



SQUARING A RACE CAR

Squaring a race car is key to proper race car set up. Pointing all 4 wheels in the same direction allows for all of your adjustments to perform in a consistent and predictable fashion.

Let's spend a minute getting on the same page in reference to squaring a race car. For the sake of clarity this article targets Late Model style cars, but the recommendations apply to many race car types. For the purposes of this article we are assuming that the housing is perfectly straight and your frame is in factory condition.

If you identify your goal before starting it helps in the end result. Common knowledge states that the rear end must be square. However, the question at hand is square to what? Referring to the [drawing below](#) will help keep things clear as you read the recommendations.

To have a rear end installed correctly we must square the housing to something. But square to what? The common answer is that we need to be square to the frame rails. If your frame rails are perfectly straight then a good result can be gained from utilizing the frame rails as a reference point.

The reality is that frame rails are not straight. Race car frame rails are made from mild steel that is simply pulled from a rack. The steel is not that straight to begin with and welding helps to distort it further. My opinion is that the frame rails are hard to rely on consistently.

Really our goal is to "square" the rear end housing to the front end versus the frame rails. The steel is along for the ride. The front suspension pivot points are the true reference points. By embracing this concept the frame can have some normal bends and bows and you can still be assured a square rear end. My recommendations involve squaring to the front pivot points as this will provide the most consistency.

In addition, we want the rear end housing to be located correctly from side to side in the car. For best performance lining up the right side tire seems to be best. To set the rear end location correctly the front end adjustments must be set up correctly and be in race ready condition.

The right side tires carry the highest forces so keeping the right side tires in line with each other creates the most stability and maximizes left side weight. Lining up the right side tires is my recommendation.



However, your car builder may support a different left to right location so you need to insure that you follow car builder's recommendations so that the needs of the rear suspension links are met. For this article we will assume that the car builder laid out the suspension with the right side tires lined up. You will want to pay special attention to this detail as it is a higher priority to have the trailing arm brackets and top link hardware to be located in the proper location. For example, you want the top link to be perpendicular to the rear end housing and parallel to the car. Trailing arms must also be running forward at the correct car builder design angle. These design elements must be considered so be sure to consult your car builder about his design parameters for the Left/Right location for the rear end housing.

Ok, now that we are on the same page, let's review: The front end is set and is race ready. The car is set at ride height by using solid links in place of the shocks or it is sitting up on stands at race ready ride height with air pressure and stagger set properly. Your rear end housing has been checked and it is not bent and it is ready for installation. We also need to insure that the panhard bar is set to the correct height and that the trailing arm and top link angles have been set properly.

STEP 1: SETTING UP THE REFERENCE STRING

Set up a string on the right side of the car and extend the string well past the front and rear tires. Attach the string between two simple jack stands. Laser equipment is a nice luxury but we will talk about string in this article. I have found that it is best to set the string up at a height off the ground equal to the bottom of the frame rail.

Now that your string is set parallel to the car turn the right front wheel until it is parallel to the string. Record the distance from the string to the right front tire. Take notice that you are taking in the effects of camber by setting the string at frame height versus spindle height helping you to align the rear contact patch with the front contact patch.

Negative camber at the right front moves the contact patch to the right. We set our string even with the frame rail so the effects of negative camber are considered as compared to setting the string at spindle height. Setting the string at ride height allows the rear contact patch to more closely line up with the front contact patch which is offset to the right due to the effects of negative camber.



STEP 2: ALIGNING THE RIGHT SIDE TIRES

Now we want to begin lining up the right side tires. Match the distance from the right rear tire to the string so that the distance is equal to the distance from the right front tire to our reference string. Quickly check at the right rear tire that your rear end square is at least in the neighborhood. If the string is parallel to the frame then the front and rear sidewalls of the right rear tire should be parallel to the string as well.

If the rear end measures differently from the sidewalls of the right rear tire to the string then average the difference to locate the rear end. For example, your measurement to the string at the right front tire is 6". We want the same at the rear but when checking we end up with 5-15/16" and 6-1/16". As the average of 5-15/16" and 6-1/16" equals our 6" dimension at the right front tire we can be content with the lateral location and we are now ready to set the housing square to the front pivot points. Leave your string in place as you will want to verify the lateral location setting the square. Adjusting the trailing arms can have an effect on the lateral location. You will need to double check the lateral location after completing the squaring step.

STEP 3: SETTING UP THE REFERENCE STRAIGHT EDGE

Many people use masking tape, plumb bobs, and chalk lines to square the housing in the car. Experience has shown that the amount of transfer error reading thick chalk lines as well as trying to make a mark exactly at the point of the plumb bob creates too much error. These transfer errors lead to inconsistency and the work is tedious. Further, each time you adjust the rear end you have to repeat the plumb bob transfer down to the floor. I believe this method just takes too long, is frustrating, and is less accurate.

I prefer to go about it a little differently. Remember we have determined that we want to square to the front pivot points. Ok, now here is where you need to spend some initial time to insure repeatability and accuracy. Find a perfect straight edge that spans the length of the rear end housing.

Next clamp the straight edge to the bottom of the frame about half way between the front and rear axles. The forward / aft location of your reference straight edge is not critical. Somewhere around center is good, but again it is not critical. When clamping the reference straight edge use a carpenter's square and clamp it exactly 90 degrees to the straightest frame rail. Even



though we are going to insure that we are square to the front pivot points the frame rail does need to be considered. We want the rear end to be square to the frame rails and we will fine tune to the front pivot points to eliminate any irregularities in the frame rail. In general the goal is to have the frame rails, front pivot points and rear end housing in perfect square.

Now that our reference straight edge is clamped in place and is 90 degrees to the straightest frame rail, we are ready to fine tune the location of the reference frame rail. Remember we want to eliminate variance in the frame rails and square to the front pivot points. Hook your tape measure on the straight edge and measure forward to the front inner pivots. Be sure that your tape is running straight forward for accuracy. Fine tune your straight edge until it is exactly parallel to the front inner pivots. Take your time and locate the straight edge until it is dead square.

Before continuing it is a good idea to mark the location of the straight edge with a scribe or a peen mark on the bottom of the frame. These marks will allow you to clamp your straight edge in place in the future in a minimum amount of time. Should you need to verify that your rear end is square at the track, you will find the straight edge and indelible marks is a very time saving luxury.

STEP 4: SQUARING THE REAR END

Hang two strings off the rear end at the outer most points. You can use two plumb bobs but a heavy nut tied to a string will work just as well. For optimum accuracy remove the rear hubs and hang the string off the machined bearing surface of the rear hubs. However, on a quick change rear end the machined axle tubes are quite accurate.

Now that your strings are hanging down you can quickly hook a tape on the reference straight edge and measure back to the strings. Be sure that your tape measure runs straight back. Adjust the housing as needed. After an adjustment you can quickly check the square. With the plumb bob and tape method you would need to transfer all the marks back down to the ground which takes a long time. The reference straight edge concept allows you to make the adjustment and measure directly to the hanging string. You can read the exact measurement very easily.

Because it is so easy to check the square be sure to keep adjusting until the housing is right on. Spend the time and get it right. With the plumb and tape method many racers would call it



“close enough” due to the hassle factor of transferring all of the points down onto the tape on the floor. Spend ample time and get it right.

You will find that the reference straight edge method is much faster and more accurate. Further, you can carry the straight edge with you to the track. The plumb and tape method requires a level and flat floor. You would have a hard time at the track with plumb bobs and tape on asphalt. The reference straight edge is an easy deal if you have done a good job of marking and recording the reference points.

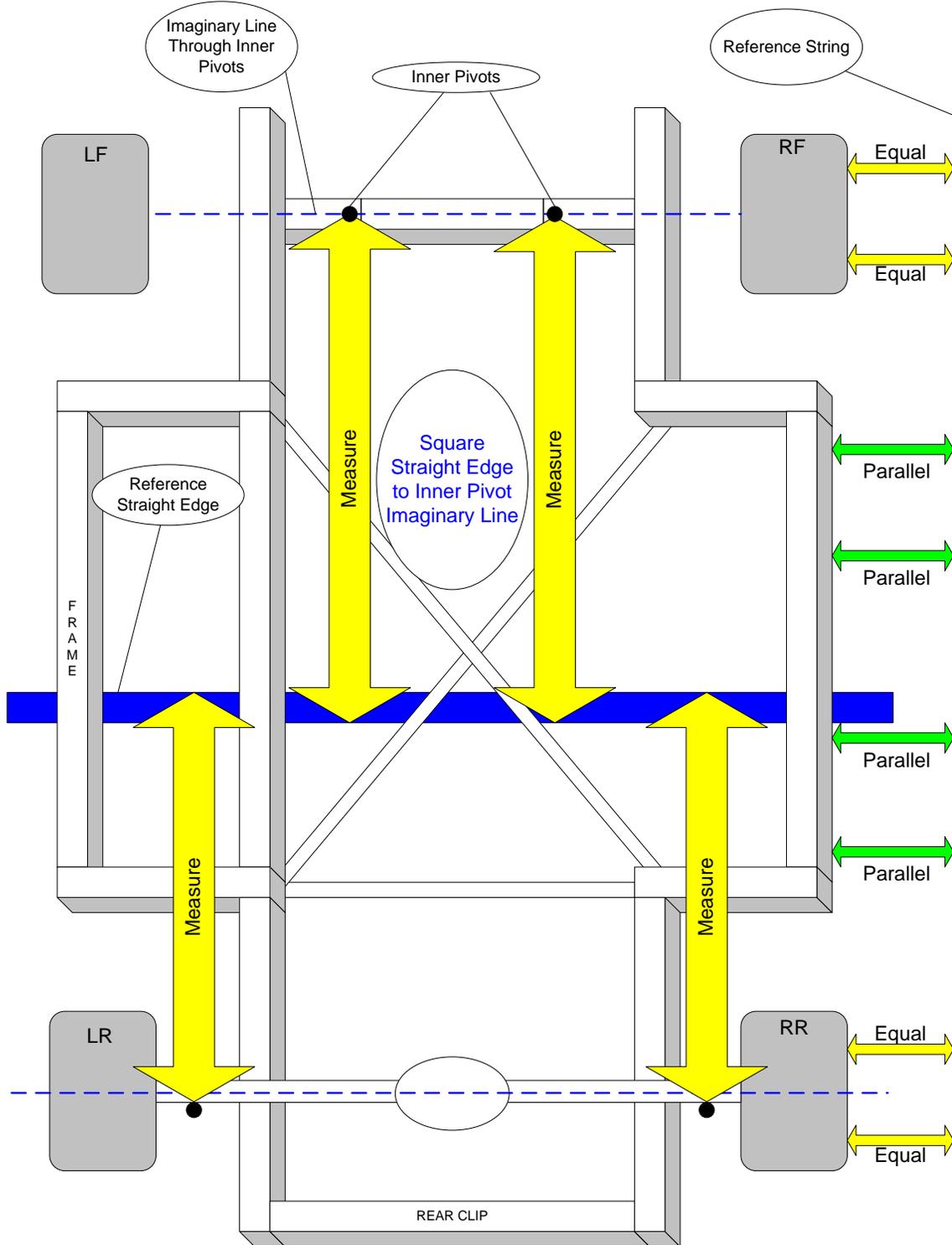
STEP 5: VERIFY THE LATERAL LOCATION

Now that you have the rear end square you need to verify that the left to right location still lines up with the right front. If it is still ok left to right then you are ready to go. If the housing no longer lines up with the right front you will need to readjust the lateral location. If you move the housing laterally you will need to repeat the squaring process. It is common to have to go back and forth between the left/right adjustment and the square adjustment as they both have an effect on each other.

STEP 6: RECORD YOUR REFERENCE MARKS

You have spent plenty of time and you have verified that your rear end is dead square. You have already marked the location of the reference straight edge and can rely on those points for quick reference. Next, it is wise to record a reference point for the left right location. On an under slung style late model you can utilize a good adjustable carpenter square. Place the movable piece of the square on the right rear brake rotor and slide the rule over until it touches the under slung frame rail. Write down the reference number in a safe place. If you have something other than an under slung style frame, simply use a tape measure from the right rear brake rotor to a reliable reference point on the frame. Recording this quick reference dimension will prove invaluable when at the track and really saves time when you need it most.

You will find that having the ability to square to these reference points will save you a lot of time. Obviously if your frame gets hit you will need to verify and adjust your reference points. But, if you damage your rear end housing at the track, you can utilize these reference points very quickly. You will find that the reference points come in handy when making panhard adjustments as well.





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