That's How We Roll

By Adam Mestemacher

Knowing how to find your front and rear roll centers—and understanding how they work—is crucial to getting your car to handle. Here's how it's done in the High Performance Steering and Suspension class at UNOH.

There are many inexpensive computer programs available to help you dial in your race car. But to get the best results, you need to start with accurate measurements. Case in point: Performance Trends' Roll Center Calculator, which we use in the High Performance Steering and Suspension class at the University of Northwestern Ohio. It provides invaluable data regarding front and rear roll centers—once we plug in the right numbers. Here's how we get those numbers.

First, we make sure that the race car is sitting on a level surface. Then we set the ride heights. (Your ride heights are determined by your rule book.) We also install the proper rims and tires and set the camber as if we were ready to race.

Next, we mark the car's centerline. Here's an easy way to do it:

1 Measure the tread width of each of your front tires and find their centerlines. Mark each tire's centerline on the ground.

2 Find the halfway point between the two tire centerlines to find the front centerline of your vehicle. Mark that point on the ground.

3 Do the same for the rear of your car. Snap a chalk line between the front and rear centerlines you marked on the ground and you've got your vehicle's centerline, which will be the basis for all of your horizontal, X, measurements. (Other measurements are from the ground up, Y.) These measurements must be precise. Don't guess or "eyeball" anything. (See "Wrong Number.")

Enter these measurements into the computer program, and you will see a scale drawing of the front suspension indicating the roll center location. If you don't like where your roll center is located, you can change the numbers. That, in turn, lets you figure out what settings you need to change to get your roll center placed properly. The computer illustration extends each side of the car's control arms (upper and lower) to a place where they cross, known as the instant center. Then it connects a line from the center of the tire on the corresponding side with the

instant center. The program then does the same for the other side, and the place where the instant-center-to-tire-centerline lines cross is your front roll center.

Finding the car's rear roll center is much less time-consuming. For a car that uses a Panhard bar, measure between the two pivot points of the bar and find the middle point. That's the roll center. If the vehicle uses a J-bar, just pretend that the bar is straight and do the same thing you would for a Panhard bar. Again, the center point is the rear roll center. If the vehicle has leaf springs, the rear roll center is located on the centerline of the vehicle at the height that the springs attach to the rear axle housing.

Front Roll Center Locations		
Dirt Car Range		**Asphalt Car Range**
2"-3½"	STARTING HEIGHTS (VERTICAL)	3"-5½"

Flat Track (0-8° Banking)		
Toward High End of Range	Heights (Vertical)	Toward High End of Range
4"-6" Left of Centerline	Horizontal Starting Point	2" Left of Centerline
2"-4" Left of Centerline	After Dive/Roll (from Program)	2"-4" Right of Centerline

Medium Banked Track (9-14°)		
Near Middle of Range	Heights (Vertical)	Near Middle of Range
2" Left of Centerline	Horizontal Starting Point	2"-4" Right of Centerline
2"-4" Right of Centerline	After Dive/Roll (from Program)	4"-6" Right of Centerline

High Banked Track (15°+)		
Toward Lower End of Range	Heights (Vertical)	Toward Lower End of Range
Centerline	Horizontal Starting Points	4"-6" Right of Centerline
4"-6" Right of Centerline	After Dive/Roll (from Program)	8"-10" Right of Centerline

Now that you know where your roll centers are, you need to determine where they should be, and how to get them there. The following chart provides ballpark location for different types of cars.

Other factors to keep in mind include your car's center of gravity. The higher the center of gravity, the farther right you can put your roll center. The opposite is true for a lower center of gravity. Regardless of the type of rear suspension, rear roll center locations don't change much. The average height of your rear roll center will be 10–13 inches. When testing your car, move your rear roll center locations in half-inch increments and take good notes. Keep in mind tire height will also change your rear roll center height; the taller the tire, the higher your roll center.

Again, this is just a start. As always, track time is the only way to figure out what works best for you and your car.

Since graduating from UNOH, Adam Mestemacher has landed a job at Richard Childress Racing, as a tire specialist on the No. 3 Bass Pro Shops Chevrolet Silverado driven by Ty Dillon in the NASCAR Camping World Truck Series.

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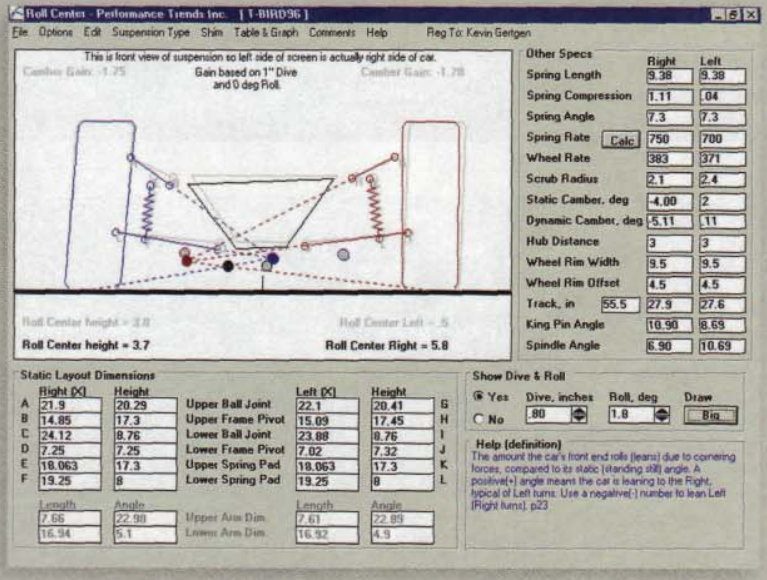

The Roll Center Calculator (pictured) is just one of several valuable software programs available to short-trackers through Performance Trends. The Roll Center Calculator, Performance Trends' simplest program, determines both static front roll center (at ride height) and dynamic (as the car goes through dive and roll), as well as camber change and scrub. It also figures motion ratio and wheel rate from spring rates, and much more.

Performance Trends also offers Roll Center Plus, for both front and rear suspension, and its full Circle Track Analyzer, which actually "drives" the car around the track.

Further, the Performance Trends Suspension Analyzer is a full 3-D suspension analysis that helps determine bump steer, caster, anti-squat or anti-dive, rear roll steer, Ackermann, and much more.

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Wrong Number

Don't dial yourself out with imprecise measurements.

Performance Trends' Roll Center Calculator can help you pinpoint your car's roll centers—provided that you provide the right input. Here's one example.

How to find the center point of a ball joint

Pull the ball joint from the car and secure it in a vise. Stick a piece of tape on the housing, move the shaft as far as it will go in one direction, and draw the centerline. Now move the shaft as far as it will go in the opposite direction and draw another centerline. The place where the two centerlines connect is the center point. (Height gauges are good for getting around suspension obstacles.)