

Crossbind, The Silent Killer - by Jerry Pearson (5/16/2005)

The sport of Soap Box Derby racing is a very simple sport but most people seem to spend their entire careers looking for that bag of magic beans. Experience tells me that there are no magic beans, just hard work. I believe to be successful in this sport you must understand one basic concept and that is, "You win at the top of the hill and you lose at the bottom of the hill". This means that whomever can get off the ramp and the top of the hill using the least amount of energy, will likely be ahead at the finish line.

One concept that is commonly misunderstood and is very counterproductive to your success at the top of the hill is called cross bind. The term cross-bind means that when your car in a static state, both axles are not on the same plane. Cross-bind hurts you all the way down the track but it kills you on the ramp. Think of cross bind as a friction multiplier.

Let me explain using a Super Stock car. First, we have to understand that no set of wheels has 4 equal wheels. Some are obviously slower and some are faster. In a perfect world, you would have 4 equal wheels and your car would have no cross bind. In this scenario, each wheel would be carrying $\frac{1}{4}$ of the total weight or 57.5 lbs and each wheel would require the same amount of energy to start rolling off the ramp. Now put a few thousands cross bind in your car with those same wheels and you now have 2 wheels carrying 65 lbs each and 2 wheels carrying 50 lbs each. You have now dramatically increased the amount of energy required to start those heavy wheels in motion. You are now behind before you even start moving and this wheel loading will remain in affect all the way to the finish line. Regardless of how fast or equal your wheels are, you just learned the very basic rule that no set of wheels will run any faster than the slowest wheel in the set. Now take the first scenario one step further with known fast and slow wheels in your own set. Say you have a little cross bind in your car but you have your wheels on your car so your fastest 2 wheels are on the heavy corners and the slow wheels are on the lighter corners. It might all equal out and would likely be invisible to you. Scenario three, now your next opponent has the opposite set up and when you swap, you now have his two slowest wheels on your heavy corners and so on. Not intentionally, but your opponent now has you in the worst possible situation. As soon as the gate falls, he is rolling and you are sitting still. Imagine this same effect in place all the way to the finish line. You just got cooked.

Many of us have been to races and seen wins and losses that go against our better judgment. Now you know more about the silent killer that might help explain some of those un-explainable observations. The best overall approach is to have no cross bind and let the wheels fall where they may.

How do you eliminate cross bind? Well, first you must be able to measure it and the only way to do that is to have a means of verifying if your two axles are parallel. Several suggestions are sighting across the axles from the front or the rear, using a level positioned on the end of the axle and move it from axle to axle, using 4 separate scales under each wheel, using a flat concrete surface with your wheels on, or building a parallel rail fixture. I prefer the parallel rail method because it takes the variation of the wheel diameter out of the process. And I think it is the most repeatable and reliable. I use old bed frame rails to construct my fixture. The fixture side rails must be long enough to accommodate the wheelbase and the fixture must be wide enough to accept the max length of the axle square stock. The goal is to be able to set this parallelogram fixture up and lay a level across each end and make adjustments to each corner until the side rails are level, side to side, end to end and diagonally. When your fixture is 100% level, sit your car on the fixture with the axles sitting on the side rails at the same position on all four corners. Now raise the front of the car just slightly off the rails and then back down until the axle makes contact with the rails. If both sides hit the rails at the same time, then you do not have cross bind. If one side hits the rail before the other, then you have cross bind. To remove this cross bind, loosen your front kingpin and put a .004 feeler gauge in between two washers of your washer stack, up against the side of the kingpin bolt. Now again torque your kingpin and recheck the car for cross bind. Continue this process with different thicknesses of feeler gauges until both sides of your axle hit the side rails of your fixture at the same time.

Remember, "You win at the top and you lose at the bottom."