From **street legal** to **track regal**

The Viper ACR is an incredible street vehicle. Now the experts at SRT® explain how to turn your ACR into a track monster.

By Matt Bejnarowicz

The Viper ACR has hit production, just in time for the summer track season. From an engineering viewpoint, *this* is what it's all about. The ACR will "strut its stuff" in the hands of the Viper faithful – all those owners that we have thought about and designed for will finally hit the road (and track). With the single focus of race track performance, the new ACR is the highest performing, street legal vehicle that Dodge has ever produced and it comes standard with the most adjustability that SRT® could fit into the package. SRT engineers have been at the track for well over a year now developing the ACR, so why not offer our advice to the new ACR owner on their first track outing? Here is a small part of our routine when we hit the track – it's a rough job, but hey, somebody's gotta do it.

A track event always starts for us in the shop several days prior to the track day. The racetrack is an abusive environment. There is good reason why a Viper warranty does not cover any race track use—it's hard on a car and greatly accelerates wear. Does this mean that the Viper is not capable of track use? Not at all. In fact, SRT prides itself on "walking the talk" that many exotic manufacturers cannot. However, more frequent maintenance is required to keep your Viper running at maximum potential and safety. Prepping, inspecting, and setting up the ACR in advance are the biggest keys to success.

Showing up at the track with a work list or unfinished setup is a sure recipe for lost track time and a frustrating experience. Costly hours are lost if you are finishing preparation or correcting problems that were not checked in the shop.

Shop preparation includes inspection, maintenance, and setup. Here is what SRT goes through every time:

VEHICLE INSPECTION AND SHAKEDOWN

We are looking for any sign of wear, fluid leaks, loose fasteners, etc.

✓ Raise the vehicle, grab the wheels and look for excessive play in the suspension. Small deflections in all the joints are normal. Check your service manual for limits.

✓Inspect boots and joints for damage due to track debris or brake heat.

✓ Check belly pans, engine, transmission, differential, power steering, radiator, for any signs that a leak is occurring.

✓ Check all of the wing fasteners, splitter fasteners and dive plane rivets. Check for splitter cable play and ensure the adjusting nut is tight.

✓ Check all suspension fasteners and run a paint mark on them to help you inspect the next time around. Don't forget those big front and rear center hub nuts. These need to be checked occasionally (250 lb-ft).

BRAKE INSPECTION

Brakes are commonly overlooked at club events. It seems someone always tries to save a buck here and extend the life of the brake components. Of all places to save

money, this is not it - eat at McDonald's or "Motel 6 it" instead!

A brake system operates on the premise of pad friction against a steel rotor surface. The ACR brakes work very well because the pads, rotors, calipers and air cooling are designed as a system to control the large amount of heat energy created by the pad friction. So what needs to be maintained?

Brake Fluid: Before every track event, we bleed the brakes about six times at each screw to flush out the old fluid. If it is the start of the season, we run two bottles through to make sure everything is fresh. As brake fluid heats and cools in a track environment, it attracts moisture and degrades. Ever look at a race brake fluid canister? Typically they reference a "dry" and "wet" boiling point. The difference for the Viper DOT 4 fluid is 160 degrees F. This means that fluid that has degraded and collected moisture will boil at a much lower temperature. What happens when your brake fluid boils? That's right—foot to the floor. If it's your lucky day, you'll only need a new pair of shorts. Always store your spare fluid with cap on tightly and avoid using open fluid that's been sitting on the shelf.

Brake Pads: After creating the friction to stop the rotor, the brake pad also acts as a thermal barrier to slow the heat passing into the brake fluid. When a brake pad wears, the thinner it becomes, and therefore the less it will slow the heat going into the fluid. When SRT is going to a hard braking track, we change the pads if they are worn any more than 40%. At the track, we change them when the friction material wears down to 6mm. Remember, that last 2mm of pad is not a friction material. It's a bonding material for the steel plate. It's not good for braking and wears much faster. Don't let it get down to that point—it's not worth the additional cost of new rotors.

Rotors: The ACR rotors are very robust. They will, however, need to be replaced depending on how the car is used. Light heat checking is our term for the small hairline cracks that appear in the center of the rotor ring. This is a result of wear and the high heat environment. When do we replace our rotors? When the heat checking starts to make its way to the edges of the steel rotor ring (inner diameter or outer diameter).

Calipers: Viper calipers are low maintenance. Look for leaks and any damage to the cross over tubes at the bottom of the caliper. During pad replacement, take a look at the pistons and make sure they are in good shape. If track days are frequent, the dust boots on the pistons will typically crack and break apart. These can be replaced, but their function is not critical to brake operation. They simply block some of the debris from entering the true piston seal hidden further inside.

Lines, ABS, etc: Take a look at the brake lines and make sure there is no damage from track debris. Your ABS system is mainly hands off. All Vipers have Electronic Brake Distribution (EBD) that actively adjusts the front and rear brake bias to the amount that the tire will allow during a stop. Never operate your car with an ABS or Brake warning light illuminated—get it checked out.

LUBRICATION AND MAINTENANCE

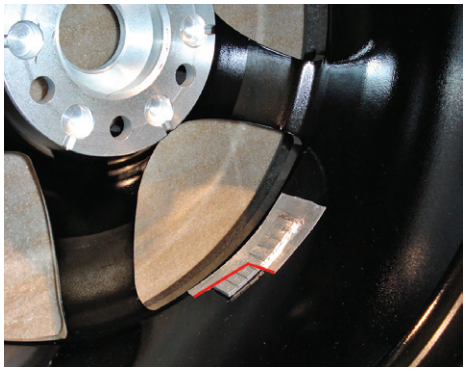
✓ **Engine Oil:** We change our engine oil and filter after every track event. (Remember, when we go to the track, we also run for 6-8 hours per day for two days or more). Fill the engine with Mobil 1® 15W-50 for extra protection under higher stress conditions and always, ALWAYS, use a Mopar® oil filter—there is a difference.

✓ **Trans & Diff Fluid:** We typically change both after every other track event. The differential fluid is accompanied by a bottle of friction modifier. This is to lubricate the friction plates inside and prevent chatter. This modifier actually embeds into the friction plates, which means it's possible to add friction modifier too often and "over lubricate the plates." How do you know if there is not enough modifier? When you turn tight circles in a parking lot, it will sound like a gear has broken back there. Change the fluid and add a bottle of modifier and let it soak back in. The more you track your car, the more this modifier seems to wear down. If you notice on your u-turn out of pit lane that the rear end is shouting nasty noises, don't panic yet—just get some new fluid and modifier in there.

✓ **Ball Joints:** Under heavy braking, the grease in these joints liquefies due to extreme heat. It also expands and can seep out of the vent hole on the ball joint boot. This is normal and just needs to be cleaned up. This also results in grease loss that should be replaced. Follow the service manual and don't fill them up tight, as this will certainly blow the boot out when everything gets hot. When ball joints go dry, they produce creaking and clicking noises.

WHEELS AND TIRES

✓ Along with brakes, tires will be your biggest wear item. They typically wear most at the outside shoulder (where the sidewall meets the tread). Take a look at your wear indicators and replace the tires if they are getting low. Never run any tires with the construction cords showing. If you intend to



put as many track miles on your ACR as street miles, it's beneficial to increase the front static camber (see Tuning Changes section later in this article).

✓ Wheel weights from the factory are the adhesive-backed style. Under high temperatures, this adhesive may soften. Add a piece of aluminum or racing tape over the weights to prevent them from dropping when the wheels are hot.

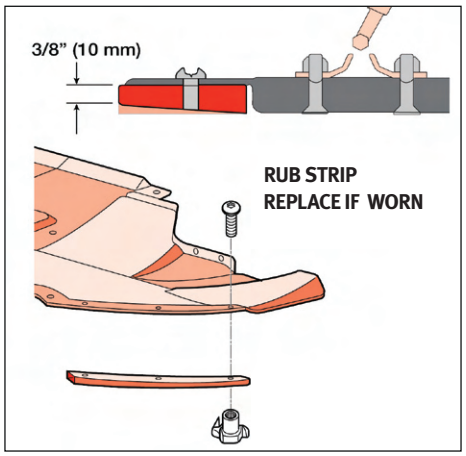
AERODYNAMICS

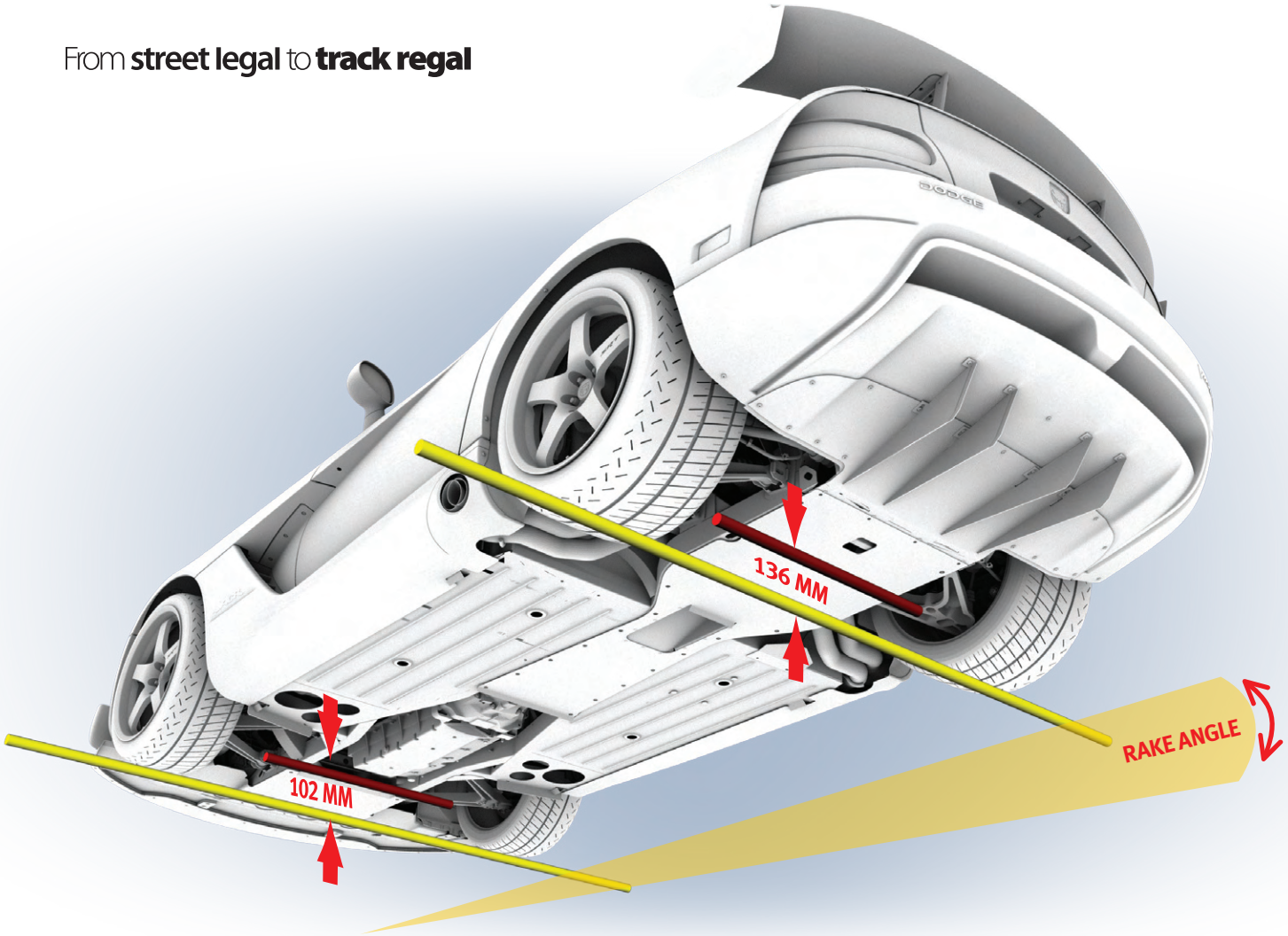
✓ During your shakedown, you should have checked all your splitter, dive plane and wing fasteners. If you forgot, check them now.

✓ The splitter is factory equipped with sacrificial rub strips. One of these is also a track extension to complete the full splitter profile at the track. Follow the ACR owner's manual and replace any of these worn down to 3/8". A rub strip is much easier and less expensive than replacing that complex carbon fiber panel!

INITIAL SETUP

The ACR comes from the factory in a street setup that meets federal regulations





A good initial setup is the first critical step toward racing success in your ACR. Begin with adjustments to the ride height and rake angle to lower the chassis and set the aerodynamic platform of both the upper body surface as well as the underbody panels. Don't forget—if you plan to make any wheel alignment changes, this is the time to do so. Remember to also check the bump steer as this also affects the ACR's handling.

while providing best comfort. Refer to the owner's manual for recommendations on both track and street settings. For now, we'll just assume your garage is at the track and cut to the final setup.

- **Tires:** Before you do anything, set the tire pressures. All your setup work should be done with even tire pressures. If you want to be critical, do everything at hot tire pressures (34-36 psi). For simplicity, we did all our work at street pressures (29 psi). Make sure you use good dry air or Nitrogen to fill the tires. Moisture in air greatly changes the expansion rate inside your tire when hot. The result will be hot tire pressures that are way too high and greatly reduce handling performance. Avoid chasing this problem.

Side note: How do you know your pressure gauge is accurate? Two psi is a significant change on a race track. Even if you have a gauge that is new and expensive, check it against one or two of your neighbors and make sure they agree. Almost every race team I have known has lost time due to a bad gauge at one time or another.

Ride Height: Time to drop the car and get that center of gravity lower. At the same time, you will also be increasing your static camber. Both are great areas to improve mechanic grip through a corner. First check your fuel level and get someone of your weight to sit in the driver's seat. The idea here is to set the car up at the exact condition it will be on track. We typically fill the tank to full, mainly because it is the easiest to stay consistent in all your setup work. The recommended starting ride height for a smooth track is:

Front: 102mm Rear: 136mm

This is measured at the axle centerline, from the ground to the bottom of the frame rail (not the aluminum belly pan). Remember, if you have recently jacked up the car, the suspension will not be settled to the correct attitude. You will need to roll the car back and forth for at least 200 ft. or have the car sitting on a slip plate (found on alignment racks or in race paddocks). Don't worry about getting all four corners to the target height—this will never happen due to manufacturing tolerances. If you can get there within 2-3mm, you are doing fine.

Alignment: If you plan to check or make any wheel alignment changes, this is the time to do so. Alignment can slip during off-course excursions or due to heavy curbing impacts. If you have paint marked all of your camber bolts, look for any movement in these areas. If you are making changes to camber or toe, don't forget to check the bump steer (dynamic toe pattern). This can play a large part in whether your ACR handles properly.

Corner Weights: If you have access to vehicle weight scales, now is the time to setup the corner weights of the car. Remember, the ACR's center of gravity is

dictated by the masses, wheelbase, and track width. This means there is not much you can do to change left-to-right weight distribution or front-to-rear. What you can change is the diagonal weights (left front + right rear or right front + left rear). We usually start at 50/50 or left front + right rear = right front + left rear. Add weight to a diagonal by running the spring seat up on either corner. Take your time and recheck your ride heights after each corner adjustment. If you are making a change to the right front, make the opposite change to the left front to keep your average front ride height the same and only move weight on the diagonals. Remember, anytime you jack up the car you will need to settle the suspension.

Dampers: The KW dampers that are on the ACR have an enormous tuning range. We could write an entire book on damper adjustments and still have questions. For now, start at the recommended smooth or rough track setting published in the ACR Owner's Manual and make one or two click changes from there.

MECHANIC PACK LIST

SRT's goal for the ACR was always to ensure it could be driven to and from the track with only a few tools for maintenance. The following list is a bare minimum that we would take with us:

Torque Wrench: Take a good "clicker" style torque wrench with a deep well 19mm socket and extension. Check your wheel torque before every session when the wheels are cool.

Aluminum Jack: This should fit easily in the trunk and are usually light enough to save your back when removing. Make sure to buy a low profile jack. If the car is too low, pack some wood planks to drive the front tires on and gain the necessary jack clearance.

Jack Stands: Bring two of these to allow you to rotate the tires left to right, improving tire life. Always use jack stands before performing any work.

Brake Pads and Tools: Front brake pads may wear fast at hard braking tracks. Bring a spare set of pads and the tools required to change them.

TUNING CHANGES

Your ACR comes standard with the joy (and frustration) of tuning ability. If you want your ACR to handle differently, here are some "knobs" to turn:

Damping: Double adjustable dampers are standard on every ACR. Each has 14 positions of compression and 18 positions of rebound that adjust independently of each other. Make changes in one or two click increments and document your results. If this is your first track outing, start with the recommended track settings published in your ACR owner's manual.

Rake Angle: The ACR is very responsive to rake angle adjustments (difference between front and rear ride height). If you have set your car to the smooth track heights, this equates to 34mm of positive rake. When you change the front or rear ride height, you are changing many areas at once

a. Center of Gravity Height (CG)
b. Roll center height and front to rear roll stiffness distribution
c. Static camber angle
d. Aerodynamic downforce and front to rear balance

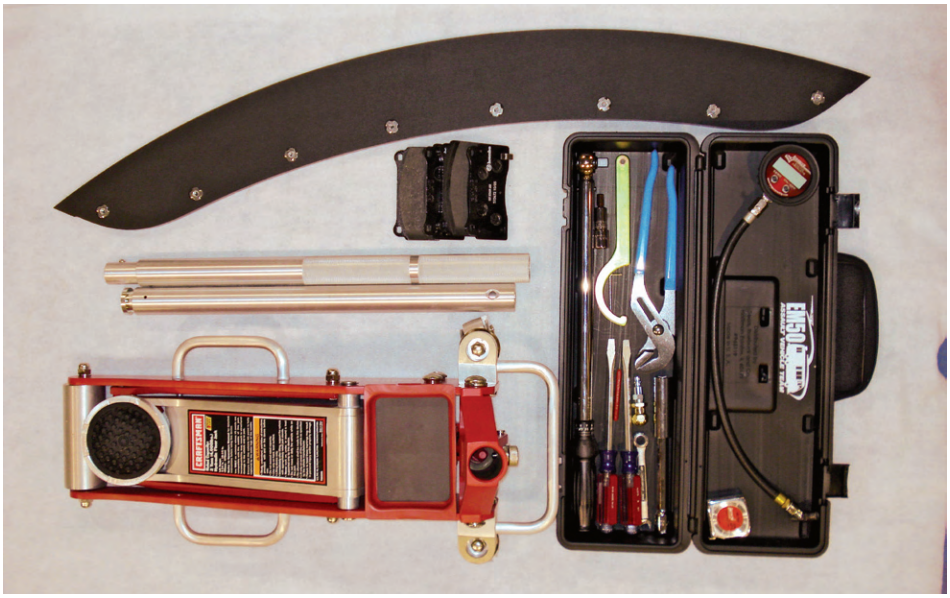
In general, lowering the rear ride height (or reducing rake) will lower the CG, lower the rear roll center, add static camber, and reduce overall downforce while shifting the balance rearward. The total effect is typically:

- Increased stability and understeer at corner entry.
- More understeer at the middle of corner.
- Better rear traction at corner exit.
- More understeer through high speed corners.

Raising the rear ride height (or increasing rake) will have the opposite effects. Be careful as there is such a thing as "too low." Here are a couple of tips:

1. If the front is too low, it may cause a terrible corner entry understeer that improves as you pick-up the throttle. One cause of this is a heavy engagement of the front jounce bumpers under braking and corner entry, acting to significantly increase the front roll stiffness. Raising the car could actually improve this issue.
2. Splitter contact with the ground during braking occurs when the front ride height is too low or when the car has too much rake angle. This will wear the splitter, but it also disturbs the front downforce and the underbody airflow.
3. Tire rub on rear inner fender liners may be experienced when the rear of the car is set too low.

- **Rear Wing Angle:** The rear wing is manufactured with seven adjustment positions. It is shipped from the manufacturer at a position that resulted in the best balance of drag, downforce, and track balance. Tipping the front of the

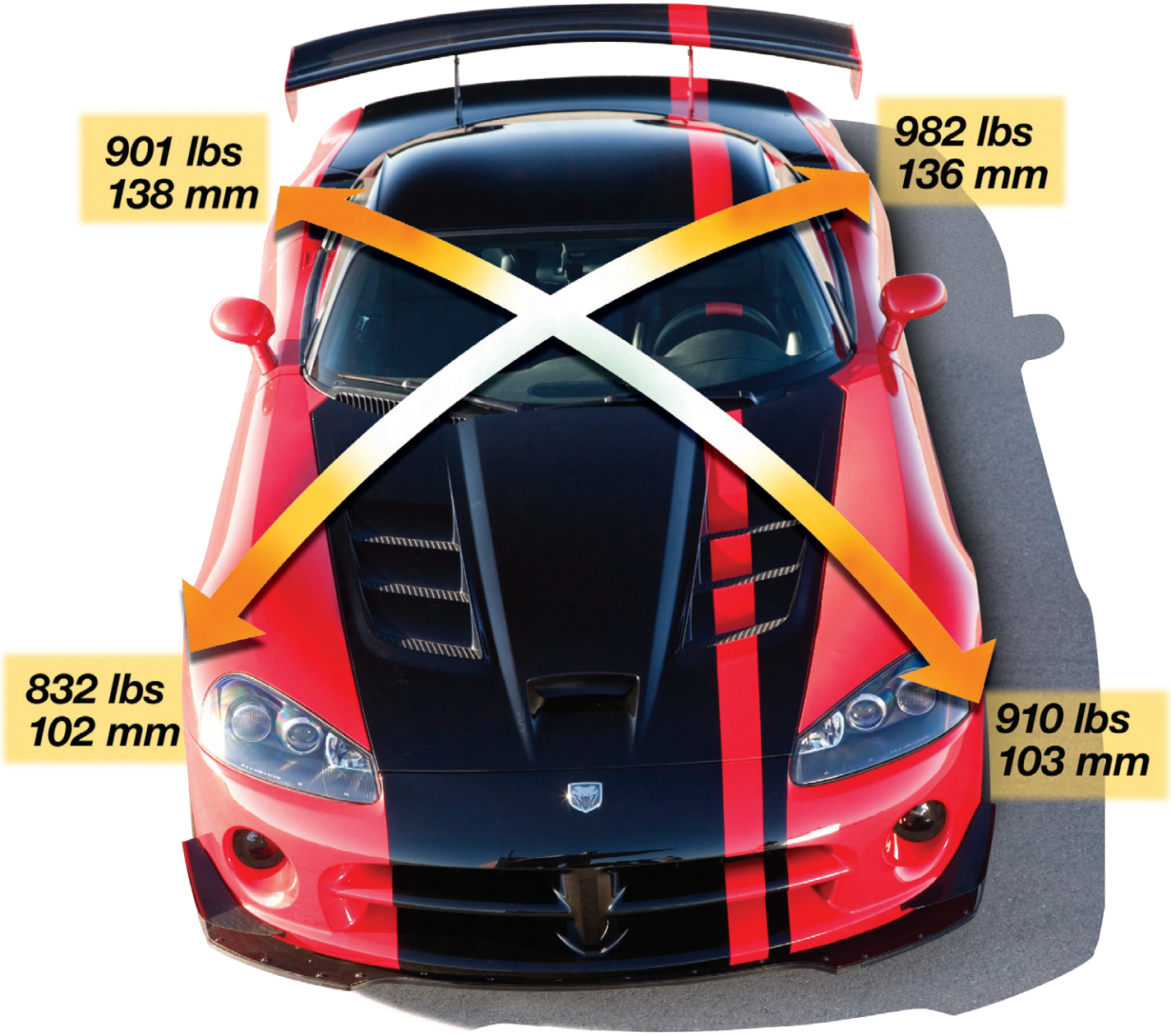


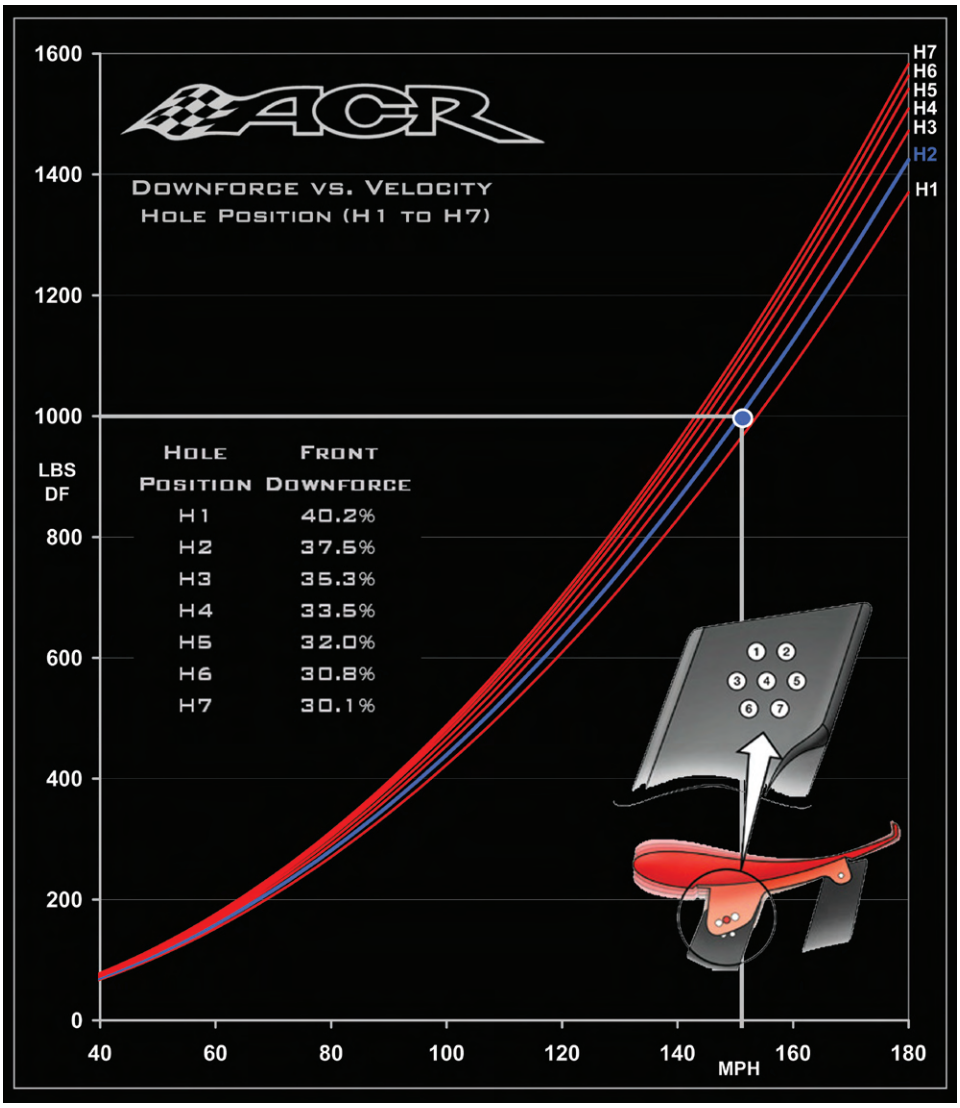
Although cargo space is not a priority with most ACR owners, there is still room for a small tool kit and a few parts in the trunk. You can also fit in a change of clothes and your safety gear. There's no room left for the clubs, but would you really rather be golfing?

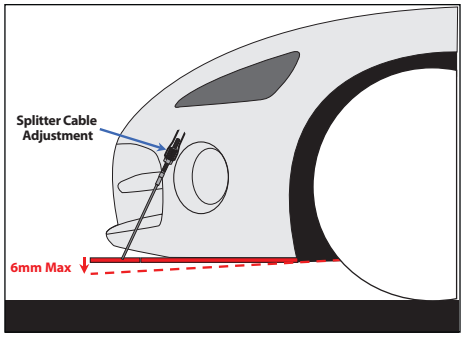
wing down will increase the angle of attack, increase overall downforce, and shift the balance to the rear. This will improve braking and increase understeer through higher speed corners. At the same time, it will increase drag and act to reduce straight-away speeds.

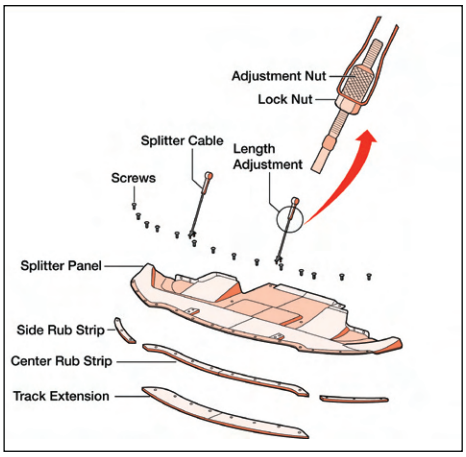
- **Splitter Angle:** Although the splitter is not intended to be adjustable, there are some small tweaks that can change the handling of the ACR. The splitter is shipped from the factory with slight tension applied through the adjustable splitter cables. It is possible to loosen these cables and allow the splitter to deflect downward under loading. The maximum amount of downward deflection should be about 6mm at the nose of the splitter. Set this by pushing the splitter down at the front and measuring the downward deflection from its free state. Take a look at the splitter cable mounts under the front fascia and make sure the T-bolt is seated properly in its saddle—it is possible for this to hang up if improperly adjusted. By allowing the splitter to deflect downward at the nose, front downforce will increase and act to reduce understeer during high speed corners. Again use caution that the splitter is not contacting the ground during heavy braking.
- **Alignment:** The ACR is shipped with a street alignment that provides a good compromise of track performance and street tire wear. If you intend to spend more of your time on the race track, increasing static front camber will improve front grip slightly and improve your race track tire life. Increasing the front static camber to around -2.0 to -2.4 deg (at the lowered track height) will greatly improve track tire life. The rear camber angle should be sufficient after lowering of the car.

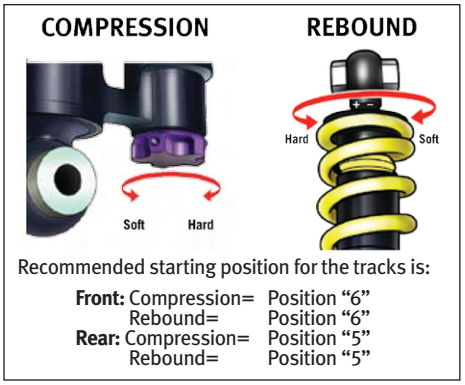
Toe changes also have a large effect on handling. Adding a small amount of front toe out (-0.20 deg total) will greatly improve the corner entry of the ACR. It will respond faster and "point" quicker. Adding rear toe in will act to increase stability under braking and increase understeer under through most of the corners. Reducing rear toe in will have the opposite effect. Don't forget to check toe and bump steer











Recommended starting position for the tracks is:

Front: Compression= Position "6"
Rebound= Position "6"
Rear: Compression= Position "5"
Rebound= Position "5"

One of the most dynamic features of the new Dodge Viper ACR is the capability it has for large adjustments in both the chassis and the aerodynamic elements. That's why it's the perfect blend of street and track car. If the handling is not the best for you, no matter how you're driving it, there are plenty of ways to improve it. And you'll find that most of these changes are relatively easy to accomplish, which makes driving an ACR even more satisfying.

(dynamic toe pattern) after any alignment changes. This is another commonly overlooked point that can lead to poor performance and inconsistent handling at the track.

ADVANCED CHANGES

Even though the Viper ACR was designed to be a weekend track day car, inevitably there will be owners that want to take their car closer yet to a full-time race car. What if you want to go beyond the envelope of tuning that is provided standard with the Viper ACR? Here are some thoughts:

Spring Tuning: The Viper ACR uses 60mm ID racing springs with the following rates:

Front: 90 N/mm (514 lb/in)

Rear: 190 N/mm (1085 lb/in)

Racing springs are sold through most major race suppliers and can be easily changed on the ACR due to the unique upper spring seat design. Use caution as you go down this path as stiffer springs are not always better.

Anti-Roll Bars: The anti-roll bars (swaybars) on the Viper ACR are not adjustable for either rate or pre-load. However, the ACR anti-roll bar sizes and links are common with the Viper Competition Coupe. Therefore, it is possible to equip the ACR with adjustable drop links (for improved corner weighting) and nylon bushings (for increased rate and response). Contact Viper Race HQ for further assistance at 888-960-3333.

Brake Pads: The brake pads on the Viper ACR are another great compromise between street and race track performance. However, changing to a full race pad on the front brakes improves initial response, reduces pad wear rate, and may improve consistency over many laps. On the downside, however, you will likely experience more brake squeal and the race pad will also transfer more heat into the brake caliper and fluid. Changing to a race brake fluid (such as Motul® RBF 600) will increase the boiling point compared to the standard DOT 4 fluid. Adding race cooling ducts will also help as well. Brake pads produced by Mintex, Ferodo, and Performance Friction seem to work well with the Viper ABS system. Contact Viper Race HQ (888-960-3333) or your local Viper race supplier for assistance.

Race Tires: The ACR comes standard with the Michelin Pilot Sport Cup tire. This is a street legal, DOT race tire that is designed for both dry and damp conditions. Running a dry race only tire (such as a Hoosier DOT) may further

improve your laptime around a track. However, switching to a true race tire will likely require additional tuning changes. During development, SRT tested the ACR on the latest Hoosier DOT tires. Although they improved laptime due to overall grip, the transitions were not as sharp. The beauty of the ACR, however, is the ability to tune for this.

Differential Cooler: The ACR has been designed for the average weekend club event. Therefore, it is capable of running 20 to 25-minute lapping sessions, followed by a cool down lap and a 30-minute cool down period in between. If you intend to run your ACR for longer durations or shorter cool down periods, it is recommended to equip your car with a remote differential cooler. This is also available through Viper Race HQ.

Ball Joint Heat Boots: The boots that protect your ball joints and tie rod ends are in the same category as the differential. If you intend to run your ACR for long durations or more frequent intervals, adding heat insulating boots to these joints will protect them from increased wear. These are also available from Viper Race HQ.

DRIVING TECHNIQUES

The ACR has serious performance potential at the race track. We tuned the car to be predictable and well balanced at the track. However, if you want to get the best laptimes, you have to drive the car smooth. In other words, slow hands and slow feet. Drivers that try to muscle the ACR into corners and chop at the throttle will have a hard time keeping up and likely complain of entry understeer and exit inconsistency.

The combination of the tires, aerodynamics, and suspension seem to greatly reward a cool and patient driver (after all, Tommy Archer assisted in our development and who else is as calm and collected behind the wheel?). Watch your hand movements as you enter the corner. Force yourself to slowly turn that steering wheel into the corner. If you have ordered the driver's stripe option, use the steering wheel stripe. As you roll into the throttle, do it smoothly and progressively.

If this will be your first track day ever in a Viper, think twice about taking your new ACR out without some instruction. Consider taking a high-performance driving school first to learn the basics of car control and race track theory. Viper Days offers great instruction specifically for Viper owners. Contact your local VCA and inquire about any track day or driving schools on their event calendar.

WARRANTY

As a final note, it's important that ACR owners understand that the manufacturer warranty does not cover any racing, track use and some adjustments from factory settings. Many people ask about this, especially since the Viper ACR was designed to rule the race track. The simple fact is that the high wear and the abusive environment of a race track or closed course event makes it impossible to cover the ACR under warranty.

The goal of the ACR was to provide absolute performance at a price tag starting under $100K. Those that have looked around at aftermarket pricing know the ACR is a bargain, especially with the understanding of all the design, development, and durability testing that was undertaken by SRT.

There would simply be no way to offer the ACR anywhere close to this price and attempt to cover warranty due to track use. We hope that ACR owners understand this was the only way we could produce this car and meet your request for an all-out track car. Please take the time to review the ACR owner's manual with your dealer for all the warranty details.

SAFETY

This discussion would not be complete unless we ended on safety. Racing is an inherently dangerous sport. Time and time again we witness individuals trying to save a buck with their personal gear and safety equipment or trying to save time by not taking proper precautions before going out on the track. Don't go down this route – a car can be replaced, but you cannot. Check with your local sanctioning body or club for safety recommendations on both vehicles and drivers. Purchase high quality driving suits, gloves, and shoes. Buy the latest Snell approved full faced helmets, head and neck restraints, wrist restraints etc. Check the expiration dates on your six-point harnesses and install quality systems following the manufacturer installation methods. On top of everything, drive within your personal limits and listen to others' advice when they tell you to cool it down. The ACR was designed for a day of track enjoyment – make sure your drive home in it feels the same.