Product Tech

Selecting a Rear Suspension

Chris Alston Explains Drag Racing Suspensions

Our popular Battle Cruiser line offers two affordable, fully adjustable styles of rear suspension. The "double-adjustable" ladder bar is ideal for e.t. brackets and street-strip applications. The 4-link is now available with a choice of front-mount designs that fit aftermarket rear frames (as shown) or a boxed crossmember.

LADDER BARS

Unlike "slapper bars" and other bolt-on devices, welded ladder bars give you a strong suspension with some basic adjustability. Any ladder bar that uses an adjustable front mount can be adjusted for three things. First is what we'll call the suspension's "intersect point" in the chassis. When you raise or lower a ladder bar in its front mount, you're actually adjusting the intersect point of how the drive loads are applied in the chassis. Secondly, you can adjust pinion angle by rotating the two rod ends at the rear of the ladder bar. Finally, you can adjust the preload in the car by setting one side differently from the other, effectively shifting weight from one rear tire to another. Adjusting pinion angle or preload in a standard-type ladder bar requires removing the bar, then screwing or unscrewing the ends.

What's known as a "double-adjustable" ladder bar allows you to adjust pinion angle and preload in the front intersect point without removing the bar from the car. A double-adjustable style is just easier to use. It has right and left threads, so it works like a turnbuckle: You can loosen and rotate the adjuster without taking off the bar. There are two real advantages to having the adjuster in the bottom bar, instead of the upper bar: (1) It's easier to get to with a wrench, which solves a real problem in many cars; (2) the rod angle goes straight back and straight forward, so you can move it a lot further before the spread between the two tubes gets so great that you can't put the bar back on the car.

Chassisworks' exclusive front crossmember features a tighter bend, more adjustment holes and stronger, 360-degree brackets.

LADDER-BAR LENGTH

Anyone who tells you that short-wheelbase cars need 30-inch ladder bars, intermediate cars use 32 inches and long-wheelbase cars use 36 inches is just showing you he doesn't understand the big picture. What makes a ladder bar work is dependent on where the front mount is in relation to the car's center of gravity. A 32-inch ladder bar can be adjusted to have the same intersect point as a 36-inch bar in relation to the car's center of gravity. The reason everyone uses 32-inch ladder bars is a space consideration. Bars shorter than 32 inches tend to rotate the pinion angle excessively, plus they require a front mount that is very close to the ground.

On a long-wheelbase vehicle (like a truck), the 36-inch ladder bar may be the best choice. When under-body clearance is not a factor, the longer bar can transfer weight more easily.

4-LINKS

A 4-link is definitely superior to ladder bars. However, a 4-link is only superior in application if you are willing to invest the time it takes to sort it out. A ladder bar has two or three adjustment holes that actually work; a 4-link might have 50! Actually, the 4-link doesn't have 50 places that are better; it has perhaps three that are better, a couple that are the same, and a whole bunch that are worse. You just have a lot more possible intersect points. A tremendous amount of engineering goes into a properly designed 4-link. There are 4-links on the market that won't gain you anything, because the spread on the holes and/or the brackets themselves are improperly located. Consequently, there are lots of adjustments that you can't even get to.

Product Tech

Selecting a Rear Suspension

4-LINK LENGTHS

All 4-links use top and bottom bars of unequal lengths. However, some have a top bar which is considerably shorter. These are commonly referred to as "unequal-length" 4-links. This is definitely an inferior design from the past, when chassis builders were not allowed to modify stock frames. This style causes rapid changes in the pinion angle and the front intersect point. Stay away from these designs!

The Chassisworks Eliminator II 4-link is the most sophisticated rear suspension available today. With its 1/2"-diameter bolt holes, the 4-link adjustments are now much finer and, of course, there are more from which to choose. This is the same design that we developed, tested and install on our 6-second Pro Modified cars.

LADDER BARS vs. 4-LINK

A 4-link is like anything else that's infinitely adjustable: If you're not going to spend the time it takes to get it adjusted correctly, you're better off with a part that doesn't adjust. If you want to buy something that's inexpensive; that doesn't take a lot of real care and extra energy to install; and that basically works right out of the box, then ladder bars are for you. If you want your car to go as fast as possible, and you're willing to invest whatever energy it takes, choose a 4-link.

Neither type of suspension is perfectly suited to all-around highway operation. To be 100-percent streetable, a rear suspension must allow the rearend to "roll" independent of the body. This movement is necessary to smoothly transverse potholes, speed bumps, curbs and other irregularities in the road. Chassisworks now offers ladder bars and 4-links with large, urethane-bushed rod ends which greatly increase the amount of rearend roll available — a real plus for Pro Street applications. Additionally, these urethane bushings will absorb some of the road vibrations.

The importance of rearend roll is greatly diminished on smooth surfaces, of course. Typically, a 4-link allows the rearend to roll a few degrees more than ladder bars. Our new Pro Street 4-link offers an unprecedented amount of suspension travel and, consequently, an incredibly smooth ride. Incidentally, this is the first race-type 4-link ever designed specifically for high-powered street cars and trucks. Beware of old-style "4-bar" designs. These are borrowed from the street-rod industry, and will not hold up to high horsepower.

One more thing: All of your chassis and suspension components should be purchased from a single source. If you buy a Chassisworks 4-link or ladder bars and another company's subframe, you're compromising whatever science was designed into each system — assuming you can even get the parts to fit! Frame design has a tremendous amount to do with the bracket design. A knowledgeable chassis builder actually designs the suspension first, and then designs a frame that will hold it.

LOCATERS

A locater keeps the rearend from moving right and left. Any ladder-bar or 4-link car with coil springs has to have one. Without a locater, you couldn't even drive the car. Only two types are used in drag racing anymore. The more common is the track locater: a diagonal link that runs from the front of one side of the suspension to the rear of the other side. In chassis where clearance problems exist, or in very narrow frames, we use a wishbone, instead, to center the rearend.

Some companies still offer only panhard rods, which attach to the frame and to the top of the rearend. In a drag car, the frame is very narrow, making this link extremely short — only 12 to 18 inches long. Such a short link causes the rearend to move right to left in the frame as much as two inches through the suspension travel. The panhard rod has no place on a very narrow rear frame, but it can be used on wider rear frames. Use a track locater whenever possible. A track locater or wishbone will always keep the rearend centered through its full travel.

HOUSING FLOATERS

If you have leaf springs and want to add either ladder bars or a 4-link, housing floaters are mandatory. The rearend attempts to pivot around both the suspension bar and the leaf spring, because they're both attached to the housing. Since it can't pivot around two dissimilar-length arcs, the rearend will bind up without floaters. The section that the spring goes through is greased, allowing the floater to slide on the spring — compensating for the different arcs through which the rearend moves. Our design also centers the rearend and permits adjustment of the ride height.

Incidentally, floater sales have been on a steady decline for years — reflecting the diminished popularity of leaf springs. Even though Chassisworks offers the most advanced floater made, it's a dying part. We recommend installing coil springs, which do not require floaters.

COIL SPRINGS

In the past, leaf springs were popular because Super Stock rules required original-type springs; leaf-spring cars once cost less money to build than coil-over cars; and Chrysler Corporation devoted lots of energy to Super Stock spring technology. However, rule changes have made late-model cars more popular — and those all came with coil springs. Plus, with the advent of inexpensive coil-spring-mounting kits, cost is no longer an issue. Leaf springs are much harder to mount; they require floaters; and they weigh so much more that it's pointless to continue with them. By the time you buy two shock absorbers and floaters and build new top and bottom shock mounts, the price difference is negligible. Last but not least are some important performance disadvantages.

Our economical coil-spring assembly offers a full six inches of suspension travel and approximately six inches of ride-height adjustment.

Because leaf springs sit underneath the frame, your ladder bars must fit inboard of the frame. In a coil-spring car, you can make the bars fit under the frame — in the space that would otherwise be occupied by leaf springs. Now the suspension has a wider stance, so the car won't body-roll as much. Moreover, you can't get a leaf-spring frame narrow enough to run big tires on any kind of skinny car. Leaf springs take up a minimum of six additional inches of frame width. So, if you're trying to put a big tire on a narrow car like an early Nova or Mustang, you'll be lucky to get a 14-inch slick in there, because you can't build the suspension that narrow. You can't install the ladder bars a foot apart; it just doesn't work.

Coil springs are the way to go. The only exception would be the guy who just wants to put a set of ladder bars on an existing, stock-type full frame. Anybody who's doing a "back-half" car, with a new frame, should throw the leaf springs away.

LADDER-BAR ROD ENDS

The rod end at the front of a ladder bar is extremely critical. This is the one that invariably fails because it's the front end that's being bent, and that's a real hard load to overcome. Conversely, the rear rod ends are being pulled and pushed, and will take a lot more strain in those directions. The strength of any rod end is determined entirely by the amount of area there is to break, and by the strength of the material. At a minimum, you need a 4130-type, 3/4-inch-shank front rod end on a ladder bar, or it will break. We've gone to a 1-inch-diameter shank, so the cross section is actually twice that of a 3/4-inch end. Plus, it's made from a new aerospace material with strength equivalent to 4130 chromemoly.

Another factor is the diameter of the ladder bar's tubing. The bottom bar tends to flex in a real high-horsepower or heavyweight car. Our 1-1/4-inch bottom bars are almost impossible to flex. To offset their slightly heavier weight, we use two 3/4-inch-shank rod ends with 1/2-inch bolts at the rear. You don't give up any strength, because you have two rod ends back there.

Even with the giant front rod end, you have to be very careful inspecting and replacing it. When you first install the rod ends, measure them with a caliper. If they stretch even a couple thousandths, get rid of them. They need to be inspected frequently, especially in a heavy and/or very fast car. At the absolute minimum, it's an annual throw-away part.

Some manufacturers advertise that solid rod ends in the front of the ladder bar will cause binding; however, since ladder bars for race use do not "roll," installing spherical rod ends would only increase the possibility of breakage — definitely a bad idea.

In a solid-rod-end car, you cannot run the front bolt that holds the rearend to the frame tight, because it pinches the bracket against the rod end, and binds it up. If you torque this 5/8-inch bolt and squeeze these brackets, the rearend won't go up and down. What it does is promptly break a front rod end off! However, track locaters that bolt onto the front of ladder bars now require that the bolt is tight; otherwise, the locater won't locate the rear suspension. Chassisworks solved this problem by going to a 3/4-inch-hole bracket with a spacer set. The spacer tightens against the side of the rod end, but it has a 3/4-inch outside, so it will pivot in the bracket — allowing you to tighten the front bolt. If you keep it greased, it's really free and really strong.

For Pro Street applications, Chassisworks has developed a huge, aerospace-alloy, billet-steel ladder-bar rod end that uses large urethane bushings. It's strong enough for big-block horsepower.

4-LINK ROD ENDS

Spherical-type rod ends should be used in all links. The rearend actually rotates, and solid rod ends don't allow that natural movement. A 4-link with solid ends will be much stiffer, making the car difficult to hook up. For drag racing 4-links, Chassisworks offers sets of eight rod ends in either mild steel or 4130 chromemoly. The 4130 units are twice as strong, and are absolutely mandatory for vehicles making lots of horsepower, and/or carrying a lot of weight, and/or running huge rear tires.

For Pro Street applications, Chassisworks has developed a huge, aerospace-alloy, billet-steel rod end that uses large urethane bushings. It's strong enough for big-block horsepower.

SHOCK ABSORBERS

Today's basic rear-suspension setup uses an inexpensive coil-spring kit with light-valved, OEM-type shock absorbers. Our adjustable-ride-height lower shock mount allows the home builder to be off a little in his calculations, and still get the car to ride where he wants. And there is some adjustment in that for performance. Our kit uses the same coil springs that we put in our Koni coil-over set. It's a nice, compact unit that works well for the budget-conscious guy. For about $230, you get a complete set of shocks, springs, adjustable-height lower mounts and upper spring mounts.

The next step up is to a true coil-over. The advantage here is mostly in the valving of the shock. What's known as the single-internal-adjustable Koni shock was specifically designed for drag racing. You take it off and rotate it to adjust how hard the shock comes apart. This separation, or extension, is the majority of tuning on a drag racing shock. Like anything else, if a shock has more adjustments, you can possibly make it work better, because you have more places you can put it. Internally adjustable Konis cost about $300 a pair, with springs. Our mounting kit is about $60, so the true-coil-over package is almost $130 more than the coil-spring kit described above. The third step up the "shock ladder" is the VariShock QuickSet 1 externally adjustable, aluminum-bodied coil-over. Since the extension setting of the shock is what controls a drag race car's rear suspension, these shocks are the "best bang for your buck." For about $420 a pair (with springs), you get the external adjustment at two-thirds the price of double-adjustable shocks.

The ultimate drag racing shock is VariShock's double-adjustable QuickSet 2. One knob at the bottom adjusts how hard the shock absorber comes together; a second knob at the bottom sets how hard the shock pulls apart. These cost about twice as much as the internally adjustable SensiSet model, but we recommend the QuickSet 2 to the racer who's seriously interested in both hooking up at launch and maintaining high-speed stability at the big end.

Spherical rod ends (foreground) are offered in several mild-steel and chromemoly versions for competition 4-links. Larger, billet- steel rod ends with urethane bushings (background) are included with all Pro Street 4-links.

WHEELIE BARS

The two popular styles of wheelie bars use either a flat bottom bar with a tubular upper bar; or tubular bars on both the bottom and top. The flat-bottom design was a functional wheelie bar in its day, but it's old technology now. It is inherently inconsistent in the way the aluminum bottom bar acts as a spring. When it gets up on the wheel, it gets some of its spring by flexing the bottom bar, and some from having an actual spring in the top. So you have these two springs working together, and it's difficult to fine-tune and get good control. It also takes up more room under a car. In a real narrow, late-model, pro-type car, this is a serious issue. Plus, its mounting-bracket design prevents this type of wheelie bar from running real close to the ground, and bumper clearance is an incredible problem on newer cars. Most flat-type bars are also too short, so they tend to unload the tire. A 44-inch bar may be real common, but it's too violent against the tire to work well. The car may not wheelstand, but you're not getting the optimum result, either. You want a wheelie bar at least 50 inches long.

Dual-tube wheelie bars are found in all real race cars because they're a little lighter; they offer better bumper clearance; and they result in a more solid assembly, making them easier to fine-tune. On dual-tube wheelie bars, it is important to "X" the top strut — not the bottom. By "X"-ing the top, you have more jack clearance. Plus, designs that only "X" on the bottom half will break the lower tube, because the partial "X" overloads the tube in the center. This will only happen in hard-launching, fast cars, but why take a chance?

Now you must choose between a spring-loaded or unsprung design. On a car that wheelstands hardly at all, you can get away with our unsprung version, because you're not violently on the bar that hard. But if you have a car that seriously wheelstands, you want the spring-loaded bar to give that extra bit of control. The difference in price is about $50. A spring-loaded bar may seem simple, but it's actually quite sophisticated. Adjustments have to be made very carefully. Most racers make way too coarse of an adjustment; the way they get a car not to wheelstand excessively is to make it unload the tire. It's a fine line to get the wheelie bars to delicately keep the car on the ground without unloading the tire, particularly where it counts most: in the first 60 feet. You need a bar that's very stable and lets you make fine adjustments. That's why dual-tube, spring-loaded wheelie bars have become the norm for pro race cars ■