

# Lap #6, Check your Rear

**H**aving a car that handles well is the easiest way to go fast. A predictable car that permits you to drive at the limit with confidence will produce the lowest lap times and more importantly allow you to pass others while driving off the ideal line. The single greatest contributor to improved handling can be found in the rear suspension where good axle location and geometry will improve predictability, and will make a big difference in handling. Good axle location means a system that does not deflect fore, aft, or laterally when under load. During cornering, any movement in these directions will require additional steering wheel inputs just to keep the car on the intended path. These inputs are in addition to the normal ones required due to changes in traction as the car negotiates a corner. Poor geometry and axle location can create a real handful to drive which may explain why so many stiffen the suspension to prevent movement.

The early Mustang rear suspension uses two leaf springs and dampeners (shocks) arranged in what is called a "Hotchkiss" arrangement. The leaf springs support the car and transmit all fore, aft and lateral loads from the tires to the chassis. While fine for street use, this can create big problems on the track as loads increase and the system stiffens or binds reducing the ability of the springs to do their job which is to maintain traction by following the undulations of the road surface. The best solution is to isolate the springs such that they perform only the task of following the road surface and use other devices to handle the fore, aft and lateral loads. In road racing, the lateral loads are substantial so on this lap we'll focus primarily with defeating them and assume the fore and aft loads will be dealt with on another lap dedicated to traction control.

There is a very important concept called "rear steer" that needs to be explained. Look at one side of a Hotchkiss suspension and you will notice that as the axle moves up

and down it swings in an arc with the center defined at the front leaf spring pivot. Generally, as the axle moves upward, the arc effect moves it forward while downward movement has the opposite effect—rearward movement. This is generally not a problem when accelerating or decelerating because essentially the resulting change in wheelbase has minimal effect on handling. But, when the chassis rolls as you're traveling around a corner the outer tire is moving forward as the suspension compresses and the inner is moving rearward as it extends. In essence, when cornering, the wheelbase is lengthening on the inside and shortening on the outside creating "rear steer" where the rear axle tries to follow the front as the body rolls. Many Mustang owners complain of severe understeer or "push" and try to correct it with changes to the front suspension when all that needs to occur is the elimination of "rear steer." This can be accomplished with the correct combination of spring length, lowering blocks, and rear shackle lengths. If you don't know where to start, crawl under a fast car at the track and take a good look!

There are two popular types of lateral location devices—the Panhard Bar and Watts Link. The Watts Link is special because it was used on the Trans-Am Boss 302s and did a great job as the race records indicate. The Watts Link has the advantage of maintaining perfect axle location through the range of motion at the expense of complexity and higher weight. The Watts Link uses a center-mounted bellcrank and two opposing links or bars that transfer lateral loads from the axle to the chassis. The pivoting motion of the center-mounted bellcrank allows the axle to move vertically without the moving laterally as the links swing in their respective arcs. The Panhard Bar provides imperfect, but acceptable, axle location characteristics with the advantages of simplicity and reduced weight. The Panhard Bar uses a single, longer link bar attached between the axle

and chassis to transmit lateral loads. Because it uses no center link, the axle does have very slight lateral translation as it moves vertically but the effect is minimized due to the long arc resulting from the longer link bar. You can easily adjust the rear roll center by raising or lowering the two attachment points of the Panhard bar. The Watts Link can also be used to adjust the rear roll center but it is much more difficult to accomplish due to the additional complexity.

NASCAR Sprint Cup cars run the Panhard bar for these reasons. You may hear them referred to by TV commentators as the "track bar" since they are used to adjust roll center and thus the rear track of the car. There are kits available from a number of suppliers for both designs, so it's your decision on which to select. Understand, the majority of winning Mustang race cars run the Panhard bar due to its simplicity, tune-ability, and lighter weight. So before spending money on springs, shocks and special heavy duty parts you might want to invest in a Panhard Bar or Watts Link.

Keep your rear under you and you'll go faster!

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