WHEN YOU PUT ON THE BRAKES. So, what's happening to the shocks when you stomp on the brakes? Oh, you don't stomp on the brakes. Right. You read *Speed Secrets Weekly* and you have that nice brake trace, looking for the end of brake point, and releasing the brake in a great smooth way, right? Well, even if you do brake that nice way, the car does the same thing as if you stomp the brakes. The front shocks get shorter and the bump force they produce tries to prevent that. At the same time, the rear shocks get longer and the rebound force they produce tries to prevent that. So, it's easy; if the car dives too much, we can stiffen the front bump and the rear rebound. Now that we know what happens, we can easily see that accelerating out of a corner is the exact opposite situation. Rear shocks get shorter and fronts get longer.

The question is: How much do you turn the adjuster? The best answer is to look at your shock profile graph. What? Yeah, that's a chart a shock dyno produces that shows the force the shock has at each adjustment setting. Unless you have a racing shock or you're super into it, you likely don't have a graph. The *Shocks for Drivers* book goes into detail on this, if you want to know more.

The thing to know is that most shock adjusters are not linear. That means the force change of

understeer is, think about what you are doing with the steering wheel. Often times, corner entry understeer is caused by the driver cranking in too much steering input, or cranking it in too abruptly. Turn the steering wheel a little less, and a little more gently. I know it may not feel right – the car is not turning enough (understeering), so you turn the steering less? Exactly. Keep the front tires at an angle that they can work at. If you steer the front tires too much, they can't help but give up their grip and begin to slide.

Again, be aware of how much steering you have input, and try taking some out. Or, turn the steering wheel a little slower, a little more gently as you initiate your turn-in. Give the tires a chance to build up their cornering grip.

Corner Entry Oversteer:

Oversteer is often a result of too much weight on the front tires, and not enough on the rears. If that is the case during the entry phase of a corner, that probably means you are braking too hard into the corner – you are trail braking too much.

The cure, then, is pretty simple. Just begin braking slightly earlier, and trail off the brakes a little sooner as you enter the corner. Perhaps, especially if it is a corner that requires little-to-no braking, it is a matter of beginning to accelerate sooner (but very gently), transferring more weight onto the rear tires.

One other thing that may help reduce corner entry oversteer is to turn the steering wheel less abruptly. Ask the car to change directions, from straight forward to a curved path, a little more progressively.

Mid-Corner Understeer:

Usually the best way to handle mid-corner understeer is simply by smoothly modulating the throttle to change the weight balance of the

the shock is not the same for each click. It may get more sensitive (more of a change per click) or less sensitive (less change per click) depending on the direction you're going. As a general rule, when you turn the adjuster toward stiffer, it will become more sensitive and as you back it out, it will become less sensitive. So make BIG changes at first. If you want to go stiffer, go from that starting mid-point, to half towards full stiff. If you don't feel a change in the dive of the car, then go to full stiff next and give that a run.

The point is make BIG changes at first to get a direction, and try to do only one change at a time. In our example, stiffen the front bump first and go drive. Then try the rear rebound stiffer, and go drive. Try to get a feel for how sensitive the adjustments are.



Now it gets complicated. Remember the shocks also move when the car rolls. So our adjustment to the front to reduce the dive also affects the car when it rolls in the corner. We just increased the force the outside front shock produces in roll while trying to reduce the dive. So this reduces the roll at the front of the car, and will change the balance of the car, in addition to the dive change we wanted. Most race car changes have two or three effects on the car; very few are 100% independent of a secondary effect. So the thinking gets more complex. Never overlook that secondary effect - it can be big.

One more thing to consider is bumps. If the car is harsh in the bumps or does not ride the curbs well, we need to soften the shocks because the shock is too stiff and not absorbing the energy. Instead, it's transmitting it into the car chassis and your body. Ideally, you want to reduce the high speed dampening (because the bumps move the shock fast). If you don't have a high-speed adjuster, just use the only adjuster you have and make it softer. But know that if you

change the weight balance of the car. In other words, just breathe - gently lift off - the throttle to cause some forward weight transfer, giving the front tires more grip.

Often, the understeer is not related to the car's set-up, but that you have gotten back on the throttle to begin accelerating just a little too abruptly or early. Again, just breathe the throttle to transfer some weight forward.

Also, just like with the entry understeer, be aware of the amount of steering input you've dialed in. Perhaps the cure to your car's mid-corner understeer problem is just unwinding the steering a little bit to allow the front tires to get some grip.

Mid-Corner Oversteer:

Dealing with a mid-corner oversteer is almost always done by changing the car's weight balance. In this case, that means squeezing more throttle on. However, one of the reasons the car has begun to oversteer is that the speed you are carrying is slightly more than the rear tires can handle. So, the last thing in the world you need right then is a bunch more speed. That is why it is critical to *squeeze* on just a little more throttle.

The mid-corner oversteer could also be caused by wheelspin (in a rear-wheel-drive car, of course), which should be dealt with by being a little easier on the throttle.

If your car's set-up is the cause of the wheelspin, about all you can do is be as gentle as possible with the acceleration, and possibly alter your line slightly. If possible, drive the car a little deeper into the corner before turning in, make the initial turn radius a bit sharper, aim for a later apex, and then let the steering unwind as early as possible. This makes for a straighter acceleration line, meaning that there will be less cornering force to combine with the acceleration force that you are

soften the bump to get through the bumps on the track better, you're going to get more dive, roll, and/or squat with it. It's a big compromise.

How do you know to soften bump or rebound to be better in the bumps? Whew, that's a complete article in itself. Some hints in the *Shocks for Drivers* book, but try reducing the bump force, first.

The other thing you can do to just learn about your shock adjustments is a "sweep." We do this on the pro teams when we get a new car. Even though we have the detailed shock profile graphs and know exactly what each adjuster does, we need to know how that changes the feel to the driver. The shocks have a huge effect on driver feel. At times, it's the most influential adjustment to driver feel on the car. So do a sweep. It's simply starting at a known setting and changing it in steps as you feel the effect. It takes awhile to "sweep" an adjuster, but if you have the track time to do it, you will know exactly what tools you have to affect the feel of your car.

Just start in the center of an adjustment and drive. Then go from there half the way to full stiff and drive. Then go to full stiff and drive. Go back to the center and drive again as a baseline check. Then back out halfway to full soft, drive, and to full soft and drive. Take good notes and work your way through all the adjustments, front and back.

Yep, that's the way the pro teams do it. Not very sexy, high-tech or fancy. Just lots of track time and effort.

So, think about how the car is moving, what the shocks are doing at that time and what you want it to do differently. If you really understand that, then you can easily figure out what adjustment to make and at least get headed in the right direction.

- Jeff Braun

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asking from the rear tires.

Exit Understeer:

If your car has an exit understeer problem, the best thing you can do without reducing your acceleration is to alter your line. Your prime objective is to lessen the amount of time you are turning the car while accelerating. So, if you turn in a little later and sharper (even if this means slowing the car down a little), and aim for a later apex, it will allow you to unwind the steering a bit earlier. That means you will be accelerating in a straighter line, reducing the harmful effects of the understeer.

And one more thing. The more gentle you are with the acceleration, the less understeer you will have. If you jump on the throttle, the understeer is going to be exaggerated. So, squeeze on the throttle.

Exit Oversteer:

Exit oversteer can be related to one of two things: either it is power-oversteer, caused more by the car's inability to put its acceleration traction to the ground; or it is due to the weight balance.

Usually, the way to deal with either type of exit oversteer is much the same as with exit understeer. The goal is to open up the exit of the corner, increasing the radius of the corner as soon as possible, by using a later turn-in and exit.

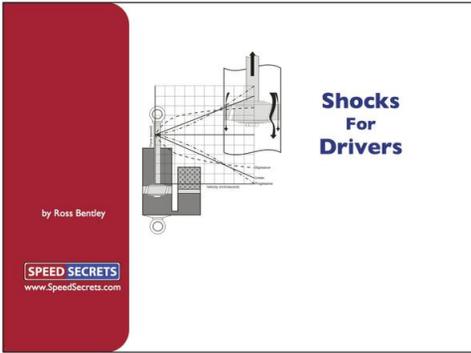
Another thing you have to keep in mind with exit oversteer is to be gentle with the throttle under acceleration. If you stand on the throttle, even if you have altered your line, you are going put a big load on the rear tires. In time, this will overheat them, making the oversteer problem worse, even causing it to oversteer in other parts of the corner.

There is one other approach to dealing with a car that oversteers at the exit of a corner – especially

But Wait, There's More...

Jeff mentioned the eBook about shocks, *Shocks For Drivers*, that I put together. You can

For Drivers, that I put together... by sucking everything I could (but far from everything) out of his head! It's available [here](#).



Got a Question?

If you have a question that you'd like answered in *Speed Secrets Weekly*, send me an email at ross@speedsecretsweekly.com.

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at the end of a corner - especially, one that has an extreme oversteer problem - and that is to almost give up, or sacrifice that part of the corner. Instead of slowing the car down and using a later turn-in and apex, you pretty much do the opposite. As you approach the corner, you brake later and carry much more speed into the corner, taking an earlier apex, and then get the car straightened out and pointed down the straight well after the apex. The idea here is that since the car will not accelerate out of the corner very well, you might as well try to take advantage of where the car is working - the corner entry.

Before using this technique I would make sure that every other technique didn't work, as you will not be setting any track records using this approach. It is a bit extreme! Perhaps the biggest challenge in using this technique is that it is unlikely you have a mental program for it. Therefore, try it out when and where it's safe, so that you are prepared for it.

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