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## WELCOME

Mark Ortiz Automotive is a chassis consulting service primarily serving oval track and road racers. This newsletter is a free service intended to benefit racers and enthusiasts by offering answers to chassis questions. Readers may submit questions by mail to: 155 Wankel Dr., Kannapolis, NC 28083; by phone at 704-933-8876; by e-mail to: [markortiz@vnet.net](mailto:markortiz@vnet.net). Topics are also drawn from my posts on the tech forums at [www.racecartech.com](http://www.racecartech.com) and [www.rpmnet.com](http://www.rpmnet.com). Readers are invited to check out these sites, and to subscribe to this newsletter by e-mail.

Mark Ortiz

## 5<sup>TH</sup> COIL LOCATION AND RATE

*I'm running a dirt Late Model with a torque arm. The car is good overall but could use some more forward bite on slick corners. I have gotten a lot of different opinions about how to set up my torque arm and 5<sup>th</sup> coil. Please explain what moving the 5<sup>th</sup> coil mount forward or backward on the torque arm does to forward bite, and what softening or stiffening the spring does to forward bite.*

First of all, there's a reason you're getting conflicting information on the effects of torque arm length and spring rate on "forward bite" (forward acceleration capability, propulsive traction, ability to put power down): the effects are mainly imaginary. There are real effects, but they don't amount to much where the tires meet the track.

The shorter the torque arm length is, the more upward jacking effect it has. Contrary to what people will tell you, this in itself does not increase the loading on the axle. It just makes a portion of the load go through the fifth coil and a correspondingly smaller portion go through the right and left rear springs. It does lift the car, however, and there is a small but real effect due to that. The higher sprung mass CG causes slightly more load transfer to the rear wheels.

Therefore, you should run the torque arm as short as you can without encountering wheel hop.

When the arm is short enough to cause the rear of the car to rise rather than squat when you get on the power (geometry of your axle locating linkages also affects this), the effect of rear wheel rate split is reversed. This means that softening the left rear spring adds wedge under power and tightens exit, whereas with a suspension that squats in forward acceleration you tighten exit by softening the right rear and/or stiffening the left rear. Effect of front spring split on exit is the same either way: stiffer left front for tighter exit.

The spring on the torque arm doesn't affect how much the car lifts. It just affects how much the axle rotates. This cushions the application of torque to the wheels. Whether this really does anything is questionable. I've had a client who did blind back-to-back tests with different

spring rates, and no spring at all, on a torque link (not a torque arm, but the effect is similar). Neither the driver nor the stopwatch could detect any difference between different spring rates, or the rigid link. It may be that the spring makes some difference in a very jerky application of power.

We can also say for sure that if the spring is too light, the axle will rotate too much and you will destroy U-joints or other parts. The minimum spring rate required to prevent this increases a lot as you shorten the arm. It varies inversely with the square of the arm length (measured from axle center to spring center), plus a bit. That is, the rate required with a 30" arm is MORE THAN  $4^2/3^2 = 1.78$  times as great as with a 40" arm. If the car didn't lift more with the shorter arm, the factor would be exactly 1.78. But it does lift more. How much more depends on the rest of the system, but it's safe to say you would need at least 2 times the spring rate.

There are all kinds of interesting possibilities with torque arms and torque links, involving offset links and arms, multiple links and arms, multiple springs, snubbers, dampers, and so on. However, these are beyond the scope of your question, and involve fabrication and advanced setup knowledge. I am interested in working with car owners or builders who would like to pursue such possibilities.

## **SOFT WALL UPDATE**

Last month I offered some general remarks about soft wall technology. I was gratified to read on Jayski that Petty Enterprises tested a segmented, molded plastic wall cushion during March. They instrumented a couple of Adam's old cars with a recording accelerometer and crashed them into a wall with and without the cushion. Reportedly, the cushion, which is about 2 feet thick, reduced peak acceleration from 100 g to 40 g. I didn't have anything to do with this, and I don't have any more specifics on the system they used, but that's definitely enough difference to save a life. If the system performs well in glancing impacts, and is reasonably priced, this looks very promising.

## **SOFT NOSES**

Another subject of recent interest is deformability of the front ends on stock cars. People have expressed concern that front clips have become too crush-resistant in the search for torsional stiffness. This may be true, but there are ways to make a front clip torsionally stiff without making it so hard in a crash. A real space-frame front clip, in mild steel, with triangulation that doesn't run so nearly lengthwise, and no boiler-plate frame rails, would help – if it were legal. Also, I think the nose structure forward of the frame could be made to absorb more energy. Right now, it collapses very easily, and then the deformation stops or slows abruptly once it reaches the frame. More sheet metal, honeycomb, and/or plastic crush structure inside the nose molding could help a lot, and this could be added to existing cars. The energy-absorbing nose cones in CART show what can be done.