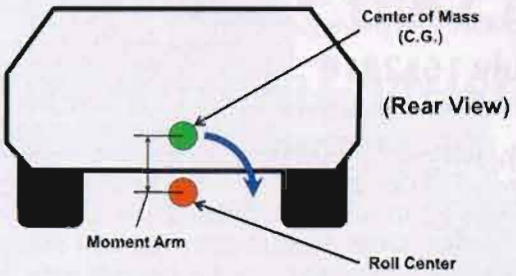
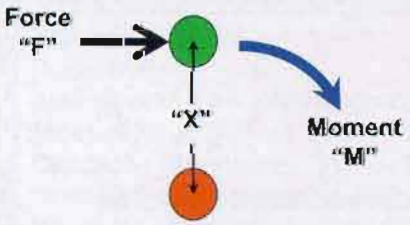
LAP 25 – THE ROLL CENTER

Tuning your Mustang to achieve perfect balance that maximizes grip and results in excellent handling is a goal many drivers never achieve. Once you've driven a Mustang setup in this manner you'll never forget it. Similar to hitting a pure golf shot, it's effortless, easy, and very addictive. Thousands of dollars can be spent on race fuel, brakes, and tires to enhance the seat time necessary to improve driving skills, but driving a Mustang that isn't properly balanced will never significantly lower lap times. Professional race teams understand this and are constantly making adjustments to maintain this balance. One of the primary things they adjust is the roll center, it's so important we're going to devote this entire lap to it.



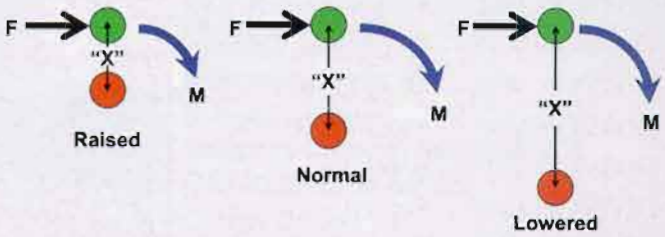
The roll center and how it affects handling is commonly misunderstood so we'll use Figure 1 to explain. First, understand your Mustang has a center of mass or center of gravity (C.G.) through which all forces act. The position of the C.G. is a result of the location of all the parts on the car so consider it as fixed, or not something you can easily change at the track. For this purpose we'll view the car from the rear and you can see the C.G. depicted as the green circle. The roll center is very different because its location is determined by geometry and is the result of the various suspension linkages on the car. The roll center is the point about which the car tends to rotate as a result of the suspension design. It is independent of the C.G. and is depicted by the red circle. A key point to notice is the relative locations of the C.G. and roll center on a Mustang, notice the C.G. is located above the roll center. Also notice, the distance between the C.G. and roll center is called a "Moment Arm".



$$M = F * X$$

In Figure 2, we introduce the notion of a Force applied through the C.G. at a distance "X" from the roll center. This force "F," applied parallel to the road surface, is the result of cornering loads (which in this example would be a turn to the left). This force "F," acting through the C.G., at a moment arm (or distance) "X" creates a moment "M" that rolls or twists the car about the roll center. The moment "M" is defined as the force "F" multiplied by the moment arm "X" or M = F * X. Think of it as a wrench, where the C.G. tries to rotate the car around the roll center.

Now the fun starts, wouldn't it be nice to be able to adjust the amount of force the car is applying through the tire and into the road surface? We can, by raising and lowering the roll center. This is easily accomplished using what is commonly called the "track bar" or panhard bar. In a car like your Mustang, where the C.G. is located above the roll center, this rolling effect has the advantage of really pushing the outside tire into the track and making it stick. Less roll means less force into the track which translates into less traction. This can easily be seen in Figure 3, where raising the bar decreases the rolling moment by decreasing the moment arm "X" and lowering the bar increases "X" and thus increases the moment "M" and drives the outer tire into the track for more traction.



So far, we've only been discussing the rear roll center, but your Mustang has one at the front which is not as easily adjusted. This means you can use the panhard bar to adjust the balance in the rear to match the front and achieve excellent handling. Remember, lower the bar to make the rear of the car stick or become "tight" and raise it to make it "loose." This is precisely what the professionals are doing in the pits when you see them hurriedly cranking on the "track bar" to improve handling. If you don't have a panhard bar consider installing one. If you have one that is non-adjustable consider modifying it to allow tuning and improving the handling of your Mustang.

Also, be sure to wave at the Camaros and Corvettes as you pass!

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