

Living off the Wall



Track Junkies, Auto-Crossers, and Car Control Clinic veterans, WE WANT YOU coming back year after year to NNJR track events.

Faithful, you have been doing High Performance Driving Events for a couple of years now. You understand threshold braking, and heel-toe downshifts and the concept of the “racing line”. Best of all, at your last event you were passing cars in your run group. You

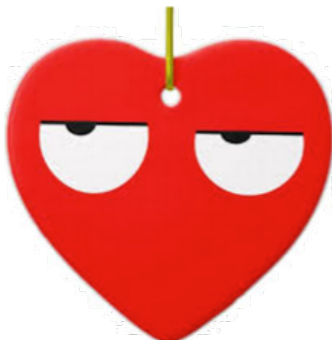
have upgraded to performance tires, swapped out your street brake pads for squeaky performance compounds and installed that shiny red fire extinguisher that tells everybody in the mall parking lot you mean business. But before we all run out and buy that fresh set of R-compound rubber, let’s do a quick refresher course on what to do when things don’t go completely to plan.

There is no substitute for “seat time” and the best place to learn the “limit” of your car is an open parking lot; preferably at the NNJR Car Control Clinic or Autocross. Repeated drifts, slides and spins in an open parking lot will train your three-axis *aSSelerometer* to know when you can save a car and when you are going for a ride. Spins happen; it’s part of the learning process, but it doesn’t have to be an expensive lesson. Knowing what a car feels like before it gets beyond your ability to correct it is analogous to a major league batter waiting on a fastball. It’s easier to hit a pitch when you it’s coming and it’s easier to avoid a spin if you can “feel” it coming.

Remember when you were starting out your instructor calmly reminded you, “If you feel the car is going to spin; GET ON THE BRAKES, come to a complete stop and stay in your car with the brakes ON”. But it never happened. It has always been “the other guy”.

But, what do you do when you are “the other guy” on the threshold of a spin? First, relax, most of the time a spin results in nothing more than a bruised ego, a slightly uncomfortable conversation with the chief instructor and four slightly squared off tires that go thump-thump-thump for a run group session. But what if we could have “caught it”?

CPR



CPR is an acronym used at many driving schools and it stands for “Correct, Pause, and Recover”. CPR best encapsulates the process you should follow if you are losing or have lost control of your car on the track.

1. Correct

“Correct” means getting the car under control with all four wheels rolling (tracking) in the same direction. Let’s apply “correction” to the most common type of mistake; an oversteering car on exit. In an oversteer condition, the back end rotates to the outside of the turn

and the front of the car is no longer pointed in the direction the car is now traveling but to the inside of the track. First, turn “into the skid” to get your front wheels tracking in the true direction the car is traveling. Turning into the skid will reduce the rate of rotation. The earlier you can get this done, the better. It can be a quick “flick” of the steering wheel or a smooth measured input depending on the speed you are traveling. Correcting an oversteer skid is a “right now”, real-time adjustment. A half a second late may be too late. Add the correction early and precisely with just the right amount of steering input and you can reduce or eliminate the rate of rotation to regain control of the car.

2. Pause

“What do you mean PAUSE!!!! My car is sliding sideways and you want me to pause?” In a word, yes. After your initial correction, the car needs time to settle on the suspension and begin tracking in the direction your front wheels are now pointing. I find that saying “Com’on Darlin” is just about the right amount of time to pause. It never hurts to speak lovingly to your car at this moment in time.

3. Recover

As you regain steering control and are tracking to an area you feel is safe, modulate the brakes to slow down. If you have “corrected” without leaving the track surface scan all three mirrors, (count them 1-2-3), slow down and plan to visit pit lane to have your car looked over.

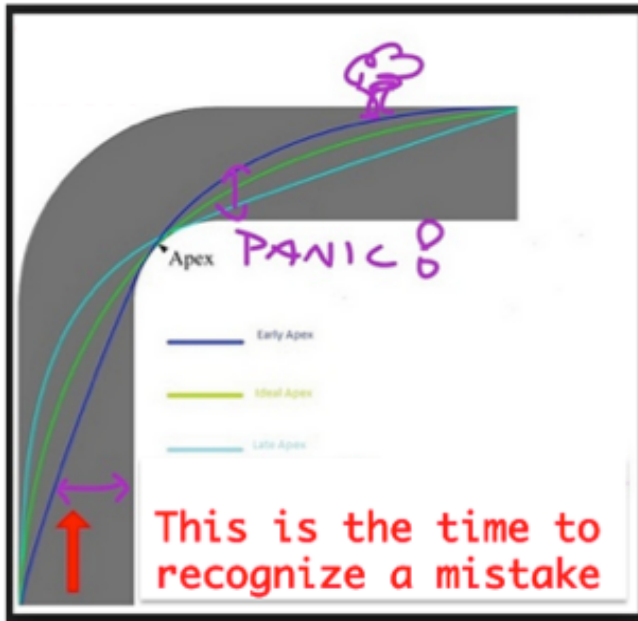
If you have left the track surface, meaning you have two, three or four wheels off the pavement remember that grass and dirt offer very little lateral traction to support a turn and wet grass offers less. Get the car completely under control which means slowed down (a LOT) and tracking straight before you even think about returning to the track. If you have spun the car, come to a complete stop, stay in your car and DO NOT be in a rush to re-enter the track. Catch your breath, wait for the flaggers to give you a signal and then drive slowly around the track off the racing line and make your way into the pit lane.

Cars go off the track in turns, braking zones, and driving down the straightaway. No area on a track is completely safe, but some sections are safer than others. New tracks, old tracks, bumpy tracks, cement patches, pavement sealer, hills, camber (banking) will all change the grip level of your car on the track. On your first warm up laps, look for tire marks where others have spun. Dark black tire marks left by sliding tires will tell just about everything you need to know about the challenging sections of the track. Make a mental note not to be “that guy” in that spot. Conditions continuously change throughout the day. Cold tracks and wet surfaces will dramatically affect your car’s handling and braking. Sand, oil, antifreeze or the remains of a migrating army of earthworms after a rainstorm can be anywhere on the track surface. Note everything and then take the time to talk to your instructor and other drivers to learn what areas of the track to pay special attention to and why. Understand the track conditions and be aware they can change in an instant. The majority of spins should never happen and we can fix most of these situations with a little practice and a better understanding of recovery techniques.

Very rarely do novice and intermediate drivers come into a turn so fast that the turn-in itself causes the car to spin. It is almost always a progression of events starting with a compromised line compounded by a lack of experience on what to do next that causes a driver to spin.

At turn-in, your initial input to steering should be gradual and smooth. Don’t be misled when you see a video of a professional rapidly spinning the wheel from side to side. This is rarely a professional driver’s initial input, but an anticipation or reaction to the car “stepping out” and the driver actions to “catch” the car as it does. In most cases the professional driver is

expecting the car to “step out”. Even though they may be sawing the wheel from side to side, the result is a stable chassis platform and a smooth turn radius.

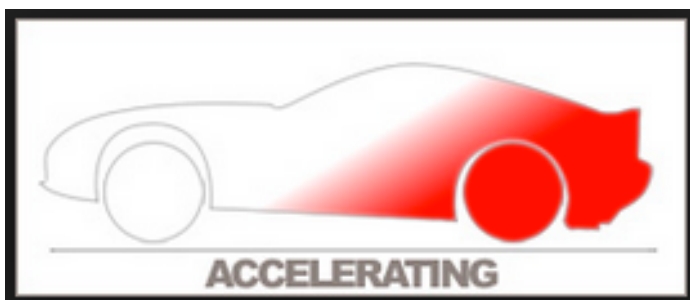


As you progress and drive faster, your braking and turn-in reference points will come up faster and you will rush your turn-in resulting in a line that leads to an early apex. It will happen. As you know from your whiteboard sessions an early apex causes your car to track out early and requires you to increase steering angle in order to stay on the track at the exit. The first time it happens, it will come about 100 feet before the track-out cone.

Our primal brain, the medulla oblongata screams, “We’re going OFF” and our basic survival instinct tells us “hit the brakes and turn the wheel to stay on the track!” Bad idea Medulla. Lifting off the throttle or hitting the brakes while changing the steering angle will spin the best handling car with the most advanced electronic traction controls.

The irony is that you could have made the turn in most cases with a slight correction done **earlier**. In the above diagram, 50 feet after turn in gives us ample time for correction but 100 feet before the exit cone maybe too late.

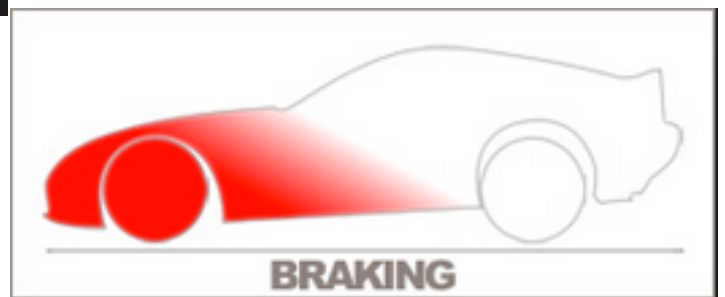
Let's dissect an early apex example to understand exactly why the wrong reaction to it will cause the classic “lift-throttle oversteer on exit” spin.



In Car and Driver tests, a 2012 Porsche GT3 RS weighing 3,200 pounds measured 74% of the weight of the car on the rear wheels under acceleration, but only 42% on the rear tires under braking. Think about it, that’s an absolute change of 32%, or close to 1,000 pounds!

Increased weight equals increased tire friction and grip, removing weight reduces grip. You can shift hundreds of pounds off the rear tires just by simply lifting off the throttle in the middle of a turn!

“Lifting” off of the throttle and increasing the steering input 2/3 of the way through a turn will



cause the car to “rotate” and may put you into a spin. As the car pitches forward in reaction to lifting off the throttle, it transferred weight off of its rear tires to the front tires. Less grip in the rear (perhaps compounded by additional steering input) induces lift throttle oversteer. It will happen in a new 911, Cayman, Boxster or 944. Older trailing arm suspension designs will actually “toe in” the rear wheel as the rear end rises up and wheels drop down through their suspension travel arc creating the classic double whammy, 911 “snap” oversteer. It happens in early 911’s, 356’s and early BMWs and it can happen in a blink.

Recognizing early when you have taken an early apex line will allow you to make corrections in the entry and center of the turn. A little more trail brake or a little less throttle will “tuck” the nose of the car into the turn and tighten your circumference.

In all cases when exiting the turn, use the entire track and **do not “hold” an oversteering car to the inside of the track.** Fight the urge to lift or hit the brakes on the exit of a corner and correct with just enough steering input to reduce or eliminate the rotation. If the conditions are dry, you can even afford to track wider and use the outside of the turn as “run out”. This is a much better option than “yanking” the car back onto the track if you put two wheels off the pavement inviting a high-speed spin across the track. The downhill at Lime Rock Park is a good example where you do not want to abruptly lift out of the throttle and add steering angle in an effort to hold the car on the pavement at the exit. Doing so will loop you to the inside of the track. Look for all the tire marks at the exit of this turn and see where they go. Spoiler alert, they track from the outside of the turn across the track to the inside tire barrier before pit in.

When a driver abruptly loads and unloads the suspension by lifting on and off the throttle or going on and off the brakes throughout a turn it never allows the suspension to reach its maximum cornering limits.

Braking spins

Next up on the spin-o-meter are braking zones. If we were in a race and not an HPDE, braking zones would be the number one hotspot for thrills, chills, and spins. But this IS HPDE and we are not challenging for position into Turn One on the first lap; right? So what could possibly go wrong? Well, lots of things. If you apply the brakes abruptly while turning in, the rear of the car will rotate out. Teach yourself to smoothly release brake pressure as you initiate the turn in.

Even if you brake in a straight line in early cars without ABS you may have to deal with both front and rear tire lockup. Rear tire lockup can actually make the rear end “hop” off the pavement. Even with a new car with ABS, a poorly synchronized downshift can make your rear end hop like a bunny. In both of these scenarios, you DO NOT want to add steering to try and “make the turn” as the rear grip of the car is compromised and can quickly rotate.

You will “feel” front-end tire lockup but you don’t always “feel” just rear wheel lock up. You WILL feel the car isn’t braking as effectively as it did the lap before. In this case, it’s better to “trust your butt”. If it doesn’t feel right when you are threshold braking then something isn’t right. If your rear is locked up and you turn in, your Porsche will react just like the handbrake turn you did with your parent’s sedan in a parking lot and spin like a top. Play it safe and use the run out at the end of the braking zone if something doesn’t feel just right. If you don’t have a run out, use as much track as you can to slow the car down before you try to turn in even if this means driving wide of your turn in point.

ICE-ICE Baby

On newer cars, the dreaded “ICE-Mode” pedal is a new wrinkle added in place of rear brake

lockup. ICE-Mode is caused by a confused Dynamic Rear Proportioning valve (DRP) and can be activated by bumpy tracks in combination with aggressively “jamming on” of the brakes. When the ABS software senses a rear lockup, a pre-programmed algorithm restricts additional hydraulic pressure by closing a valve in the master cylinder to the rear brake lines allowing the rear tires to continue to rotate. When the valve is closed, the brake pedal feels “hard”. In theory, you still have full brake pressure and modulation on the front calipers and pushing harder may apply more front brake pressure, but we have experienced instructors and racers that would dispute that this “theory” is of any real value. If you are threshold braking, you are likely close to 100% of your front brakes capacity and pushing harder is not going to help you slow down.

If you cannot slow the car down by simply pushing harder on the brakes, come off the brake pedal and then reapply the brake firmly. The assumption is that releasing the brake pressure will reset the DRP value to a normal “dry” brake bias. If it doesn’t work, try it again while looking up for the run-out extension. Fortunately on most of the tracks we run there are run-out areas at the end of the longest straights; use them!

OK, you get it, incidents happen in turns and during braking, but did I mention the straightaway? Been there; done that. I had my 911 hydroplane and spin as I lifted to brake on the front straight at Watkins Glen in wet conditions. I pirouetted down the straight, through the braking zone, past the turn in and up the “escape” road. Round and round I went for probably 800 feet in total. It’s always better to be lucky than good, and that time I was very lucky.

“Lift Happens”



Unless you are driving a true downforce car, (you are not) aerodynamic lift happens when you add speed. You can feel “lift” when you are at high speed on a straight by the “lightness” in the steering. The same or more lift is happening at the rear of your car. A modern Porsche adds a lot of speed on a straight and your automatic pop-up spoiler or aftermarket wing reduces lift, but it doesn’t eliminate it. As your car loses downforce, it becomes much more susceptible to crosswinds and yes, hydroplaning in wet conditions. Anytime the coefficient of friction of the track is compromised, bad things can happen even when you are driving in a straight line. At 120 MPH, you are covering the length of a football field in 1.6 seconds and it will take 4 times the distance to stop at 120 mph as it would when you are doing sixty. So, don’t relax too much on the straight.

Remember, your car has built up serious potential energy according to Sir Isaac Newton’s $F=ma$, as in Force = Mass **multiplied** by Acceleration. While on the straight, try to anticipate EVERYTHING that could go wrong. Be sure you have a view of the car in front of the car in front of you. If a car blows up halfway down the straight and the two cars in front of you hit the brakes, you need to have a “plan” for where you would place your car. If you are hounding the driver in front of you trying to “encourage” the driver to give you a

passing signal, you may not see what is going on in front of him. With speed you have reduced your downforce and added serious potential energy (Force) so be very attentive to track conditions, debris, disabled cars, or in my case, running water on the “dry line” braking into turn one. Bottom line, you can never be looking “too far” down the track at speed and you should always have “a plan”.

Fast Car - Slow hands

On fast straights and fast sweeping turns add this new “Law” to your track day Wikipedia, FT=SH. “Fast Turns = Slow Hands”. You can't toss the car around like you can at a 35 mph autocross at speed. Slow your steering inputs down and give the car time to react and settle so you don't overcorrect and make things worse! When a car gets loose at a high speed, you can still use CPR, just slow down your inputs.

CORRECT “SLOWWWWWW HANDS”

PAUSE “C'mon Darlin, pretty please....”

RECOVER “Phew, that was interesting”

Moment to Moment



If you find yourself losing control on a straight or on a very fast turn, it is rarely the first variable that gets you; it's under or over correction that puts you over the limit. Think of a “fishtailing” car, the first moment of inertia leads to an equal and opposite “moment” of inertia. What typically happens is the driver has not corrected quickly enough after the initial step out of the rear of the car and then holds a corrected steering angle too long as the car rotates back the other way compounding the effect of the second swing. As the driver gets behind on the correction the car ends up fishtailing. If you come to the car control clinic, I'll

show you a technique where you let the steering wheel “slip” through your hands as the car recovers from your first moment of inertia and starts to swing to the second. Left alone, your front wheels will track very quickly to the exact vector your car is currently traveling and then track precisely to your forward direction magically through the car's rotation all by itself. It's Caster, a Friendly Ghost.

One Good turn deserves another

I didn't mean to scare you. OK, maybe just a little, but it's all worth it when you get it right. When you enter a turn, you load the front suspension by braking or simply turning the front wheels. With street cars, this loading takes time as the car transfers weight to the front tires and then to the outside wheels. As the weight transfer equalizes against the spring rates and friction force builds, the front end of the car takes a positive ‘set’. As the car changes direction, the load transfers to the outside wheels.

In a well-executed turn, the front-end will turn in smoothly with the rear tires following from the pivot point originating from the center of gravity of the car. The rear of the car will drift to a point of equilibrium equal to the “Moment of Inertia” balanced against the lateral frictional resistance of the tires. As you track toward the center of the turn, the lateral frictional force will continue to reduce the speed of the car. At the center of the turn (true apex) or just before, you can offset this deceleration by gently adding throttle balancing the weight distribution between the front and rear tires. As you pass through the apex you can feed in more throttle, moving more weight to rear tires as you slowly unwind the wheel to track out. If you line is right you can continue to feed in power.

When it's right, your car turns in smoothly, is balanced in the center of the turn and on exit, the rear end squats down, "hooks up", the engine sings, the steering feel lightens and you rocket out of the turn with a huge grin pressed against the inside of your helmet. That's the dance and the warm embrace your car will reward you with if you can consistently and smoothly "balance" the weight distribution through the entry, center, and exit of a turn. If we could only do this perfectly every time, we could all quit our day jobs, but even professionals get it very wrong sometimes. But when it's right; there is nothing quite like it.

One last thought: The last run of the day

Skiers have a saying that goes something like this, "Don't take the last run of the day". Why, because everyone seems to break their leg on the last run of the day. I know, it's hard to take another run with a broken leg, but humor me here. You are having a great weekend and progressed in every session. After the first couple of laps in your afternoon session, you screw up two turns in a row. It happens especially when you have fast Freddy in your mirrors. Next lap you blow past a braking zone and miss the turn in. Your car is running perfectly, but you're not. You are tired.

With all that adrenaline pumping you may not feel the fatigue but your concentration is waning and your reaction times are compromised. Point Fast Freddy by, check your mirrors and gauges, work on your lines, and drive at 8/10's. You made it this far without having Jay Mazzola, body man to the stars, look over your crumpled fender shaking his head. More importantly, it's an NNJR event and there will be plenty of cold beverages waiting for you when the track closes. Think of coming in a few laps early and focus on beating Fast Freddy to the cooler.

See you in the spring.

