Autocross Handbook

(from the Top of the Rockies Corvette Association web site)

This handbook is designed to cover only the most basic subjects and techniques. As you gain autocross experience, you will learn and incorporate more advanced driving and course assessment skills. At the end of the handbook you will have been introduced to everything you need to know to be a competent beginning auto-crosser. Autocross is great fun and an easy activity in which to get started. It is a very difficult sport in which to excel. Championship drivers have spent years developing their skills to be as good as they are. Stick with it, ask questions, drive a lot, and learn as you go. You may become a future Champion!

A TYPICAL AUTOCROSS EVENT - FROM A TO Z

What follows is the normal sequence of events for a typical autocross:

- Pre-Registration – This is normally done on-line prior to the event.
- Arrive Early - There is a lot to accomplish before the event gets underway, and the earlier you get started, the better.
- Sign the Waiver - Everyone who enters the event site MUST sign the insurance waiver, and wear a wristband.
- Paddock Parking - Take as much room as you need, but use what you take.
- Check In - Proceed to Registration immediately after parking. The line will get long quickly, and the time you spend in line can be put to better use. If you don't check in before Registration closes, you get to watch!
- Prepare your vehicle.
- Determine which Run/Work Group and Run Order you are in- Lists will be available at Registration and on the "scoreboard".
- Grid your car when appropriate.
- Walk the Course - As many times as you have time for.
- Attend the Novice Meeting and Course Walk.
- Attend the "All Hands" Meeting – it's Mandatory!
- Drive when it's your turn.
- Work when it's your turn.
- Help with Clean Up - When everyone helps, it's much easier, and it goes much faster.
- Attend the Trophy Presentation - Who knows, you (or someone you know) may be getting one.
- Drive safely and sanely to your Respective Homes. The adrenaline rush takes a while to subside.

PREPARING FOR AN EVENT

Before Leaving Home... Prepare your vehicle:

- Top off all fluids - coolant, oil, brake fluid, transmission fluid, differential fluid, and gas.
- Make sure your tires are in good condition - measurable tread present, no cord showing, properly inflated.
- Ensure lug nuts/bolts are tight.
- Check your battery tie-down. Batteries must be securely fastened down by an OEM or aftermarket bracket, designed for that purpose. No bungee cords, bailing wire, coat hangers or duct tape allowed!
- Remove all extraneous items - Infant car seats, gym bags, umbrellas, books, CDs, newspapers, Coke cans, etc. Anything that can move around in the car during an autocross will.

Be sure to pack and bring the following:

- Food, water, sunscreen, and rain gear - weather conditions are fickle; be prepared for anything.
- Necessary tools and equipment.
- Car numbers and class letters.
- Helmet, shoes, gloves, if you own them.
- Extra motor oil, power steering and brake fluids - If you've prepared your car properly you won't need these, but somebody else may have forgotten.

When You Arrive On Site

- Get to the event early! Quite a few will show-up by 6:00 am so you won't be too early if you arrive by 7:30 am. Even though registration will have a definite opening and closing time, arriving in the nick of time leaves you very little lime for registration (even If you have registered on-line, you still have to check in and pay the entry fee), getting the car through tech inspection, and walking the course.
- Unpack your vehicle – Hopefully you removed most loose items from the interior, trunk and engine compartment, including floor mats if they're not secured to the floor, radar detectors, soda cans, fast food wrappers, and everything and anything that could move around when you are out on the course before you left home. Other items can be stored in plastic storage containers that will keep your stuff from getting wet, or blown away.

Prepare your vehicle:

- Check/adjust tire pressure - Most vehicles tires will benefit from the addition of from 5-10 pounds of air. This will help keep the tire sidewalls from "rolling over" under the heavy side loads you are about to subject them to. Rear wheel drive cars usually take a few more pounds in the front tires than in the rear. Front and all-wheel drive cars typically take the same amount in the front and rear tires.
- Double check fluid levels - Better safe than sorry.
- Apply car number and class letters. If using paper numbers, be sure to tape down the leading edge of the paper to prevent the wind from ripping them off the car.

The Grid

The Grid is the place you position your car for competition runs. There are usually two grids, Grid A and Grid B. Heats 1 and 3 use grid A while Heats 2 and 4 use grid B. Cars are grouped by class and usually in numerical order. The "number" being your number - the one you applied to the side of your car. You will be assigned a grid space and that will be found on the "Grid Sheet posted on or near the timing truck - usually on that large wooden "scoreboard." Look up your number, and then park your car in that assigned space on the grid. The numbers will be written on the

ground in white chalk.
After positioning your car on the grid for the first or second heat, raise your hood and trunk lid to alert the Tech Inspectors that your car is ready for tech Inspection.

If you are in the first run group, you will want to position your car on the grid IMMEDIATELY after checking in and prepping your car. Generally, cars will run in order from grid spot Number One. An exception is the two-driver car. Two-driver cars will be sent out to run intermittently during the run group, so that both drivers have an opportunity to drive before the run group starts their next run.

Tech Inspection
While in the Grid area, your car will be undergo a Technical Inspection. The inspectors will check the following items:

- Tires for measurable tread present, no cord showing.
- Wheels firmly attached to the car; lug nuts tightened.
- Battery must be mounted with no chance of coming loose.
- The throttle must have a "positive return."
- Brake pedal for firmness; proper fluid level.
- No fluid leaks.
- Overall condition of the car - no parts ready to fall off.
- Helmet meets the current Snell Rating requirements.
- Car numbers and class letters meet the requirements and are legible while on the course to the Timing, Scoring and course workers.
- The tech inspectors WILL NOT verify your car is classed properly; that is the driver's responsibility.

Course Walks
Walk the course. Walk the course. Walk the course. Walk the course.

If you are new at this, attend the Novice Course walk. A novice mentor will take you on a "guided tour" of the course, showing you the line, and pointing out the particular features on the course. While it is true that there can be slightly different lines for different cars (FWD, RWD, lighter, heavier...) just learning the basic line through the course will suffice for now.

There are many techniques for walking and learning the course. As a beginner, try walking the first time just to get the overall "feel" of the course. Where are the straights? Where are the sharpest (slow) turns; the higher speed sweepers?

On a second walk, look for

- the apexes - where you want to be close to the cones.
- any bumps, changes in surface (i.e., asphalt to concrete).
- any camber changes (surface tilt) that could upset the car.
- braking spots.
- where to get ON the throttle.
- the slalom zone; pace it off to see if it is evenly spaced or if it gets tighter or looser.

Walk the course again and try to memorize it as best you can. Remember, walking the course is not a social event. Resist the temptation to engage in conversations not related to the course. Don't walk the whole thing only to realize that all you did was talk to your buddy... with no recollection of what you saw!

Walk the course again!

Look for the longest straights. Remember that some sections can be deceptive because they look like they are turns when the proper line selection actually makes the driving line more or less straight If you can keep your foot to the floor, it's a straight.

Look for the turns leading to straight sections. These are the most important turns - the ones in which you want to maximize your exit speed.

Determine the point in a turn where you can apply maximum acceleration and plan on how to get the car to that position and pointed the right direction (toward the next gate, or "feature") when at that point. You may be surprised at how much you have to slow down to be able to position the car in the optimum position to maximize your exit speed.

Remember; slow in, fast out!

ALL HANDS MEETING

These are MANDATORY meetings for everyone at the event, whether you are driving or not. Important safety information will be briefed during the meeting, as well as announcements concerning the conduct of the day's event.

PREPARING TO DRIVE

In The Car

- Adjust your seating position - a little higher, forward and upright than usual. With your back against the seat back, stretch your arms straight out and rest them on the top of the steering wheel; your wrists should contact the top of the wheel.
- Place your left foot on the dead pedal (or at least find a firm resting place for it).
- Drive with both hands on the steering wheel except when shifting. Use the 9 - 3 or 10 - 2 hand position.
- NEVER grab the steering wheel from inside.
- Adjust your seatbelt tight. Lock the seatbelt inertial reel if you can.

While sitting in grid, waiting for your turn to run, do the following:

- Re-check your helmet strap and ensure it is fastened snugly.
- Re-check your seatbelt/harness and fastened tightly.
- 'Drive' the course in your mind. Visualize each section and your plan of attack.

Almost TIME TO DRIVE, But first...

Some Driving Basics...

LOOK AHEAD! Not straight ahead, but "down-course", through the next gate or two. Looking just over the

hood makes every turn a surprise, and results in slow times. Make smooth (not slow) applications of throttle and brakes. Abrupt application upsets the car. Practice smooth transitions from throttle-on to throttle-off to throttle-on situations.

Remember that spinning tires are a sign of being too abrupt on the throttle.

When on the gas, push it ALL THE WAY DOWN! (There are some exceptions).

Brake in a straight line. Trying to turn at maximum braking may well cause a spin. To go fast, you must learn how and when to go slow, to apply the brakes. Don't lock up brakes. This is where ABS is good. No ABS?? Use Threshold braking - braking as hard a possible without locking the wheels. Generally, you should be accelerating or stopping for all you are worth.

Use the whole course. Don't just drive down the center. Generally you should be close to one edge or the other. The proper line through the course may not be identical for every car, but it will usually be close. The shortest distance is seldom the quickest way around the course.

Look where you want to drive. Your hands will follow your eyes. Don't stare at the cones!

OVERSTEER and UNDERSTEER

Over steer = Loose
You turn the steering wheel and the back end wants to come around. Just lifting off the throttle in a turn can cause a spin with rear wheel drive cars. If you do spin, don't panic. Just remember, in a spin, both feet in - brakes and clutch. Slow the car until the tires regain traction (usually a dead stop, but not always), get back on the course and finish the run.

Under steer = Tight
You turn the steering wheel, but the car turns less than you expect. At higher speeds the car tendency is to over steer while at lower speeds, it tends to under steer.

In low-speed turns with under steering cars, ease off throttle and/or take out some steering input, and BE PATIENT. More gas will not help. Neither will more brakes (the tires are already skidding!) Next time, brake sooner and/or harder BEFORE you get to the turn.

Very few cars will ever turn over, no matter how heavy-handed you are. Cars with a high center of gravity, stock (soft) suspensions, and on stickier competition tires are at most risk of turning over.

What is a Late Apex and Why Should You Care?

- A late apex helps prevent over steer as acceleration transfers weight to the rear which helps the rear stick better.
- A late apex is the "safest" way through a turn.
- A late apex results in a higher exit speed. If you exit a turn slow, you will be slower at every point along the following straight.
- More turning is done BEFORE you reach the midpoint of the turn, allowing you to "stay ahead" of the

turn.

To maximize speed on the longer straights, the exit speed from the turn leading to the straight is very important.

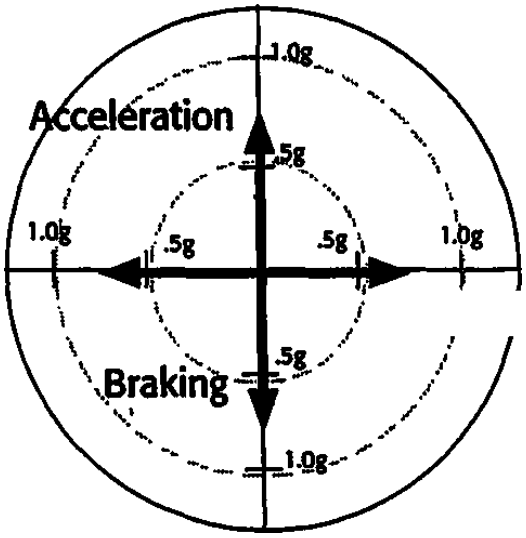
Brake HARD in a straight line *BEFORE* you begin to turn. After the turn has begun, you may be able to add some throttle.

Should You Always Use A Late Apex?

No. There are some turns in which a late apex would be a bad choice.

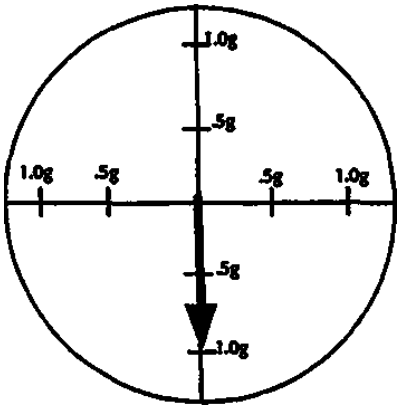
When several turns are linked together, the exit from the last turn leading to a straight is the important one Sometimes there are sections of a course which reward patience. You have to learn how to go slow to go fast. Trying to hurry through a portion of the course that should be driven slowly guarantees you will collect penalty cones and/or lose momentum. When things get really slow, worry less about late apexes and concentrate on driving smoothly through that section.

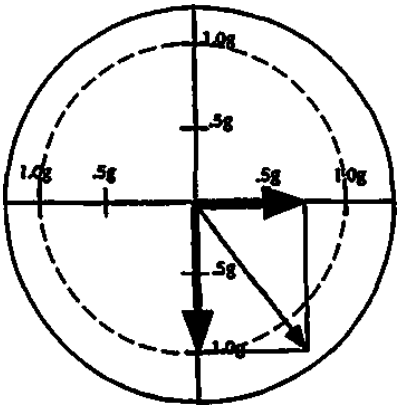
THE TRACTION CIRCLE



Why can't I brake at the maximum and turn at the same time?

If your tires have the ability to retain their grip at one g, then one g is all they can give. If your tires are already at their limit of traction (left circle), then attempting to turn would require more grip than they have available. The result can be over steer (a spin), or under steer (continuing straight ahead, or at least not turning as much as you want). Either way, your times will suffer. Releasing some brake pressure before turning will allow your tires to do some of both. The same is true of accelerating out of a comer. If your tires are at their maximum grip in the turn, attempting to accelerate is futile until you begin to unwind the steering wheel. Learning to blend your braking, turning, and power applications smoothly is essential for improving your times.

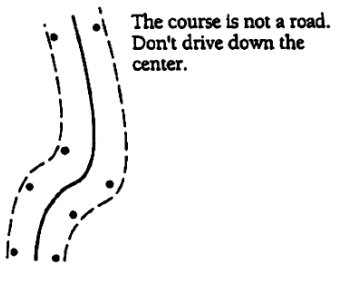


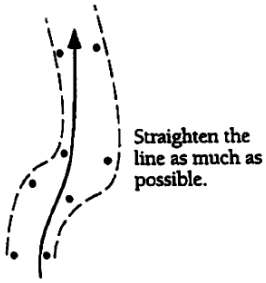


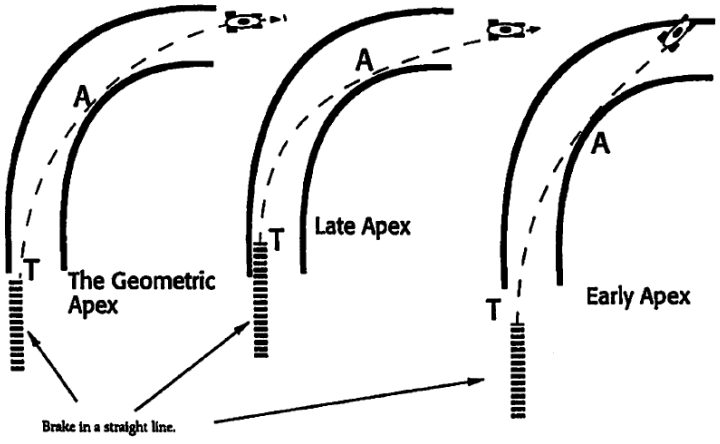
Below are three simple examples of the three basic lines through a 90-degree comer. The T indicates the turn-in point for each. The A Indicates where the driving line makes its apex in each example. Note that depending on the actual turn, the difference between an early or late apex can vary from a foot or so to several yards.

The first illustration is the geometric apex, a constant radius turn. It assumes a constant speed through the turn. The middle illustration shows a late apex through the same 90-degree turn. Notice how the turn-in point is farther down the straight. The late apex allows you to accelerate much earlier. The last turn is an early apex and will often cause you to exit the course on the outside of the turn. Your only recourse may be to brake in the turn, possibly causing a spin. Either way, your run will suffer.

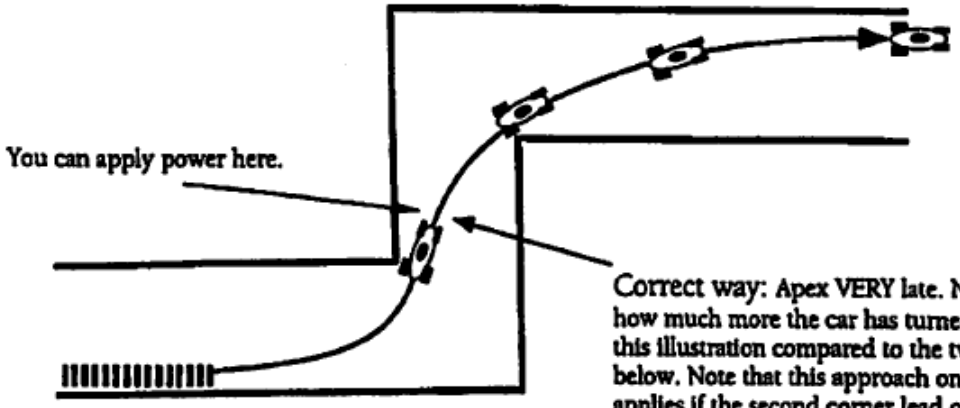
If you are in doubt as to whether to brake later or earlier, brake EARLY. You can move your braking point later on subsequent runs.



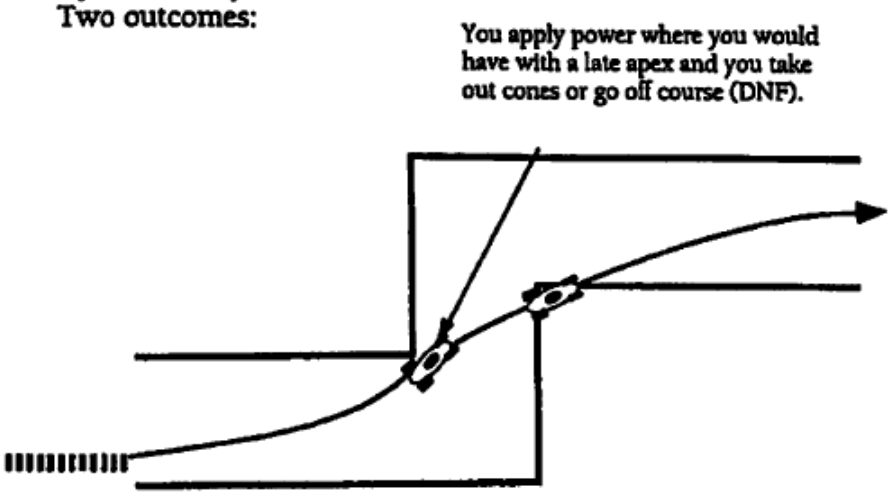


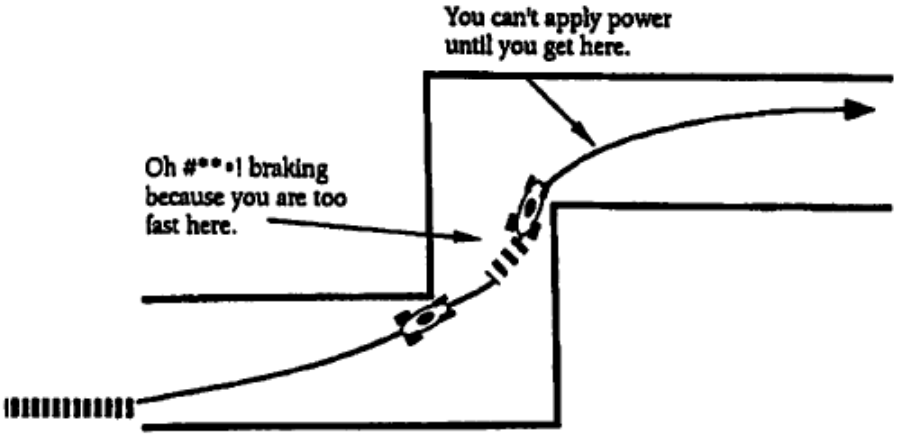


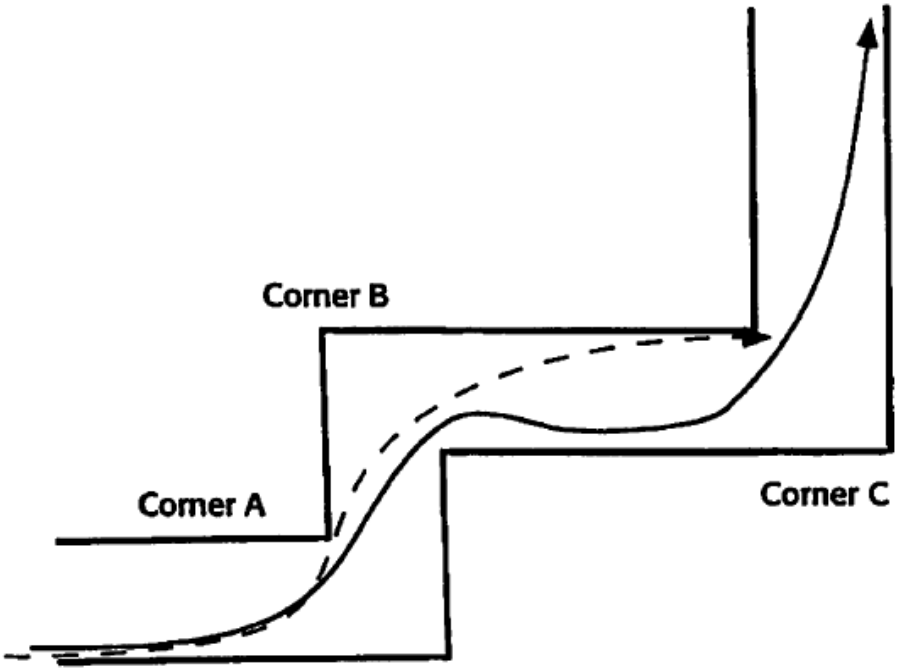
Linking turns



Wrong way:
Apex too early.
Two outcomes:

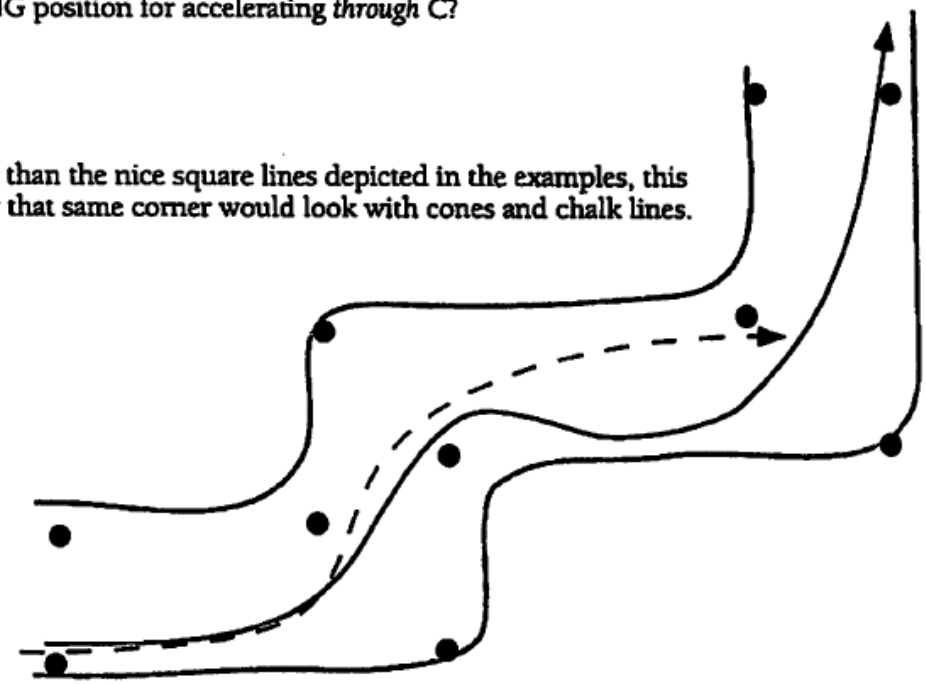




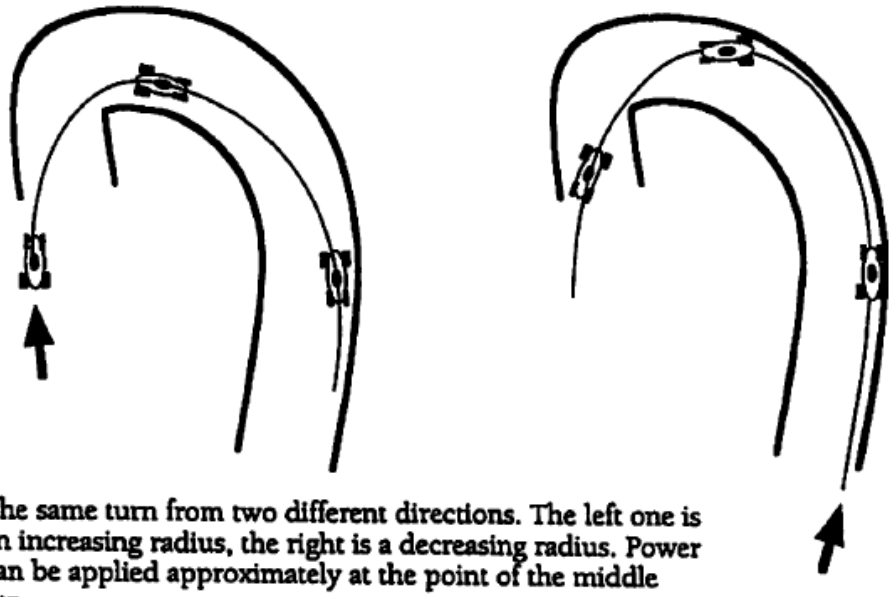


Corners A and B are exactly the same as in the previous three examples. The dashed line is the same as the late apex in those examples - what we just said was the proper line. Since Corner B does not lead on to a straight, but Corner C does. Can you see how the line differs significantly and positions the car for acceleration out of Corner C instead of Corner B? Can you see how a late apex at A places the car in exactly the WRONG position for accelerating *through* C?

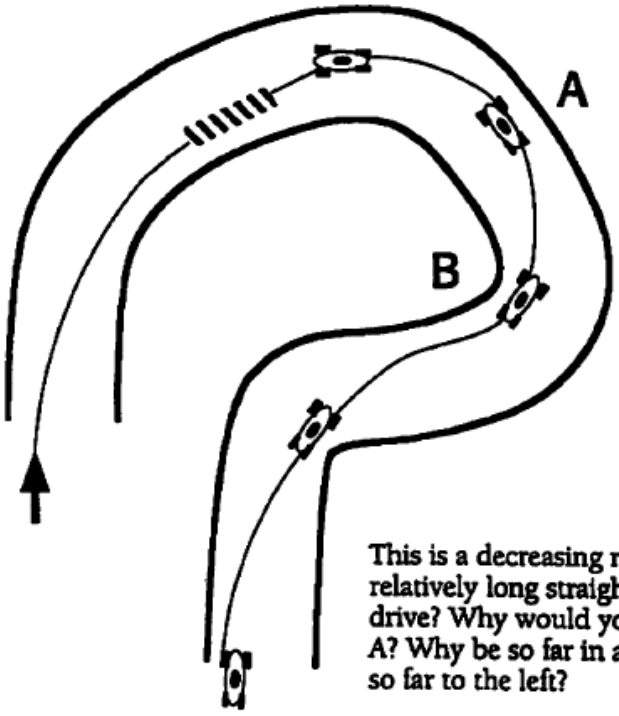
Rather than the nice square lines depicted in the examples, this is how that same corner would look with cones and chalk lines.



Increasing & Decreasing Radius Turns

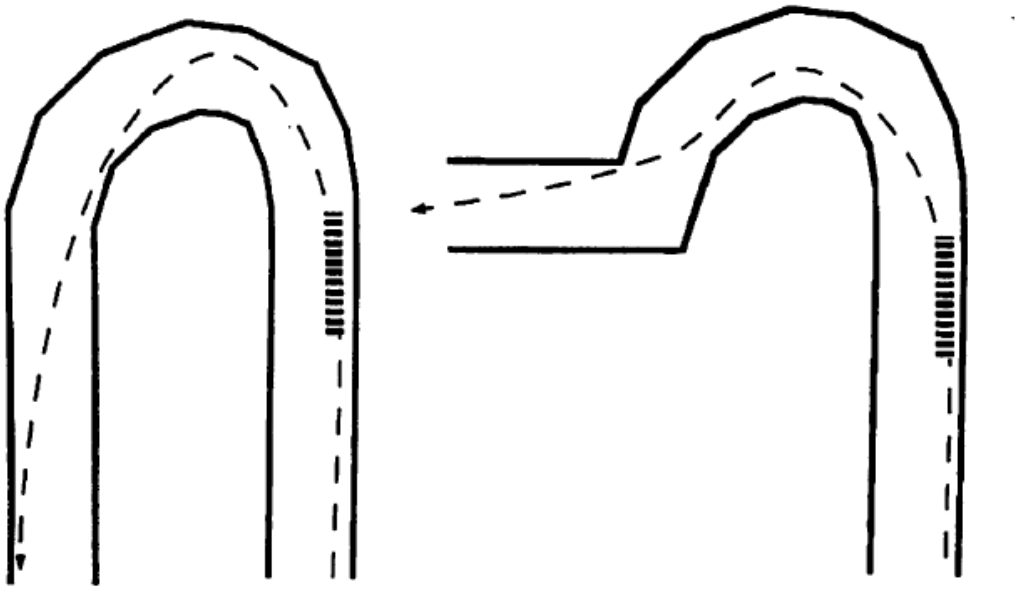


The same turn from two different directions. The left one is an increasing radius, the right is a decreasing radius. Power can be applied approximately at the point of the middle car.

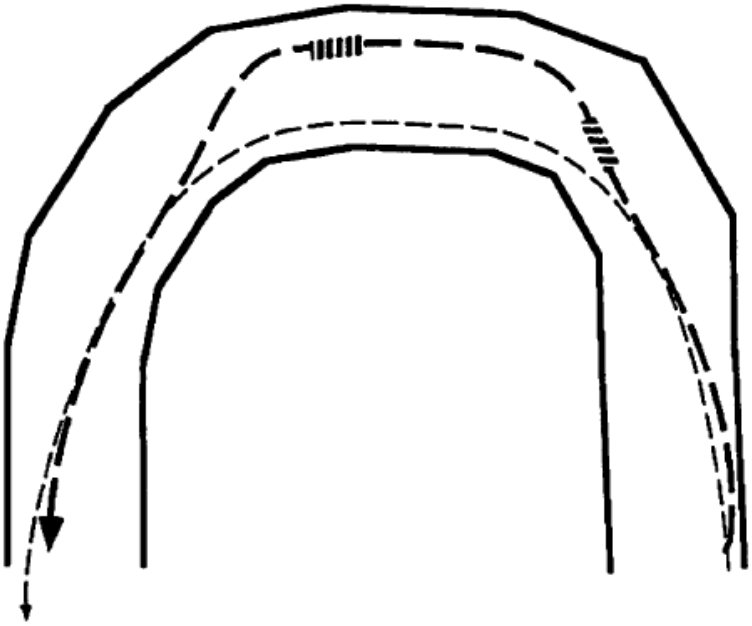


This is a decreasing radius turn leading on to a relatively long straight. Is this the line you would drive? Why would you want to be so far out at point A? Why be so far in at point B? Should you enter from so far to the left?

Hairpins and Sweepers



Hairpins turns are tight turns approaching 180 degrees. If the turn leads to a significant straight, it is probably best taking a late apex as shown at left. If there is not a significant straight after the turn, you are much better off hugging the inside of the turn. In practice, Solo2 courses seldom have a straight long enough to justify maximizing exit speed. In most cases you are better off driving a tighter line, thereby sacrificing some exit speed to minimize the distance driven through the turn.



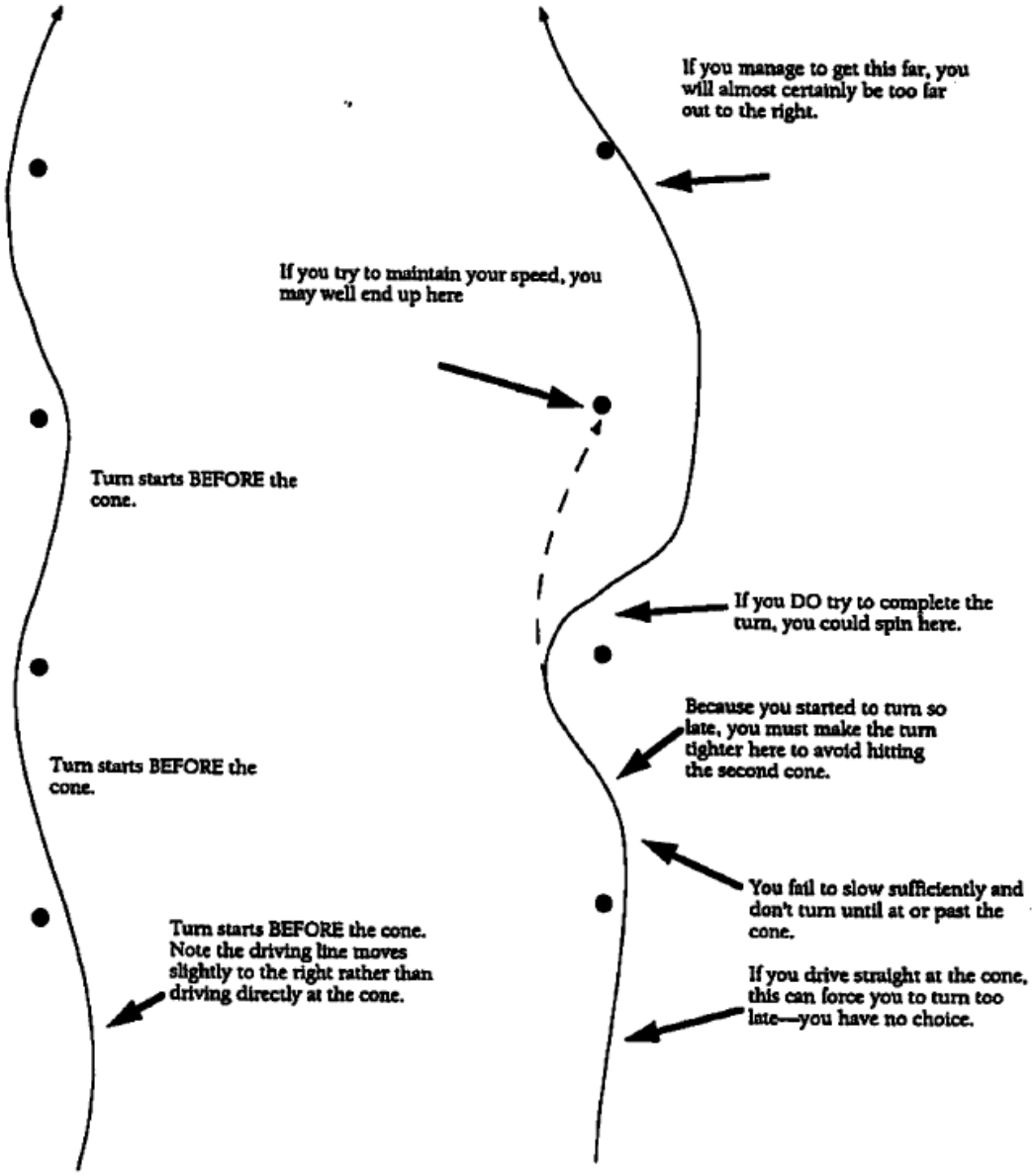
Sweepers are large-radius turns of more than 90 degrees—usually 120 to 180 degrees. Since they can be driven at much higher speeds than hairpins, setting up a late apex often just means you drive a greater distance for no significant increase in exit speed. Hugging the inside is preferable. (Thin dashed line)

Another technique, if the radius is large enough, is to make short straight sections within the sweeper. (Heavy dashed line)

THE SLALOM

Properly done, slaloms can be a graceful dance with your car. (Not my phrase, every driving book uses it) It is important to turn slightly earlier than one would think. Waiting until you are even with the cone before you start the turn ensures you will start out "late' and most probably never catch up.

The illustration on the left shows the turns starting just before the car reaches the cone. The slalom at right shows what can happen if you wait to turn until you are beside the cone. The first turn has you going too fast too straight, too long. By the time you turn, you are past the cone and too close to cone #2 requiring a much sharper turn to the right This carries you way out to the right and out of position to make the next left You will either spin or run over the last cone. At the extreme, the car can begin to rock side-to-side as you are forced to turn sharper and sharper to avoid running over the next cone. Should this occur, STOP THE RUN, slow down and regain control of the car. Your run is already shot so there is nothing to save-except the car.



TIME TO START YOUR RUN!!!
Be in your car with your helmet on and the engine running when it is your turn. Proceed slowly to the starting point and pay attention to the starter. When you get the go-ahead, get underway within a few seconds. A "drag strip" start isn't necessary since your time doesn't start till you pass the "Start" lights ahead of you.

Look well ahead (down course) and try to drive the line you imagined during your course walk. If you hit a cone, just keep on going and forget about it. It's either a penalty or it isn't and you can't do anything about it at this point.

Concentrate on driving quickly and smoothly.

If you see a red flag waving, STOP THE CAR! This usually means that someone ahead of you has either spun out and stalled their car, has gotten lost on the course, or is suffering some mechanical difficulty preventing them from keeping on pace. The course worker will either tell you what to do or wave you on. When allowed to proceed drive through the rest of the course at a reduced (but not slow) speed. You will get a re-run, unless you are the cause of the red flag.

After crossing the finish line, slow down and drive slowly back to your grid spot Think about what you did well and what you need to Improve. Don't try to correct more than one or two things-even if you can think of ten things you did wrong. Pick out what you think were the one or two worst errors and correct them. You can correct other errors on subsequent runs. Learn something from every run.
Now, go do it again; Quicker this time.

SOME UNIVERSAL TRUTHS
- The car is faster than you are (if s not the car, it's you!)
- There is always someone faster than you.
- There is no way to "make up time" on the course. Time lost is gone forever. You can't go any faster than you can go.
- There is no substitute for seat time.
- Autocross is fun, but getting good is hard and takes time and practice. Concentrate before, during, and after a run.

IMPROVING THE DRIVER
- Read the rulebook.
- Take instruction.
- Ride with experienced drivers.
- Have experienced drivers ride with you, and ask them for feedback. Be mindful though, that they will likely be honest'
- Walk the course with minimal distractions.

IMPROVING THE VEHICLE
- Read the rulebook.
- Don't buy stuff until you are sure you are committed to the sport.
- Don't buy "stuff until you talk to others with similar cars-find out what works! Tires, shocks, and wheels provide the most performance gain when you are new.

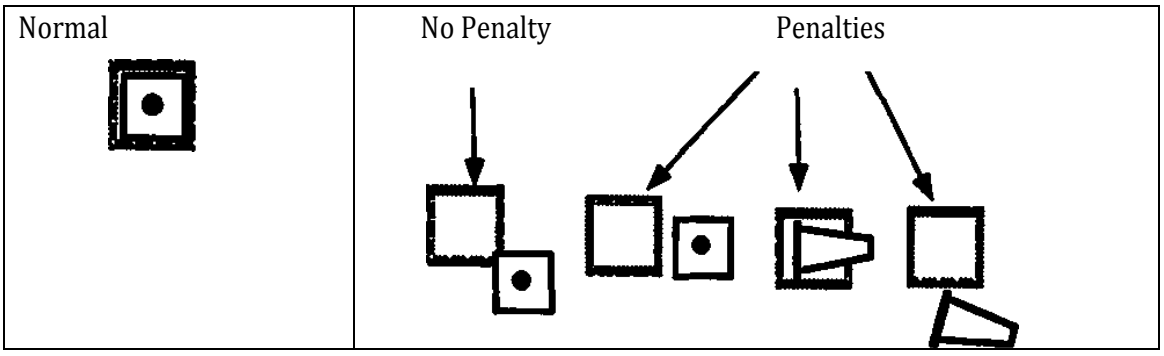
WHAT'S NEXT?
Schools and reading books on driving are all helpful, but the route to improvement is SEAT TIME. As a Novice, use your first year to take advantage of participating in all local area events.

Seek advice from experienced drivers with a similar vehicle.

COURSE WORK AND THE "SPECIALTIES"

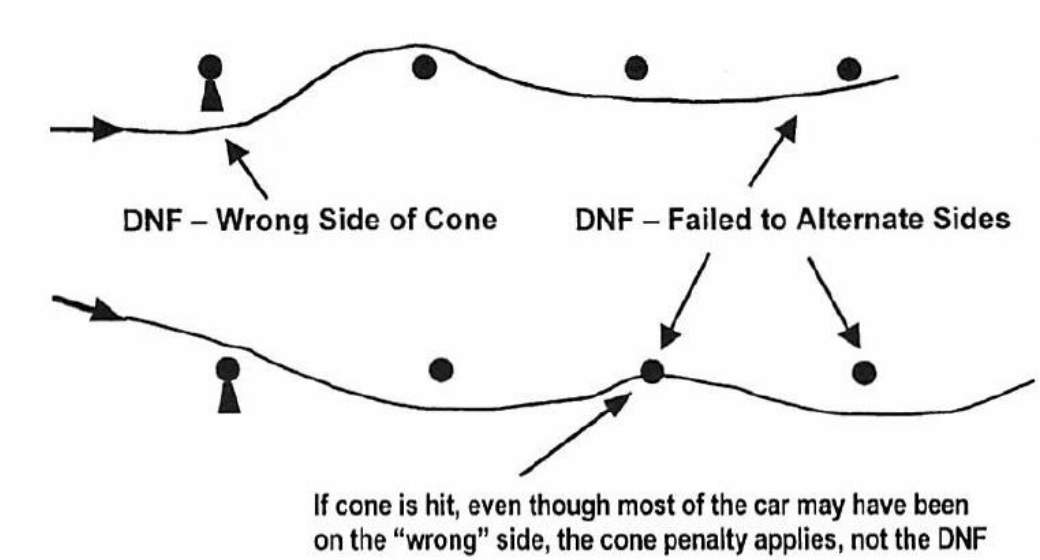
Working the Course
Everyone participating in the event will be required to perform a work assignment. As a beginner, you will most likely be assigned to work the course as a corner worker. The corner workers' job is to return cones to their proper position when displaced, correctly assess any penalties that may result, and report penalties to the corner captain.

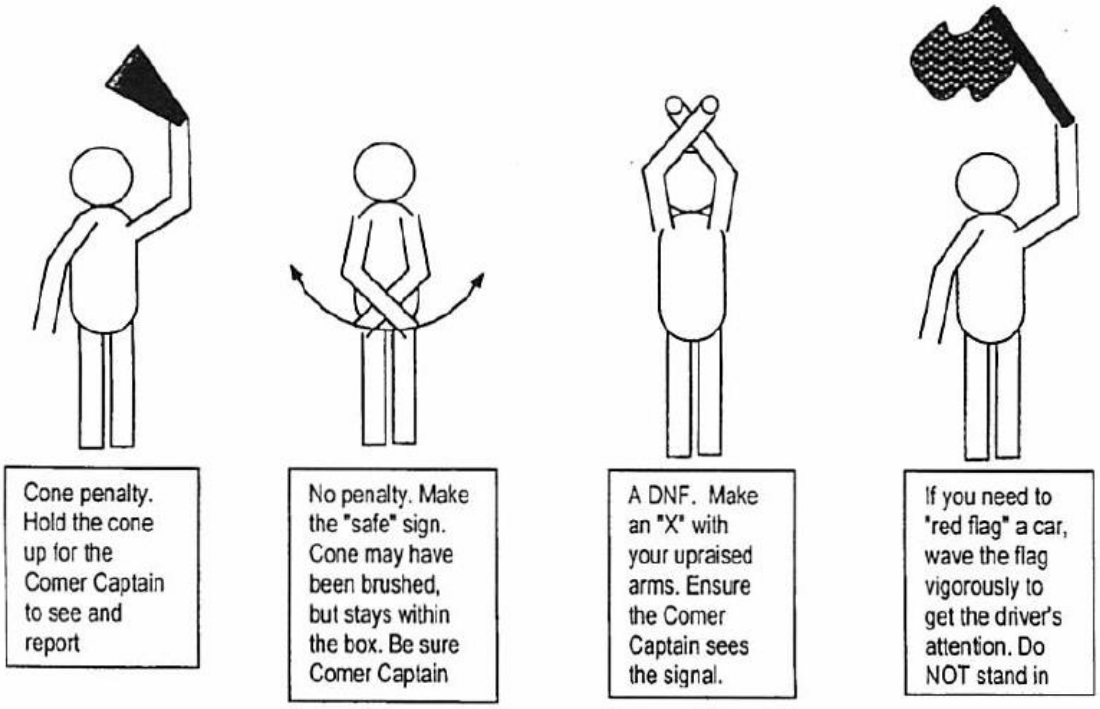
Every cone on the course has a box drawn around it with chalk. The box prescribes the "normal" position for that cone. When a cone is disturbed by a car hitting it, the driver will incur a 2 second penalty (for each cone!) If the cone is either knocked over, or moved *completely* out of its box. If any part of an upright cone it touching the box, there is no penalty assessed. See the figure below for an illustration



Comer workers will also report any DNFs (Did Not Finish) that occur. A DNF results when a prescribed course. Driving outside the chalk line that defines the course lane is permitted, as the course before going through the next gate. See the figure below for an illustration.

A DNF occurs in a slalom zone if the car enters the slalom on the wrong side of a "non-optional" slalom, or fails to alternate sides correctly.





Course Working Tips

- Show up for your work assignment on time.
- Do not bring cameras or cell phone on course. The course is a dangerous place to be if you are not paying attention to the cars.
- Learn and follow radio protocol.
- Understand the "down and out" cone penalty rules.
- No sitting down while the course is "Hot".

- Prepare for the weather - take water, sunblock, rain gear and appropriate clothing onto the course. During your work assignment, that sunny day could turn into a cold rainy one.
- NEVER turn you back to an oncoming car. As soon as one car leaves your area, another will be on its way. A spinning car can travel quite far off the course.
- Watch the cones, not just the car. It's easy to start watching the car and not notice the cones flying through the air just behind it. Missing a penalty means a subsequent car will see the down (or out-of-place) cone and stop, requiring are-run.
- Don't bunch up. Spread the workers along the course so fewer workers can cover a greater distance.
- Be sure the Corner Captain sees your penalty signals. If not don't wait for them to see you. Re-set the cone and return to your "safe" position, and then, get the Corner Captain's attention.
- Move quickly to re-set downed cones, but, NEVER put yourself in a dangerous position with respect to the next car on the course. You will have only 25-30 seconds to reach a downed cone, re-set it and return to your '"safe" position. If in doubt leave the cone and remain well off the course until the next car passes.

Other Work Assignments

Besides comer working, there are a number of other work assignments that you may fill once you've gathered some experience. If you are interested in learning any of these jobs, contact the Chief of Workers, or an experienced worker, and they'll help you get started. Training for these positions is primarily "on the job."

These work assignments include:

- Announcer - The announcers report unofficial results in real time as the event unfolds, and make other announcements. A "radio' voice and a good command of the English language are helpful in this job.
- Early and late workers - These workers assist in setting up and tearing down the course and equipment Announcements will be made on the club's mail list prior to each event soliciting for early and late workers. The beauty of these assignments is that you do not have to complete a work assignment during the event.
- Gate - These workers ensure everyone who comes on site has signed an insurance waiver form. This seems like a trivial job, but mess it up, and it could mean we lose our ability to get insurance, which means we can't run any events!! Attention to detail is a must! Gate workers must be adult (18 years of age or older) club members.
- Grid - The grid master is another critical position. They ensure that a steady stream of cars is supplied to the starter. The grid master also needs to contend with multi-driver cars and cars that are granted re-runs for one reason or another, ensuring every driver has a fair and equal opportunity to take their allotted runs. Good organizational skills are a benefit here.
- Scorekeeper - This person maintains an unofficial scoreboard for competitors to reference during their runs. Another seemingly trivial job, that is oh so important to the competitors wanting to check on their standings against the competition.
- Starter - One of the more important positions is that of Starter. To keep the event moving, the Starter must keep the cars entering the course at an acceptable interval - usually around 25 to 30 seconds apart, while ensuring the course conditions are safe.
- Auditor - checks corner sheets against T&S penalty records to verify penalties were accurately assessed

Other "Specialty" Work Assignments
Certain other jobs are called 'Specialties' because they require special training, knowledge and/or experience. Specialty Chiefs are appointed to manage that specialty and the individuals who work it If you are interested in learning a specialty, contact the chief of that specialty. Specialty Chiefs are listed on the contacts page of the club's web site.

Specialty assignments include:

- Course Design
  The course designer is responsible for designing and setting up the course. This job requires both skill and talent as the best use of he lot must be made to ensure as fair a course as possible for all competitors (something for everybody) while maintaining course design safety standards.
- Tech Inspector
  The tech inspectors ensure your car and equipment meet minimum safety requirements, and checks your car number and class markings for compliance with the standards.
- Timing and Scoring (T&S)
  These folks run the timing equipment and record official times, penalties and DNFs. T&S is a place for people who can handle pressure, since cars will be crossing the finish line every 25-30 seconds!
- Safety
  Responsible for the safety of the event, Including the entire site, the course, the people and the cars. This job requires formal training and licensing by the SCCA National Office. Typically a minimum two years of experience, a high level of integrity and sense of responsibility, as well as good interpersonal skills are required for this position.
- Worker Assignments
  The Chief of Workers is responsible for making work assignments and ensuring adequate coverage of the critical work assignments.
- Registration
  Runs the Check-in table, collects entry fees and ensures all drivers are licensed. Also schedules and manages the gate workers up to first car off.*

A FINAL WORD
This document is by no means considered comprehensive as it is meant as an introduction only. There are driving techniques that have not been mentioned but are necessary if you are to improve. You will learn those through additional experience, discussions, and observation.

Several of the examples in this publication were borrowed from the excellent book by Henry A. Watts, "*Secrets of Soto Racing, Expert Techniques for Autocross & Time Trial*" which is available through any good bookstore or through the web.