Finding More Speed!

In the movie “Talledega Nights” a young Ricky Bobby says “I want to go fast”. We all want to go fast. That is why we race karts. Speed wins races and puts you standing on top of the podium. However, going fast is not easy. It requires a good deal of hard work and careful planning. In pursuit of that speed, I often see folks practicing and working very hard to improve their driving skills. Unfortunately, they don’t really seem to go about it in an organized fashion and their efforts often miss the mark. They endlessly drive more and more laps just engraining many of their bad habits. They make very little progress and just are really making it harder to make the changes they need to really improve. Or they invest time and money working on kart setup, buying new karts, motors, etc., when improving their driving skills is really what is holding them back.

I am writing this article with some thoughts on how to short cut the progress of improving your driving, learn more quickly and find more speed. Much of the article is high-level, but should provide a good overview of the skills required to be a good driver. I suggest you pay attention to the last section on using data analysis to improve you skills. I rarely see anyone but top drivers spending there time here.

The First Rule

The first major rule is you can’t be fast unless you turn the steering as little as possible. Turning the steering wheel excessively slows the kart similar to braking. You are no longer rolling the tires end over end, but instead twisting them sideways. Every degree you turn the steering wheel causes more drag and also destabilizes the balance of the kart.

The Second Rule

Never slide the kart and break traction. This includes not sliding the kart through a corner and not locking up the brakes. Sliding the kart causes a great deal of loss of momentum. Keeping the kart in sync with the track grip is often referred to as “being on rails”. The kart rolling in line with the track. When your kart is working well and “on rails”, you should get the feeling of the steering wheel turning in sync with the corner. You are also need to control the throttle precisely getting on and off at the optimum time. You can be on the right driving line, but still losing time if you are braking too early and not getting back into the throttle as soon as possible.

Driving Line

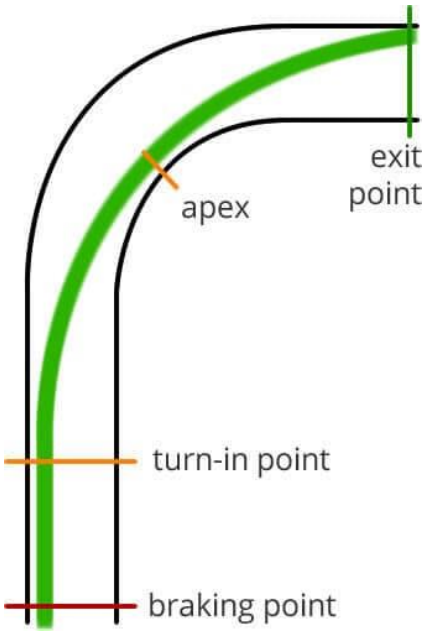
Learning the proper driving line is usually pretty easy to pick up. Best approach is to watch some fast drivers take some laps. What you are trying to accomplish is limiting the amount of turning you are doing, entering wide hitting the apex of the corner and then running all the way out to the exit of the turn (see diagram below). The flatter you can make this arc the more speed you can carry through the corner.

It is important to understand you can only use track grip in one direction or another. You can either brake and slow the kart going forward or steer the wheels and turn the kart. The friction of the tires can only maintain so many g-forces.

It is a balancing act to apply g-forces on one direction or the other. The best approach is to either:

- Apply the brake, holding the steering in a straight line (or)
- Be off the brake and turning the steering wheel

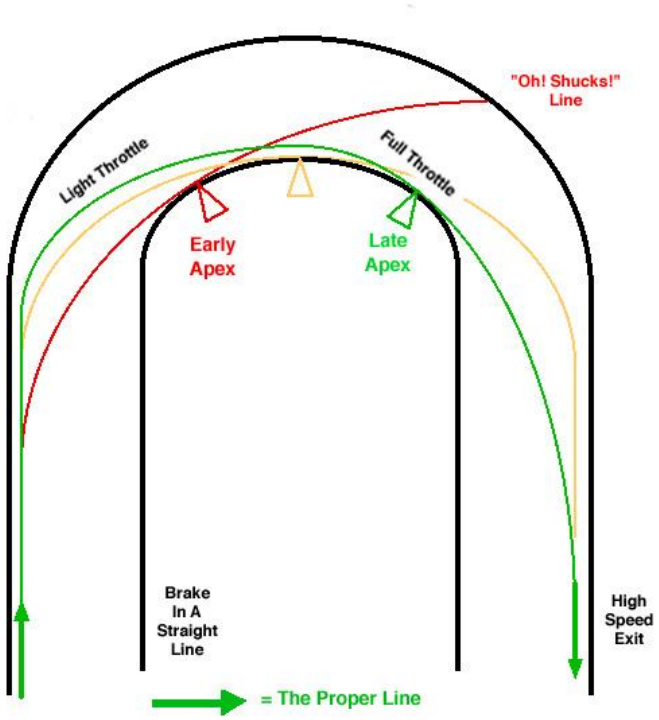
Never turn and brake at the same time. Most new drivers will spin out if they apply both. It is a common rookie mistake. You are going to want to: (1) brake coming into the corner in a straight line, (2) slow the kart, (3) let off. and (4) start turning. Note that turning will also slow the kart, similar to braking.



The diagram on the right shows a typical corner. A corner breaks into 4 components:

1. **Braking point.** This is the spot where you want to first start applying the brake pedal. The goal here is to go as deep into the corner and wait as long as possible to slow down for the corner. This is one area that most folks struggle with the most. Typically, they lack the confidence to go deep and brake too early losing a good deal of time. The other issue is being very inconsistent with precisely hitting the braking point, which leads to very inconsistent lap times.
2. **Turn-in point.** This is the spot where the driver stops applying the brake and turns the steering wheel to make the corner. Top drivers are very exact about how much they turn the steering wheel. The idea is to limit the amount you turn as much as possible. You don't want to overturn and then have to make a mid-corner correction. The hands of an excellent driver will be very quiet. You won't see them sawing back and forth, unless the grip conditions and kart setup are an issue and the driver is fighting the kart.

3. **Apex.** This is the spot where you come closest to the inside of the corner. When turning in, you need to have an exact location picked out for your apex. A good driver will hit this lap after lap. This spot is usually in the middle of the corner and easily identified by a curb. When entering long straights or going through back to back corners, you may want to adjust late apex or possibly even make an early apex.



4. **Exit Point.** This will usually be at the very edge of the track. You want to allow the kart to completely run out, allowing turning to be decreased as much as possible.

Your strategy going through a corner should be to use as much of the track as possible.

Corners will have curbs. If these are not big enough to upset the kart, you likely will want to run one side of wheels or possibly both over the curbs to short cut the track. A good deal of time can be picked up in this fashion. You are going to want to experiment with this and see if "curb hopping" is going to be faster or slower. Be careful not tear up the bottom of your kart. You should always have chassis savers on the bottom if you are going curb hopping.

The diagram above shows how to drive a corner applying a early or late apex. A late apex can be very preferential when entering a straight. It will give up a little bit of corner speed, but will allow you to exit the corner faster, which will lead to more speed all the way down the straight, overall gaining time. What this requires is a **slow in and faster out** mentality. Also, when a kart is not handling well and not carrying corner speed, using a late apex can be good approach to make the best of what you have. The worst case scenario is the "oh shucks" line show in the diagram. This is where you have over-driven the corner, have to get out of the throttle, and have very poor corner exit speed. The net result is you lose considerable time. Especially taking this line leading to a long straight will be disastrous.

When you make a corner pass this is typically the line you are taking, using a lower track entry, early apex, this forces the passed driver behind you, but you give up speed. When making passes, laptimes can considerably slow. In low horsepower classes like LO206 making passes in this fashion can be very problematic. Sometimes advancing a position is not really your best approach. Passing in this fashion you are going to have slower exit speed. Exiting slower, you will lose straight speed as well and you may get gapped from the pack of karts you are drafting with. When racing LO206 losing the draft can take your right out of the race. Going slower will also allow karts trailing you to catch back up. So, choose your poison carefully. Think strategically about when and where you make passes.

Posture

New drivers often struggle with maintaining good body posture. They will lean in the direction they are turning. This is very bad, because today's karts are designed with caster in the front geometry that will lift the inside rear wheel. This achieves a three-wheel approach, turning the kart very effectively through the corner. You are typically looking for the kart to lift the proper amount through the corner to achieve the best cornering speed. Adjusting the caster to the proper amount for the track conditions is one of the best ways to tune kart setup.

Leaning will throw all the technology designed into the kart off. Vintage karts did not have this advanced design and you will see them leaning to hold track grip, but with today's modern karts this will be much slower. If the leaning occurs inconsistently it can make kart tuning very challenging. The proper body poster is to sit straight up vertical with a strong spine. Holding that through the corner and never changing throughout the lap.

Where you hold the steering wheel is somewhat of a preference, but I recommend holding the steering wheel high. It will give you a better feeling of control and improve your body posture, which actually can give you more confidence.

I hope Braden Eves won't have issue with me stealing this picture of him. Braden is an excellent driver and has been climbing the ladder towards Indy Car. I have always admired how beautifully he sits in the kart and holds his body posture lap after lap. This clearly helps him go fast.

Braking

In kart racing braking separates the men from the boys. Considerable time can be lost or gained in the braking zone. It is especially critical in higher forms of karting like Tag and Shifter where you are carrying much more speed into a corner.

There are three types of braking: threshold, stable, and trail braking.

Threshold braking is also referred to as straight line or lock-up braking. You complete all your braking to slow the kart prior to turning in. Braking in a straight line prior to the corner is best approach for beginners. Threshold braking also implies you are breaking full out, all the way just short of lock-up. Someone that who has mastered this you will actually here the tires chirp on lock-up. Threshold braking is required for most higher speed classes like KA100, and especially Tag and Shifter where you will be hitting speeds over 70 mph and all the way up to 100 mph. It should be a goal to learn threshold braking even if you don't plan to run high speed classes. It is very useful in making a pass under braking.

Stable braking is similar to threshold braking in that you also brake in a straight line, but don't use all of your braking and keep good control of the kart before turning. This is the approach you will want to use for LO206 where you are maxing out from 55-60 mph and have less horsepower to accelerate. Typically, you will not slow the kart below 30 mph, so you are having to slow the kart far less than in high speed classes. In LO206 you are going to want to focus on keeping your momentum up and minimizing brake use. A quick steering input entering the corner can get a good deal of turning done and also slow the kart.

Trail braking is combining braking and steering, but more difficult and should be considered an advanced driving technic. Trail braking is really not required to reach you maximum performance, especially in a class like LO206 where you are focused on keeping momentum. Trail braking uses braking to help rotate the rear of the kart through a corner. It is very difficult to master and could lead to losing control of the kart. In general trail braking is also not faster than threshold braking. It can be useful if you are past your braking point and need to get the kart rotated to make the corner. You should focus on learning to master full threshold braking.

It is critical that you fully learn the lock up point of your brakes. Often you many want to drive as deep into a corner as possible then use the maximum braking potential to slow the kart down. That maximum is just short of lock up. Learn to push the brakes all the way up to lock up going into a corner. Unless you understand where the lock up point is, you will never turn your best possible lap times.

One way to learn threshold braking is to take practice laps and aggressively push the brakes until you slightly lock them up. Kart will slide, so be careful and keep the steering wheel straight. Try to back off slightly from the lock up point on subsequent laps.

A good drill is to go to a big parking lot. Set up two caution cones, then drive hard up to the cones and then slam on the brakes, locking them up, and slide to stop. Kart should not slide sideways if you are hold steering straight. If it does slide sideways, you didn't have the wheel straight. Keep repeating this drill until you learn to get this just right in terms of holding steering straight when locking up the brakes. Once you can keep the kart sliding straight, then start seeing how short of the distance you can make the kart go before stopping. Make more runs, reducing the braking slightly until you are no longer sliding the kart at all. At this point you should see that you have now stopped the kart fully in a short distance. Practicing will give you a great sense of where you maximum braking point is without locking them up. Take to this to the track and you will see faster lap times. You will also become fearless making passes by out braking the other drivers.

Data is your best friend

To get to the next level in karting, data analysis is definitely your best friend. Reviewing data gives you quantifiable information on your performance. It is very hard to get a sense of how you are doing by just driving the kart.

My preference is to use the AIM MyChron products. They are the most established data collection product and is used by over 90% of the kart racers. I also like AIM's lifetime warranty policy. If your unit breaks, mail it to them and they will fix for free. Their van also often attends many major karting events and will provide support / repairs right at the track.

I highly recommend the MyChron 5. It has a few major advantages over the old MyChron 4:

- Built in high resolution GPS
- WiFi support to easily wirelessly transmit your data to your computer.

Another nice feature of the MyChron 5 is setting the display to show a comparison vs. your fastest lap. Mid lap you can see if you are doing better or worse than previous laps, giving the driver real time feed back while driving. Also, AIM has improved on the original MyChron 5 with the MyChron 5S. It provides even better GPS resolution.

If you have a MyChron 4 it is essential you also get a GPS and a data key for downloading the data. Without the GPS analyzing the data can only be done by time. The GPS will give you a precise positioning map to help guide your analysis. You will also need the data key if you want to download your data onto a computer and use Race Studio. This process of using the data key is more cumbersome that using the WiFi with the MyChron 5. By the time you add the cost of these, you would have been better off selling your MyChron 4 and buying the MyChron 5.

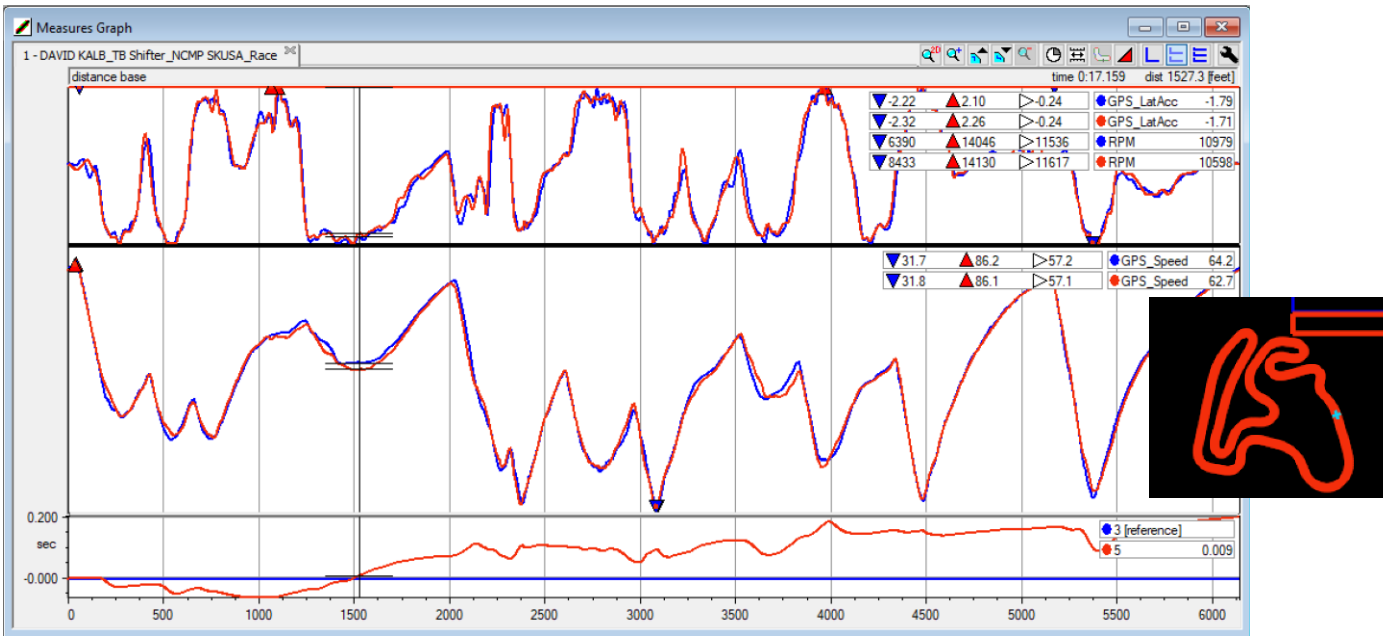
A great way to learn more quickly as a new driver is to compare your data to an experienced fast driver and get it analyzed by someone experienced in using Race Studio. The part of the track you are losing time will clearly stand out. It will zoom in on what corners and sections of the track you need to work on and approve. You can see your braking points, cornering speed, and lateral / longitudinal g forces that will show you how hard you are driving the kart in comparison. This will also help jump start you and teach you how to download the data and do the analysis for yourself.

Looking at data after nearly every session should be second nature. Especially when trying to compete at racing events. Instead of sitting around in the pits, get out your computer and work to get faster. The process is a continuous loop of:

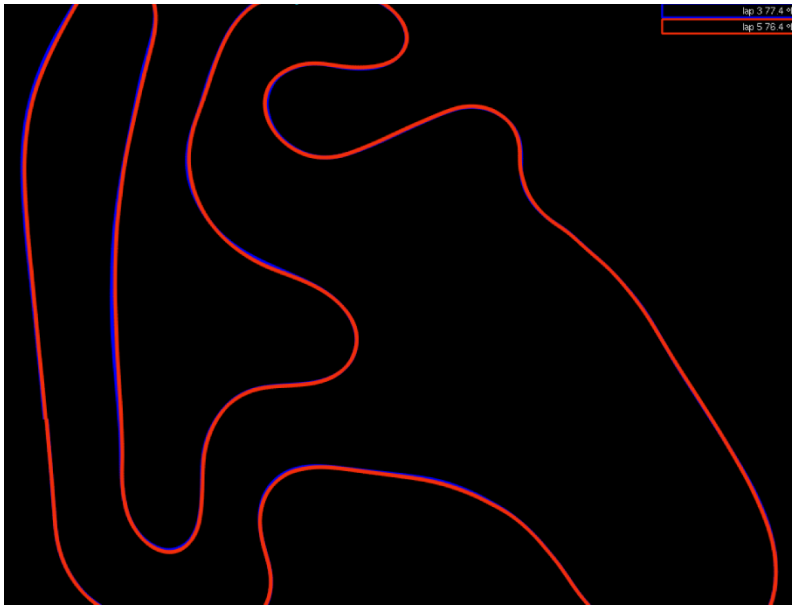
- Driving
- looking at the data
- making a detailed plan on how to go faster
- driving again
- evaluate your previous plan, make new plan
- and repeat.

The best drivers in the world religiously do this.

The first analysis you should learn to do in Race Studio is to compare two laps. Here is low hanging fruit of using data. Below is a couple of laps by my son, David Kalb Jr. in his shifter kart at New Castle on the Iron Man layout. Lap times where fairly close, 2 tenths difference. You want to select the time and distance chart. You can see at the bottom and shows you the difference between the laps. You can see he started out gaining time through turn 3, but lost time flipping the lap negative on the sweeping corner of the Iron Man section. His braking and acceleration in the RPM and GPS speed charts are nearly identical. You re looking for this consistency. On laps that change you should note the difference and analyze what happened.



The GPS chart will show your changes in driving line. While it is not 100% accurate because of GPS fade, it does do a pretty good job. The new MyChron 5S makes this even more useful. In this test you can see there are only minor deviations in David Jr's driving line.



Once you have compared laps and determined what section(s) you are losing time. Then you want to go deeper. The three areas to pay particular attention to are:

- Braking point
- Apex speed
- Exit speed

These can be influenced by track conditions, but over time you will get a good idea of what is optimal for each. Driving lines can be nearly identical, comparing at these key points is really where the rubber meets the road and will highlight what is fast and what is not.

For your braking point, first you should be noting at what point on the track you apply the brakes. It can often to be helpful to have some reference point on the side of the track for this. You can also look at how much force you are applying and how fast you are slowing the kart. This is done by reviewing GPS Longitude G data. On hard braking corners you should be using the maximum braking force in every corner and driving as deep as possible.

At the apex of the corner, you can use the GPS Lateral G data to review how much you are turning the kart. The goal is to get most all of you turning done prior to the apex. You should see the Lateral G data declining smoothly after this point. If you are counter steering or adding extra steering after the apex you will upset the kart.

Upon corner exit you are going to want to see your MPHs. Corner exit speed is critical. One of the first places to look is your corner exit speed leading into the longest straight. If you are slow coming out of this corner you will lose time all the way down the straight and lose considerable time.

You should also be looking for jagged edges in your data. These indicate where you are missing braking points or over/under steering and making corrections. Remember every time you steer the kart you are also applying longitude forces that are slowing you down.

One of the more advanced things you can do is look at accelerometer data and g forces. This can show you whether you are taking a corner at the maxim available with the current grip conditions or whether you are braking to the maximum. You can sum the lateral and longitude forces into a G Sum. You want to maximize your G Sum on every corner to know you are driving the kart as hard as possible. You will also find that different tire compounds have different maximum grip level and g-forces you can carry through a corner.

Use Video

Using a GoPro or an AIM Smarty CAM are excellent driver coaching tools. Matching video to your slowest and fastest laps can help you review what you are doing right and wrong on the track.

It is best to put your camera on the left side pod to also capture your braking foot. You can also put the camera on the front ferring and may also be able to pick up your feet. Never put a GoPro camera mounted to the top of your helmet. This can be dangerous and reduce the effectiveness of your helmet in a crash.

Having a experienced driver review the data with you can help you progress quickly. He can point out what mistakes you are making and give suggestions for driver improvement. He can give you great feedback on how much braking you are doing, what line you are taking, and how you are using the steering.

In conclusion

Raising your game and going fast in karting is hard work. It takes lots of practice and testing. Having a plan is key. First, obtain the basics skills outlined in the first half of this article: learning driving line, braking, and good body posture. From there it is a process of refinement and gaining seat time. And more seat time. Top drivers have many years of on track experience. You can't get fast overnight and have to be willing to put in the work.

Having the right help is key. Driver coaching can make a significant different in short cutting the learning curve. For new drivers, Kart-Start highly suggest you find a qualified coach to help you. Integrating data and video analysis into these sessions will help significantly and allow you to progress faster.

If you ever need help, Kart-Start would be happy to work with you. We can conduct on-track coaching sessions, do AIM data analysis, video analysis (both in person and virtual), and kart setup tuning. We also offer a full line of COMPKART chassis.