Mark Ortiz is the

THE CONSULTANT

CHASSIS TROUBLESHOOTING GUIDE

From time to time, people ask me to write a simplified chassis troubleshooting guide, as some other writers and car builders have done. I have shied away from this because so many things can alter the way chassis variables work. For example, changes to the left springs of an oval track car work one way in steady-state cornering on a flat track, and the opposite way in steady-state cornering on a steep banking. Rear spring split works one way if the rear suspension squats under power, and the opposite way if it lifts. Anything that adds diagonal percentage tightens the car (adds understeer), except on entry when the car is mainly being slowed by the back wheels, if the retarding force is strong and cornering force is moderate. So I always ask a client about the car, the track, and the driver's style before trying to solve problems (although in some instances a question does have a quick, simple answer).

However, it is possible to create a simple troubleshooting guide for a certain set of conditions and assumptions. I will offer such a guide here, but I want to be very explicit about the assumptions.

The inside suspension is assumed to extend rather than compress in steady-state cornering. That is, the turn is assumed to be fairly flat, grip is assumed to be fairly good, and relationship between ride and roll rates is assumed to be fairly conventional. This will make the guide applicable to relatively flat ovals. It will also be applicable to most road course corners, but I will assume for this discussion that we are examining a left turn. Road racers will have to remember to 'think mirror image' when applying the rules to right turns.

The suspension is assumed to be free of large jacking forces. In braking, the front suspension compresses and the rear suspension extends. Under power, the front suspension extends and the rear suspension compresses.

The front brakes are assumed to do at least half of the braking. The driver is not assumed to be tossing the tail out with the brakes.

The surface is assumed to be smooth enough so that sprung mass motion creates most of the shock movement, rather than bumps. This means we are looking at low-speed damping.

Taking the turn

To consider the situation fully, we will need to break the turn down into five portions, rather than the customary three:

(1) ***Early entry:*** Braking is hard, and brake application is either steady or increasing. Cornering force is present, and increasing, but still moderate compared to rearward force from braking. This phase of the cornering process may not exist in many corners on a road course, or a severely paperclip-shaped oval. In such cases, the driver will do the hard braking in a straight line, and start to ease out of the brakes as he/she begins to turn in. But on most ovals, this phase will usually be present. I quite often see oval track drivers turn before they lift, or about the same time. This phase may also be present in road course corners that are fast, last a long time, or require an in-fast-out-slow line.

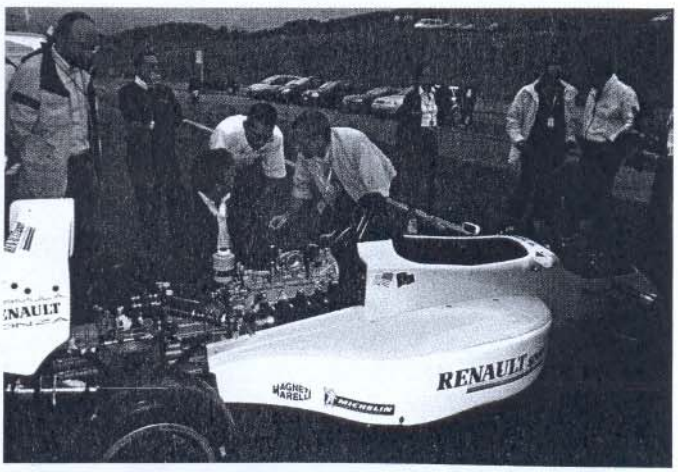
In this phase, roll position is rightward from static (left turn, remember), and increasing. Roll velocity is rightward, and increasing. Pitch position is forward from static, and increasing. Pitch velocity is forward, and may be increasing or decreasing.

The most active corners of the car are the right front and the left rear. The right front suspension's position is compressed from static, and its velocity is in the compression direction. The left rear suspension's position is extended from static, and its velocity is in the extension direction.

(2) ***Late entry:*** Braking is diminishing, and ends at the completion of this phase. With a capable driver, cornering force should build as braking force diminishes.

Roll position is rightward from static, and increasing. Roll velocity is rightward, and may be increasing or decreasing early in this phase. Late in this phase, roll velocity will be rightward and decreasing. Pitch position is forward from static, and decreasing (because braking is diminishing). Pitch velocity is rearward.

The most active corner in terms of position is the right front. It will generally see its greatest compression somewhere early in the late entry phase. (This varies depending on several factors, including anti-dive, anti-roll, and roll rate/ride rate relationship.) The left rear is also active in →



It must be understood that spring and damper rates can have opposite effects in a corner

Mark Ortiz Automotive is a chassis consulting service primarily serving oval track and road racers. In these pages he answers your queries on chassis set-up and handling. If you have a question to put to him, e-mail to **markortiz@vnet.net**, call **704-933-8876** or write to **Mark Ortiz, 155 Wankel Dr., Kannapolis, NC 28083-8200 USA**