The Mark Ortiz Automotive

CHASSIS NEWSLETTER

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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 useful insights into chassis engineering and answers to questions. Readers may mail questions to: 155 Wankel Dr., Kannapolis, NC 28083-8200; submit questions by phone at 704-933-8876; or submit questions by e-mail to: markortiz@vnet.net. Readers are invited to subscribe to this newsletter by e-mail. Just e-mail me and request to be added to the list.

SETUP FOR LOWER GRIP

All the books talk about setting the car up in a general manner but do not mention anything about what to do with regard to the grip level at different circuits. I run in a classic cars series where the aerodynamic downforce is very small and we have to use the same type of tires for all of the season. I've set the car up at a track where the grip level is considered to be high. The car goes well there and the times are good, but when I've been to slicker tracks I don't know what to do. Should I make the car softer?

In general, a lower-grip surface does call for softer settings.

However, there can be exceptions. If you are restricted to a relatively hard tire, and if the tire needs to heat up to work properly, a stiffer setup may help get the tire up to temperature. Given a free hand, you'd go softer on both the compound and the suspension.

Many street tires, and some tires used in vintage racing, do not get stickier as they get hotter, in which case you would generally go softer with the suspension.

Another factor that enters into this is how bumpy the surfaces are. Bumpier surfaces require softer suspension. So if the slicker tracks are also bumpier, the decision is pretty easy. We then have two factors that would tend to demand softer suspension settings. On the other hand, if you have a situation where the grippy tracks have bumps and the slick ones are smooth, things are not so clear-cut.

You don't mention what kind of car you have, or what class you're running. It would be possible, particularly in vintage racing, to have a car that is favored by a grippy track merely because it has a power advantage against the cars it's classed with, and also has a handling disadvantage. In such a case, you may just have to live with the situation.

If you have not tried softer suspension at the slicker tracks, and you are less competitive there, I would say trying softer settings would make sense. Keep good records, and you can always go back to your old settings if the softer ones don't help.

LOWERING BLOCKS ON TRUCK ARMS

What is the effect of using lowering blocks on a truck arm suspension?

First of all, there is no effect to the anti-squat or anti-lift properties, assuming that the pivots at the front of the arms are not moved, and assuming the ride height is adjusted back to its previous setting.

In most big-spring cars, the springs act on the truck arms, near the axle. In such cases, the car will be lowered by the lowering blocks. If there are jacking bolts at the springs, the ride height can be reset to the previous position, assuming sufficient available adjustment.

On most stock car truck arm suspensions, the shocks and the Panhard bar attach to the truck arms. It would be mechanically possible to build a truck arm suspension without this characteristic, however.

In some classes, coilovers are allowed on truck arms. Usually, the coilovers attach where the shocks would attach on a big-spring car. But again, they wouldn't have to.

If you have coilovers attached to the truck arms, the same thing happens to the ride height as if you had big springs on the truck arms. If you have coilovers that attach to brackets on the axle tubes, ride height adjustment won't be affected.

With coilovers or big springs, if the shocks attach to the truck arms, lowering blocks will cause the shocks to be extended more at a given ride height. This means the shocks have more compression travel and less extension travel available. This may hurt, or help, or make no difference. If you use bump rubbers on the shocks to keep other components from hitting, you may need bigger bump rubbers.

If the Panhard bar attaches to the truck arms, the end of the bar that attaches there will be lowered. On racing truck arm suspensions, you usually have at least a couple of inches of adjustment on this attachment. As with ride height, if sufficient adjustment is present, the Panhard bar can be returned to its original setting, but the overall range of possible settings moves lower.

Assuming the lowering blocks have no taper, they will change pinion angle slightly, upward. This effect will be small, and should not affect the car's behavior.

So is there any advantage to using lowering blocks? If you want a lower rear roll center or more bump travel from the shocks, maybe. Otherwise, the blocks are added weight, with no benefit.

OHLINS HIGH-FREQUENCY PISTON

Are you familiar with the Ohlins high-frequency shock piston? The claim made by Ohlins, and by those who use them, is that they offer more grip.

Great description of the pistons' benefits, huh?

Ohlins is not the kind of company to build such an odd piston without a reason, but I have yet to hear a scientifically sound explanation. Any input?

Last year I attended a seminar presented by Ohlins, where they showed us these pistons. (If you get a chance to attend an Ohlins seminar, do it – they're good.)

This piston provides what might be called relative position (or displacement) sensitivity. This would contrast with absolute position sensitivity, meaning sensitivity to position of the piston in the shock body. This relative position sensitivity is sensitivity to the piston's position **relative to last velocity reversal**. The shock is softer for a few millimeters of motion after any reversal of piston motion.

This effect is more or less the opposite of "stiction", the phenomenon where the friction is higher in the first little bit of motion.

The shock therefore has a softer action on low-amplitude disturbances. It might be a bit more descriptive to call it a low-amplitude piston, but high-frequency disturbances tend to also be low-amplitude. Or maybe it should be called a negative-stiction piston. That would cause some head-scratching.

Here's how it works: under, or inside the teflon piston sealing ring is an o-ring. Unlike many designs that use the o-ring to load the sealing ring against the wall, in this design the o-ring is a loose fit in its gland. The o-ring can float up and down, and will also let fluid pass around it.

The lands that form the top and bottom surfaces of the o-ring gland have holes drilled through them, rather like vertical gas ports in a drag racing engine piston. When the o-ring seats against the top or bottom land, it closes off these ports. When the ports are open, they add bleed to the shock, and soften its action.

The o-ring is moved partly by its own inertia, but mainly by oil flow. When the piston comes to rest after moving in one direction for a while, the o-ring will be seated and the ports will be closed. As soon as the piston starts moving the other way, oil flow unseats the o-ring and starts driving it toward the other land. When it gets to the other land, it seats against the holes there. When the o-ring is floating from one land to the other, the ports are open and the shock has increased bleed.

On a series of small-amplitude disturbances, the o-ring might be floating between lands most of the time. The piston's unique properties would have the greatest possible effect under these conditions.

Most race cars have considerable stiction in the suspension due to the large number of sliding-contact pivots. One reason passenger cars use rubber bushings at the pivots is that they don't have stiction. So this piston to some extent compensates for the stiction not only in the shock itself but in the rest of the suspension.

WHICH SHOCK TO SOFTEN?

I have a quick question about my DIRT modified. To get off the corner harder, would you use an easy-up (soft rebound) shock on the right front, the left front, or both?

Quick answer would be right front.

The basic rule here is that anything that adds an extension force or reduces a compression force (extension damping force acts in the compression direction) adds load to the near tire and the diagonally opposite one, and unloads the other two. If that adds diagonal percentage, we tighten the car. If it reduces diagonal percentage, we loosen the car.

We are making a few assumptions here, though. We are assuming that you're trying to tighten the car. If you've already got a power push, making the car tighter won't help you come off harder. Instead it will make you be gentler with the throttle to keep the front end stuck.

We are also assuming that the surface is smooth enough so that sprung mass motion is the main cause of suspension motion. This may not be the case at all, especially on dirt.

The effectiveness of using shock valving this way will also depend how much extension velocity the right front has.

My own preference is to try to work with the springs instead, and valve the shocks for optimum roadholding rather than trying to trick the shocks into controlling wheel load distribution.

WHY THE CHAINS, SIR?

When NASCAR teams use a chain for one of the sway bar links, are they using it as a lost motion device, allowing wheel travel before the bar rate becomes active?

More common than a chain nowadays is an adjustable pad on the end of the sway bar, bearing on a pad on the lower control arm. Chains are still seen sometimes in the lower divisions, where original-equipment-style bars are required. But the basic idea is the same either way: have a connection that transmits force in only one direction. The bar only resists rightward roll, unless it's preloaded, in which case it does resist leftward roll up to the point where it unloads.

The intent here is to help keep the car from going quite so loose when the driver gets the left front wheel on the apron of the track, which is sometimes abruptly flatter than the banked turn.

Usually, the bar is run snug or slightly preloaded at static condition. That means that the bar acts just like it normally would in a left turn. When the car is cornering, the bar has substantial load on it. The one-way connection, be it a pad or a chain, will only go slack if the left front wheel hits the apron hard enough to put the front suspension into a left roll condition – left front deflection greater than right front. This leads me to question the use of these devices, especially since they make the car loose when turning or spinning to the right, which can happen during a crash or when avoiding one. Nevertheless, they are very popular.