Welcome to the Champaign County Sport Car Club's Pete Hetman Driving School. CCSCC is a car club for drivers. We do have monthly meetings at a local Champaign/Urbana restaurant, but, our purpose it to drive our cars. The 2 types of events the club puts on is Autocross and Rally. We'll only discuss Autocross (AutoX) in this guide.

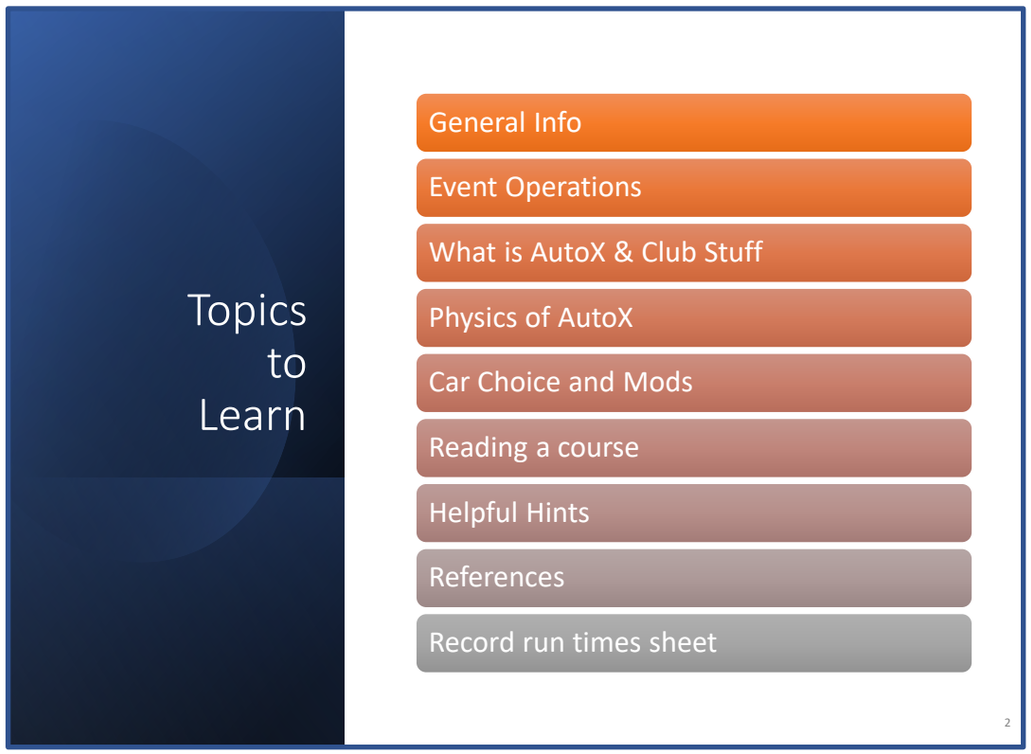
The club presents this school to help educate and train the new/new'ish autocrosser with basic information about the events and skill development during the driving part of the school.

The learning curve (pun intended) for a driver to be proficient at AutoX is steep. We're here to help you get up that curve faster and safer. You will be over-whelmed at times, but, that's a thing that happens with all new skill development and learning something as complex and difficult as AutoX.

So, please look over this guide……..there's lots of good stuff about the sport, events, and skill building.

The school is really 2 parts……Part 1 is you reading this guide. Part 2 is showing up to the school event, being coached while you drive, and learning how the events are run.

Part 2 is where you drive the course. You and your coach will start by making baseline timed runs. The last page of this guide has a sheet to record your times. During these runs the only input the instructor may provide is navigation. These runs will establish a benchmark for skill development. Following the base runs, the student and instructor will work together to develop basic autocross skills. By the end of the day most students will have had the equivalent of three to four events' worth of autocross driving experience. While the event is timed for instructor/student reference we do not rank the results, apply the index to compare classes, or publish results. At this event, the only "competition" is with yourself. The ultimate results are for you to improve your autocross driving skills.



This guide is divided into a number of sections for easier reading.

Something to note is that CCSCC does not “make up rules”. We use “a great body of knowledge” from the Sports Car Club of America (SCCA). That rule book is available as a PDF on the scca.com website under Solo. And, is available as a printed book from Amazon.com for $20.

Your coach will talk about rules and safety and such……all of those are rooted in the SCCA rulebook for Autocross (Solo). Pay attention and live by them if you’d like to continue with the sport. The Club sponsored events have no latitude for shenanigans and misbehaving…….you may get a warning or you may just be told to leave……so, don’t be that person.

Tech Inspection for your car is required. All clubs have a sticker of some sort to put on your car to indicate you’ve passed the inspection. Please don’t take it off. CCSCC has a tech sheet on the website and the link is typically emailed with event instructions. SCCA and CCSCC does a “self tech” with verification. So, it’s up to you to tech your car, write up the sheet, and someone at an event will verify it and you’ll get a sticker.

Your helmet will also need to be teched and stickered. The allowable helmets are listed on the scca.com website under Autocross.

What Is Autocross?

- Why do you want to autocross?

- What is autocross?

- What kind of car do you autocross?

Why AutoX? I'm sure there are lots of reasons. I enjoy it because I get to push myself and my car to some limits and just have some fun. No matter what your motivations are, it is one of the safer automobile sports available……notice I didn't say "safe". Because, driving cars can be dangerous, sometimes, things just get out of control. But, we'll talk about this as we progress thru this guide for AutoXers.

What is AutoX??

As defined by the SCCA Solo Rules, autocross is *"...a non-speed driving skill contest… These events are run on short courses that emphasize the driver's ability and the car's handling and agility"* rather than speed or power. (2025 Solo Rules I.1.4)

General comments:

- CCSCC history – May, 1957, 68th Anniversary
- How can we offer Autocrosses?
- Sites: treat them like we're guests….'Cause we are.
- Insurance:
  - Event
  - Individual's car
- SCCA Rules are used for events

Yes, the CCSCC club is 68 years old in 2025. The Board members hold a unique position to continue a long history of this club being a driver's club.

For the club to offer driving events, we need insurance and it's expensive. Also, the site we use for the driving, it's also expensive.

Something to be mindful of…….your "street insurance" for your car, does not cover bad things that happen when you are on course. The club's insurance is not to "fix your car" when it gets broke…….the club's insurance is for humans and site property. So, be mindful, you may need to pay for damage.

Sites, yes, treat them like a campground……..you bring it…..take it with you. There are some trash bags left around for trash. Please drain any bottles and cups, because, the Event Chair will need to take that bag somewhere to dump it…….let's not get them all wet with our left over drinks.

Go to the scca.com website and look under the Programs – Autocross – Autocross section for rules and helmet requirements and other info.

CCSCC is different from SCCA mainly from an affordability standpoint. The sport and events are quite similar. But, SCCA charges a "weekend membership" fee if you are not a national member. CCSCC has decided to build the insurance costs into the entry fees. If you join CCSCC, you will get discounts on weekend registrations.

Event Administration:

Drivers Divided into heats

- 2 heats (up to ~75 drivers): Run 1, Work 1, break in between

- 3 heats (75+ drivers): Run 1, Work 1, Rest 1

- 4 heats (100+ drivers, rare at CCSCC events): Run 2, Work 1, Rest 1

Run heat

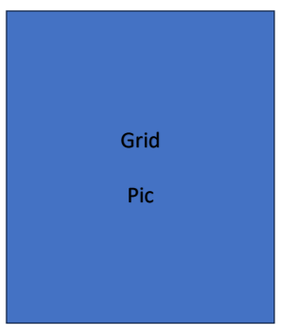
- Line up in grid – Return to same grid position between runs

- One area will be designated for 2 driver cars

- Typically, 6-8 runs (more if things go smoothly)

Work Heat

- Worker assignments -- We can't autocross without them



At the new site on the east side of the Rantoul Airport, the general event configuration is a permanent grid for 2 heats. Heat 1 cars are on the right as you come towards the Grid and Heat 2 cars are on the left.

If you are not driving, you should be working your assignment.

Note: no work, no trophy…….the trophies are pretty cool T-Shirts specially designed for each event.

Timing and scoring:

AXWare – Timing system used by CCSCC

- Online registration with Motor Sport Reg (motorsportreg.com)

- Allows Live timing/results on laptop on side of truck

- LED Display by Timing Truck & along Finish chute

Multiple Cars on course

- Uses a computer with written log

- Posting results

- Trophies, winners, & reporting results

The timing results are posted on the side of the truck in a “live” method. Ask someone to help you decode the display…….it makes for more fun during the day.

At the end of an event, the Final Standings, Raw Standings, and PAX Standings are posted on the website at ccsportscarclub.org under Autocross – Schedule and Results

At the current site, there will most likely be only 1 car on course at a time. The pavement is a bit too narrow to have 2 cars passing each other.

Safety Steward:(requires CCSCC certification)

- Focused only on safety of event

- Signs off on course safety

- Controls course “hot” vs “cold”

- Only observes when cars are running

- Run event alternating with other Safety Steward

Anyone who wants to serve as a CCSCC Safety Steward this year must be trained and certified by the CCSCC Safety Chair. (Robert Burkholder, 2025)

Email: safety@ccsportscarclub.org

Yes, safety, safety, safety……there are very few 2nd chances in outdoor automotive sports.

The Safety Steward is out there to keep the humans safe from damage as best they can. So, please listen to any instruction and directives from them. If you don’t, you may be told to leave the site.

Tech inspection is a part of the safety program at CCSCC. If you are interested in being a tech inspector, you’ll be safety trained as well.

Listen for an air horn and/or watch for waiving flags…….that means there’s a safety issue and you need to stop your car. More instruction will follow at that time depending on the nature of the safety event.

Waivers:

Ensures everyone on site has signed the insurance waiver

- Issues wrist bands to all on site

- Digital Waivers on phone

Keeps all forms for club records for 5 years

Works before event starts

- Controls Access for Site during Event

2nd most important job at the event (SS most important). Waiver process enables club to maintain insurance.

2024 brought new wristbands for annual waiver holders. A very nice silicon band with the club logo and year are now available. 2025 is a nice royal blue.

Other important jobs:

Starter:(the gate keeper)

- Communicates with Timing
- Releases cars to course
- Sets multiple car spacing

Tech:

- Safety inspection on cars
- Year Long Stickers on car and helmet

Pre-Starter:

- Releases car from Grid
- Performs check of helmets
- Verifies 2 driver car numbers
- Forward part of Grid

Grid:

- Releases Cars to Pre-Starter
- Alternates 2 driver cars
- “Sets the pace” for heat

Ask what needs doing…….the club is staffed by volunteers and it takes a village to put on an event.

Ask someone if they need help.

How to volunteer so it helps you run better?

1. Find Chief of Workers and ask what you can do
2. **Help clean up after the event**
3. Help set up the course (Friday afternoon about 3pm)
4. Volunteer to do day of pre-event tasks
   a. Unless low turnout you won't have to work during the event
5. Ask what tasks are difficult/time consuming & **pitch in**
6. **Club run by Volunteers**. If you see a better way to do something work with Autocross Chair (Mitchell Payne) to improve

Yup, just ask if you can help with anything. Learn lots of different jobs and be a valuable volunteer.

Event Registration:

- Use direct link through CCSCC website to MSReg
- Pre-registration online (required):

  - Pre-Reg saves (Lots) of time for Timing/Scoring

  - Saves you waiting in line (Spend more time walking the course)
- Car Number
- Car Year/Make/Model/Color
- Car Class – next slides, SCCA Rulebook

All registration and payments are now going thru MotorSportReg.com. There is no on-site registration and payment available. Please plan ahead and arrive on-site at 7:30’ish.

What Class is my car?

Website for Classification help…unofficial

https://www.scca-classifier.com/a/index.html

Class descriptions begin in Section 13 on page 74 of the 2025 Solo Rules book.

Car classes begin in Appendix A on page 185 of the 2025 Solo Rules book.

The following can be found on the SCCA website at:
https://www.scca.com/pages/introduction-to-autocross-classes

YouTube Video for a bit of assistance:
https://www.youtube.com/watch?v=Zj4EKpMej-I

Classing your car is kinda important…keep in mind that “novice” is not a car class. It’s a special group we put new drivers in. So, you can have others to drive with that have similar skill sets and experience.

Cars and vehicles are classed in AutoX/Solo according to modifications and potential. Each category has a set of allowed modifications and then the cars are divided into classes by ability. After all, it wouldn’t be fair to have an Italian exotic against an economy car.

Street Category (Super Street and A Street to H Street)
Classes in the “Street” Category have the most restrictive rules which keep competitors from feeling the need to make extensive modifications to their cars. “Racing” tire compounds are not allowed and only a few parts and changes are allowed to the car beyond what it had on the showroom floor.

Street Touring® Category (Super Street Touring to G Street Touring)
Street Touring classes are the next level up from the Street classes and although they still require true "street" tires, more bolt-on modifications are allowed to make the cars handle better and get through the course quicker.

Street Prepared Category (Super Street Prepared and C Street Prepared to F Street Prepared)
This set of classes is where the level of commitment to modifying your vehicle really starts kicking in. Tires must be DOT-approved but sticky “racing”-style competition tires (sometimes called "R-comps") are allowed. This is the first set of classes where competitors can modify some engine externals (induction, exhaust, etc.) and even swap parts between some trim levels.

Street Modified Category (Super Street Modified, Street Modified, and Street Modified Front-Wheel-Drive)
Want to add a turbo? Do an engine swap? Install a cam? A wing for some aero-grip? This set of classes might grab your interest. Tires must still be DOT-approved but R-Compounds are allowed.

Prepared Category (X Prepared and C Prepared to F Prepared)
This is a step up from the “Street” set of classes and is based off wheel-to-wheel road racing preparation for production-based cars. Prepared allows true racing slicks (non-DOT tires) and "guttting" of the interior are allowed. Rules for this category can get more intricate based on what car and class you’re running, so it pays to familiarize yourself with the rules when building a specific car for its Prepared-level class. Convertibles are required to have a bolted-on factory hardtop and/or a roll bar.

Modified Category (A-Modified to F-Modified)
The highest set of allowances, these classes have a place for cars built specifically for autocross, production-based cars with the most extreme modifications, and road racing formula cars and sports racers. If your car doesn’t have a good place before this, it is sure to find a place here.

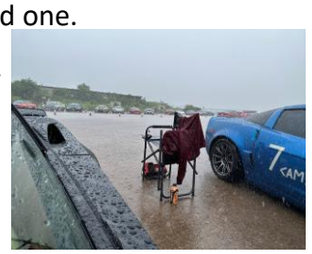
Karts, Classic American Muscle, Xtreme Street, Club Spec etc.
There are some classes which don’t fit the previous sets, but play an important part of automotive and racing enthusiasts lifestyle. SCCA has classes for karts, Classic American Muscle (CAM), Vintage cars, and College-engineering Formula SAE.

What you need to bring to an event:

- Helmets (Snell 2015 or newer Rating -- M or SA)

  –We do have loaner helmets

  –If you're going to buy, get the newest you can find/afford (Snell 2020 or later), $150 will get you a good one.



- Air Gauge -- CCSCC provides an air compressor

- Be prepared for the weather

- No Alcoholic beverages, illegal drugs…. **ever**

- Smoking allowed only in the pits, not on course or in the grid

- No firearms (all of our sites ban them)

- Notebook to keep tire pressures and other helpful hints

This is an outdoor sport. The event will continue in the event of rain or snow. The only thing that stops the event is **lightning**…….and that's only for 30 minutes.

The helmet specs are very specific. SCCA website has a list of allowable helmets: https://www.scca.com/downloads/71097-2024-helmet-certs-solo/download

The club will provide water in disposable bottles……but, bring your own and protect yourself from the sun. It does get hot on course in July and August.

Before You Run:

Tech inspections

Self-classification

Year long tech & waiver on file (card)
- Sticker car/helmet, digital waiver

– If you have Year Long Tech you are EXPECTED to do everything tech includes before each event

– You and Your instructor will tech your car with you before you run at the school.

The sticker is the club logo with the year below it……that sticker needs to be on your car and your helmet before you are allowed to drive. Ensure the sticker is on the left side of your helmet. The grid worker and starter will need to check it. And, having it on the left side makes that much easier.

Don't take the sticker off at the end of the day……it's pretty durable and if you return, it will prove you've been teched. Otherwise, you'll need to go thru Tech Inspection again and get another sticker.

Before You Run:

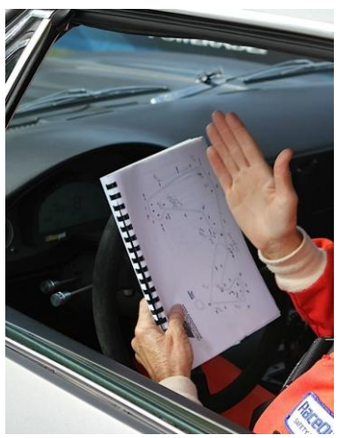
Course Walk

Happens before Drivers' Meeting and after Tech/Waiver/Check-In

Walk the Course and learn where it's going

Walk the Course again talking to friends about the course

Walk the Course a 3rd time and make notes (Business Walk)



General order of activities at an event: Waiver, Check-In, Tech Inspection, Course Walking, Drivers' Meeting, then Drive/Work.

As a new AutoXer, you'll have a tendance to have a group of friends and socialize as you wander around the course. You'll think you've "walked the course", when in fact…..you just had a party with friends on a stroll thru a runway. Sure, this may be fine for the first walk….just getting a "lay of the land" and where the course goes in a general sense.

Take a 2nd walk and start imagining you are driving your car. Where will you turn, where will the car be placed in a turn, when will you brake, when will you accelerate, etc.? This is hard to do when you are talking with friends about tonight's plans. So, talk with them about "how to drive the course".

3rd walk is the "Business Walk", this is where it's you, with your notes, and you are in your head driving the course and that's it. That's it. No talking with friends, just you imagining you are driving the course.

Many clubs have a "novice walk" just before the Drivers' Mtg. Usually it's timed so when the novice walkers get back to the "truck", the meeting begins.

Yes, make notes……take a notepad with you and draw the course. Note where you do things and how you want to attack the elements.

Have a plan, make a plan, planning is important. But, in the words of a famous general…….Plans never survive the first engagement with the enemy. Be flexible, ask questions, and change what you do.

Before You Run:

The drivers' meeting:

Held just before the start of the first heat. About 8:45am

Everyone is required to attend. Pay Attention!
(Not socializing time!)

Come to the drivers' meeting prepared to immediately go to your work assignment in case you are working the first heat.

If you are running the first heat you should be prepared to get your car and put it in line immediately.

Prep your car **before** driver's meeting.

Attending the Drivers' Meeting is **NON-OPTIONAL…….MANDATORY**…….and, you need to be quiet and listen to what's being said.

If you are a novice, many times you will be asked to come to the front of the group. This is not to embarrass you. This is to introduce your face to the other drivers and maybe they can help you during the day.

The meeting usually lasts **15 minutes**…….great time to ask questions.

Scoring:

Times -- what they mean

- Raw Time (FTD) -- Indexed Time (FTDI or PAX)

- Score for places in class – 1st = 10, 2nd = 9, 3rd = 8, etc.

Cones:

– Pointers

– Normal - +2 seconds

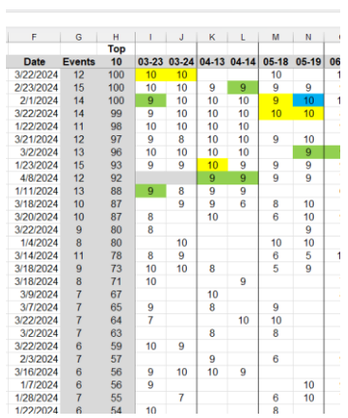
– Special (Start / Finish, Defined as special, =DNF)

Fun Runs, at Event Chair's discretion:

- May occur after normal event - $1 per run

- Any Registered Car & Driver

- All passengers must have Seatbelts and Helmets



Date	Events	Top 10	03-23	03-24	04-13	04-14	05-18	05-19	06
3/22/2024	12	100	10	10			10		
2/23/2024	15	100	10	10	9	9	9	9	
2/1/2024	14	100	9	10	10	10	9	10	
3/22/2024	14	99	9	10	10	10	10	10	
1/22/2024	11	98	10	10	10	10			
3/21/2024	12	97	9	8	10	10	9	10	
3/2/2024	13	96	10	10	10	10		9	
1/23/2024	15	93	9	9	10	9	9	9	
4/8/2024	12	92			9	9	9	9	
1/11/2024	13	88	9	8	9	9			
3/18/2024	10	87		9	9	6	8	10	
3/20/2024	10	87	8		10		6	10	
3/22/2024	9	80	8					9	
1/4/2024	8	80		10			10	10	
3/14/2024	11	78	8	9			6	5	
3/18/2024	9	73	10	10	8		5	9	
3/18/2024	8	71	10			9			
3/9/2024	7	67			10				
3/7/2024	7	65	9		8		9		
3/22/2024	7	64	7			10	10		
3/2/2024	7	63			8		8		
3/22/2024	6	59	10	9					
2/3/2024	7	57			9		6		
3/16/2024	6	56	9	10	10	9			
1/7/2024	6	56	9					10	
1/28/2024	7	55		7			6	10	
1/22/2024	6	54	10				8		

FTD is Fastest Time of the Day

FTDI is Fastest Time of the Day – Indexed

Fun Runs are not part of the scored runs. They are just for fun……maybe someone will let you drive their car. Or, let a fast driver drive your car and get some quick education.

Check the CCSCC website if you are interested in your points standings. Only club members are eligible for end-of-year trophies.

Comparing across classes -- the Index

2025 **PAX**/RTP Index – https://www.solotime.info/pax/

Developed by Rick Ruth used by SCCA and CCSCC to "compare" classes

SS	0.836	SSP	0.857	XP	0.890	AM	1.000
AS	0.826	ASP	0.851	BP	0.874	BM	0.978
BS	0.819	BSP	0.855	CP	0.863	CM	0.899
CS	0.813	CSP	0.859	DP	0.865	DM	0.906
DS	0.811	DSP	0.847	EP	0.858	EM	0.916
ES	0.790	ESP	0.840	FP	0.877	FM	0.917
FS	0.817	FSP	0.831			FSAE	0.980
GS	0.794			HCR	0.814		
HS	0.784	CAM-T	0.821			KM	0.937
HCS	0.789	CAM-C	0.825	SMF	0.850		
		CAM-S	0.844	SM	0.868		
SSC	0.809			SSM	0.878		
		XA	0.846				
SST	0.837	XB	0.848	CSM	0.800		
AST(STR)	0.834	XU	0.869	CSX	0.812		
BST(STU)	0.833						
CST	0.830	EVX	0.839				
DST(STX)	0.818						
EST(STS)	0.815						
GST(STH)	0.810						

Visit the website periodically.

Rick Ruth updates the Index#'s periodically…….and, expect to start each new season with new Index#'s

PAX, The Index.....So, how does it work?

Dean runs a 50.000 in his SS Corvette:

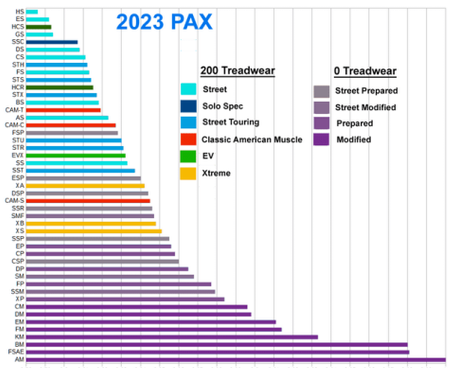
- 50.000 raw * SS Index (0.836) = **41.800**

Andrew, in his EST Miata runs a 47.500 raw:

- His index time is 47.500 * 0.815 = **38.712**

Dan runs a 45.250 in a DM Midget:

- His index time is 45.250 * 0.904 = **40.906**



So, Dan gets FTD. Andrew gets FTDI. And, Dean gets to have fun and clap for the trophies.

PAX is used as a way to compare all drivers to other drivers at the event. Think of it a bit like a “golf handicap”.

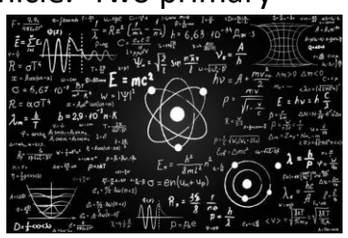
PAX doesn’t compare “car to car”, it’s more about comparing “driver to driver”.

If you’re interested a PAX of 1.000 is assigned to the AM (A Mod) cars. Those are supposed to be the “perfect” AutoX car.

Physics of Autocrossing:

The study of a vehicle in motion is a very complicated subject. Many books and countless studies have been written to attempt to define a vehicle in motion. Despite this complexity a basic understanding of the physics involved can be a help to any driver.

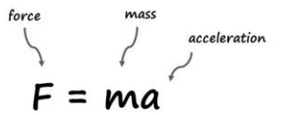
Physics defines performance of a vehicle. Two primary laws of motion define vehicle dynamic performance



- Force
- Inertia/Energy
- https://www.youtube.com/watch?v=MwrUz1WI5GY

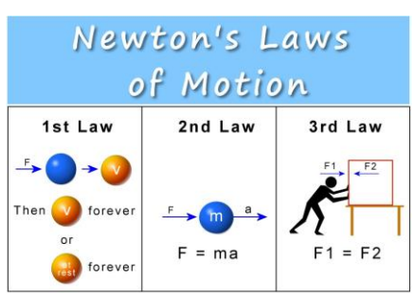
Watch the YouTube video…..it's only 16 minutes long and very, very informative……..very informative. I learn something new each time I watch it.

Linear Force:

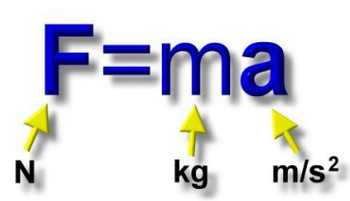


F = m*a
(F=Force, m=mass, a=acceleration)

- **Force** is Energy being Placed on the Mass (Throttle, Brakes, Turning)
- **Mass** is weight of the vehicle
- Acceleration is the **Rate of change** of Motion



(It's what we feel and what makes AutoX fun)



No additional notes here.

Force:

- Centripetal Force (Turning/Lateral force)
- **F = mv²/r** (m=mass, v=speed, r=radius of turn)
- More Mass (kg) requires more Force
- More Velocity (meters/sec) requires more Force
- Smaller Radius (meters) turn requires more Force

Cornering "G's" nearly entirely independent of Vehicle Mass.

Combine above equations **m*a = F = m*v²/r**

mass cancels out…… leaving **a = v²/r**

more on acceleration later.

Centripetal Force

$$F_c = \frac{mv^2}{r}$$

Isaac Newton, 1684

Think about how this works in curves/turns.

Faster requires more force to change direction.

Tighter turns require more force to change direction……also, more grip. You'll see as we look at tires that "more grip" really is more force from the tires.

Heavier car requires more force to change directions.

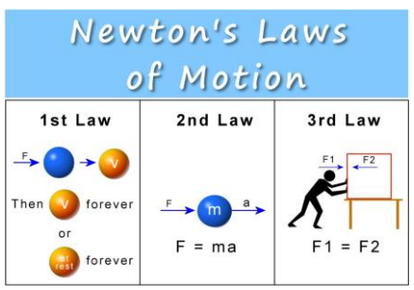
Inertia/energy:

A vehicle in motion wants to stay in motion. Its current motion has an energy associated with it that must be overcome to result in a change in motion (Velocity or Direction).

Linear inertia: **i = mv**

More mass -- greater inertia

More velocity – greater inertia



Ultimately this means more force to overcome inertia.

Inertia/energy:

Rotational: all parts of the car have inertia. Rotating the car requires changing the direction of **all of these parts**.

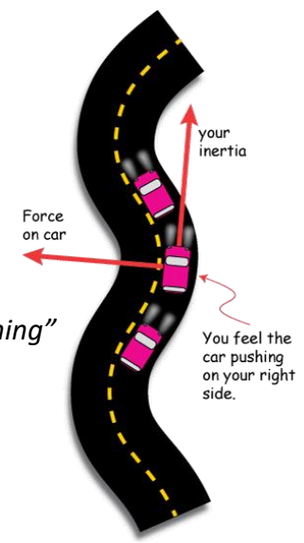
Mass towards center of car
- It turns easily whether you want it to or not, "twitchy" feel.

Mass at ends of car
- It resists changing its turning state. More stable 'feel'.

Rotational Inertia is not "turning" it is "State of Turning"

If not turning -- it resists turning

If turning -- it resists going straight



No additional comments.

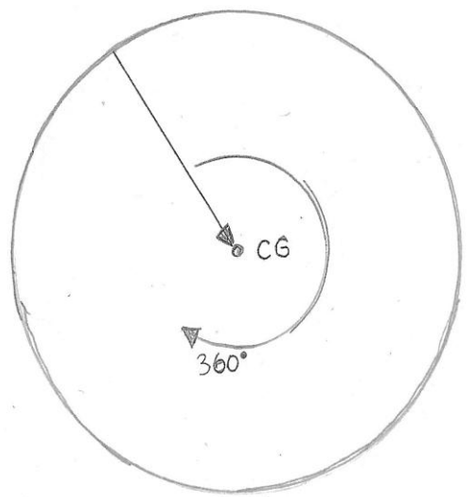
Circle of Traction:

A vehicle's ability to accelerate is determined by the total force available to move it.

Forces (and accelerations) are vectors meaning they have both Magnitude and Direction.

The magnitude of this force is primarily a function of **tire** grip level and this force can be applied to the vehicle center of gravity (CG) from any direction.

-The result is the Circle of Traction.



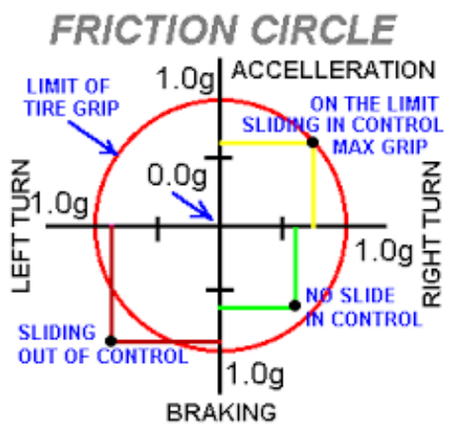
Begin thinking about the "circle of traction" and how "weight transfer" effects the performance of your car.

Circle of Traction/Friction:

If we draw an axis on this chart showing lateral (Left-Right) and longitudinal (Forward-Backward) forces you can see that at any point on the circle the force on the CG is a result of a lateral and longitudinal force components.

This means that there are times where you can be cornering and still have traction available for braking/accel.

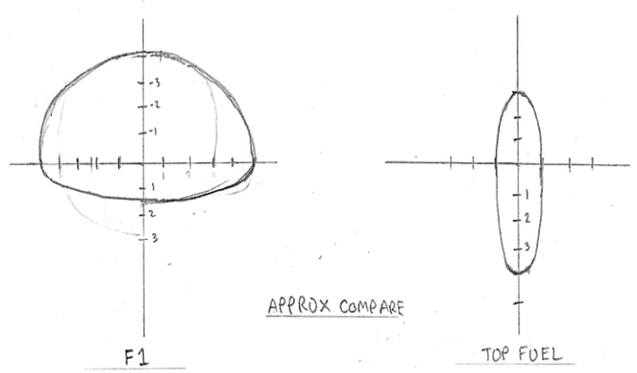
YouTube: https://www.youtube.com/watch?v=JjCcFsGLpaM



YouTube link is the Engineering Explained guy talking about the math. Check out his videos, he does a great job of explaining concepts.

Circle of Traction: Not always a Circle:

- More frequently this chart is expressed as “G” loading.
- This is achieved by converting the Force into acceleration and dividing by acceleration due to gravity.
- In the real world the shape of the “circle” may be irregular due to vehicle characteristics however the effect is the same.

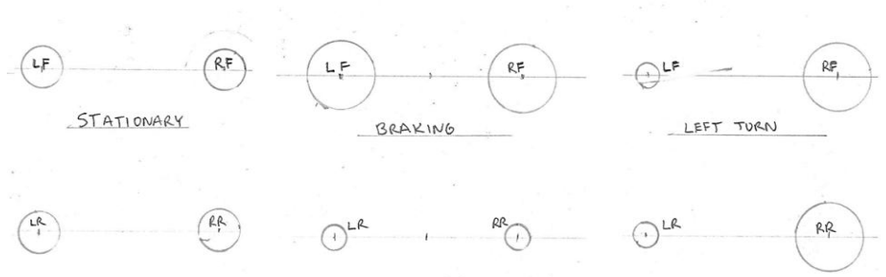


Do a Google search for “Circle of Traction” or a YouTube search for the same term.

There’s lots and lots of great visuals to get a better understanding of how tires grip and how the grip changes.

Dynamic Motion: 4 Tires Contribute Force:

A car experiences the result of the forces of all 4 tires.
–That means that each of the 4 tires provide a force that acts on the car.
–We can visualize this as 4 small circles of traction representing each tire.
- The diameter (Total available force) at each tire is determined by the dynamic situation that that tire is experiencing.
- Vehicle dynamics is the interaction of these forces and the resultant force on the vehicle.



These diagrams show how weight is transferred between the 4 tires during Braking and a Left turn. The opposite occurs under Acceleration and a Right turn.

What does all this mean to the AutoXer?

The more accomplished driver is always attempting to operate the car at it's limits. The "limit" is the outer edge of the performance envelope and is directly related to the ability of the tires to grip the surface. If you try to go beyond those limits, you get wheelspin or slides or skids or "no traction". Exceed the limit in braking and you lock a wheel. In cornering, exceeding the limit will result in understeer, oversteer, or a vehicle spin out.

A tire has only so much grip available. That grip can be used for acceleration, braking, or cornering in any given combination as long as the tires' ultimate ability to grip the surface is not exceeded. If you are braking at 100% and attempt to turn, you will exceed the tire's limits and either skid or slide.

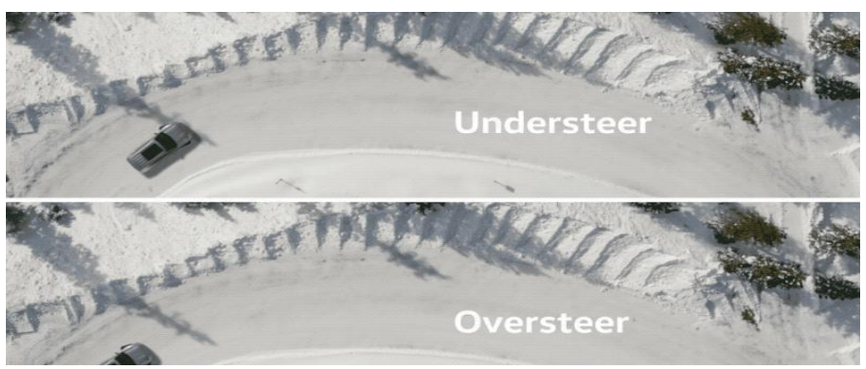
Thus, when driving near the limits of the tire; acceleration, braking, and cornering forces must be kept in balance.

Tire Behavior: Grip as function of Dynamics

Tires generate force as a function of the coefficient of friction multiplied by the normal force (Weight) on the tire.

If only it was this simple.

Since we are moving and applying dynamic loading to the tire as well as changing its path of travel it is important to understand how the tire responds over variable inputs.



Understeer – car goes straight…….not enough brake before turn

Oversteer – car spins as rear end comes around……too much throttle in turn

That's the thing……."dynamic forces" on the tire change the way it behaves. Dynamic forces are always being exerted on the tires when you have the car in motion.

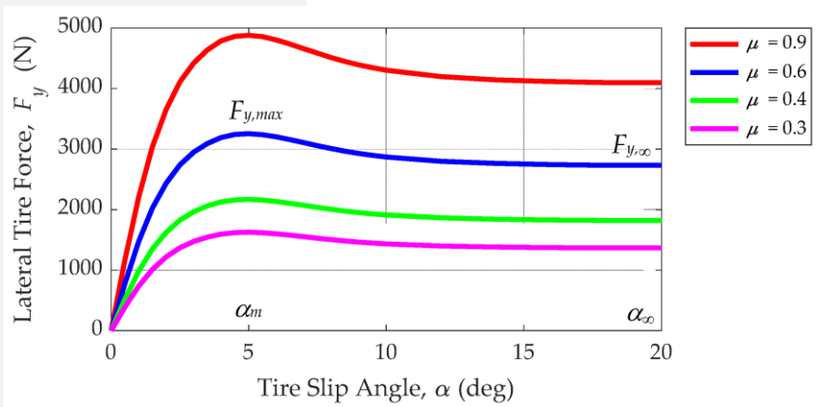
Tire Behavior and Vehicle Weight

As weight is increased on a tire the coefficient of friction decreases slightly.

This results in a force that does not increase linearly with weight increases.

Weight is transferred during dynamic motion.

Due to tire behavior this ALWAYS decreases total available grip.



Adding a bit of weight to the tire increases its ability to grip the surface…….but, to a point. Past that point …….. grip decreases.

This leads to the idea that an AutoXer is a “weight manager”. As a driver, you will manage the weight of the car on the tires to maximize grip in the desired directions. So, acceleration will push weight to the rear and allow more acceleration to occur. Pushing on the brakes just before a turn will push weight towards the front of the car and allow the front tires to grip more.

Tire Behavior: Slip Angle

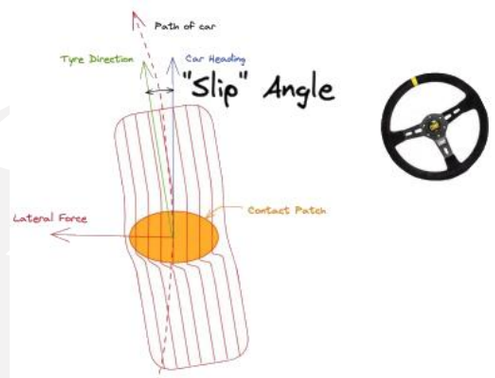
The contact patch of a tire is in stationary contact with the ground even while the vehicle is in motion. Expect the coefficient of friction to be highest when this is true.

With tires it's not.

Tire grip is highest when they are sliding **a little bit** relative to the ground.

This is known as **slip angle** and is most easily visualized with a turning tire as the angle between the tire centerline and the path of travel.

It also applies to Acceleration and Braking

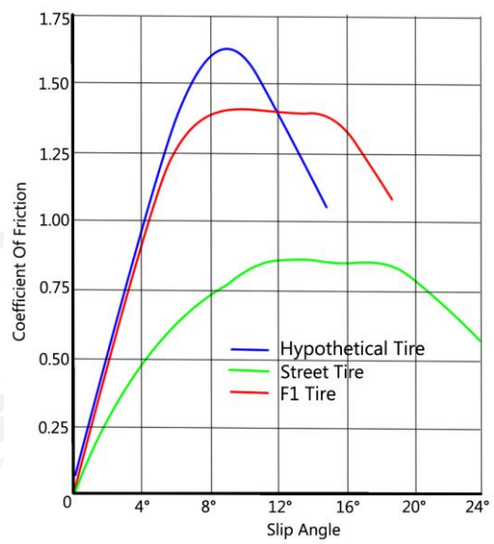


Read the words and look at the picture.

Notice how the center part of the tire (contact patch) is stuck to the surface and the other part of the tire is "bent" in the direction you are pointing the steering wheel.

Tire Behavior: Slip Angle

What happens before and after this peak and how wide this peak is are important characteristics of tires to understand.



The “peak” and width of the peak is different depending on the characteristics of the tire.

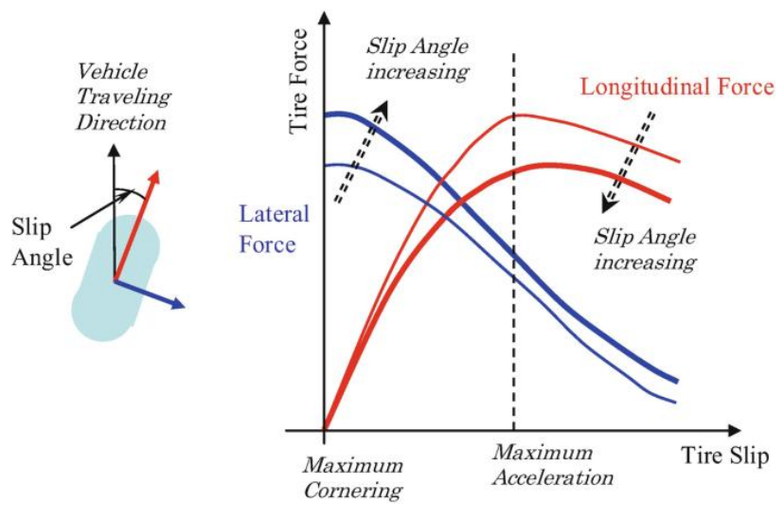
Note how “wide” the peak of a street tire is. That makes the tire more forgiving of mistakes by the driver and generally leads to fewer “bad things” happening. Also, note how high the slip angle is on a street tire. Again, this tire would be more forgiving of driver mistakes and be an “easier” tire to drive.

However, the wide peak of a street tire does NOT lend itself to a good AutoX tire.

A good AutoX tire will have a lower tread wear rating. Think something in the 200-250 range or 200TW. A 200TW tire’s peak and width will be between the street tire and the F1 tire. A 200TW tire is a good “1st modification” to make to your car. You’ll be amazed at how “only tires” will change the car and your ability to get around the course.

Also, 200TW is as low as you can go in the “street” classes. If your tire is rated lower, you’ll be put into “modified” or “race tire” classes.

Tire Behavior: A different view



Another way to look at the tire performance in a curve/turn.

Note the “maximum acceleration” is a bit past the peak of the slip angle performance curve……just a bit past.

2nd note: if you go too far past the slip angle peak…….you change sports and begin Drifting**. AutoX is not Drifting**…….they are different sports.

What does all this mean?

This is a simplification of the concepts involved.

The reality of what goes on is complicated by:

- Suspension geometry
- Spring rates
- Chassis dynamics
- Alignment
- Temperature
- Surface conditions, and so on.

Despite this we can take away a few things from the idealized view.

One of the coolest things about being a driver……..is that you can train your body and brain to take all of this input, make decisions, and create actions that maximizes your car’s ability to navigate the course.

Physics Takeaways

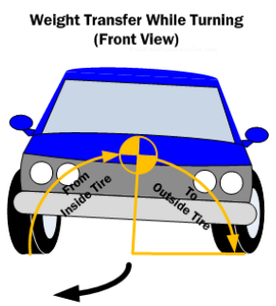
Smooth inputs

- Vehicle dynamics are all about transitioning between different forces. Being smooth in your inputs makes it easier to feel what is going on and less likely to “overdrive” the car.

- It is very difficult to throw the car into a corner and expect that you will arrive at precisely the correct combination of slip angle and cornering force that you require for the line you are on.

Drive what you have

- Certain behaviors are characteristics of your vehicle and/or of your tires.
- Learn to exploit the **full traction circle** for your vehicle.
- Exploiting the edge of traction is a more valuable skill than making the circle bigger.



AutoX is very much a “driver training” sport and not a “better car” sport.

Drive what you have and learn to maximize it’s potential. You’ll be amazed a what a “regular car” is capable of with proper driver skills.

Physics Takeaways

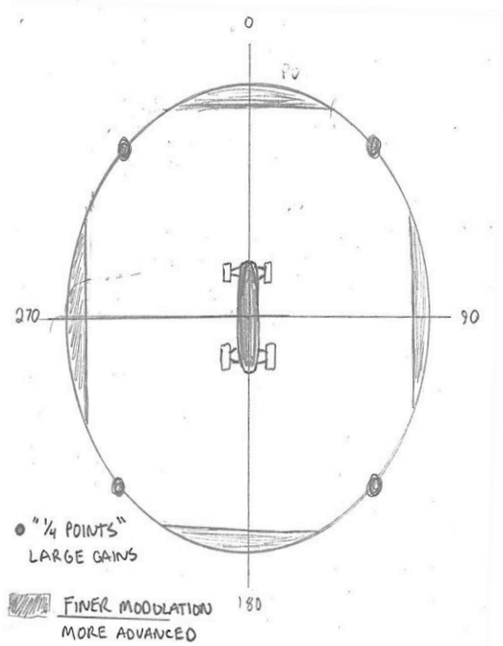
Feel the Grip

Learn how to feel the tires as they approach and exceed the peak slip angle.

Work on the ¼ points of the traction circle first. The gains here are substantial.

Finer modulation of Lateral and Longitudinal grip (Trail braking, Mid-corner throttle application) are much reduced because of the limited force available at the pure lateral or pure longitudinal points on the circle

Hear the tires…..they will talk to you



Yes, the tires will talk to you. They will make “good noises” and “bad noises”.

Generally speaking, a high-pitched squeak is “good”.

As that sound becomes a lower pitched “growl”, that’s bad……you are over driving your tires and loosing traction. That costs you time around the course.

Physics Takeaways

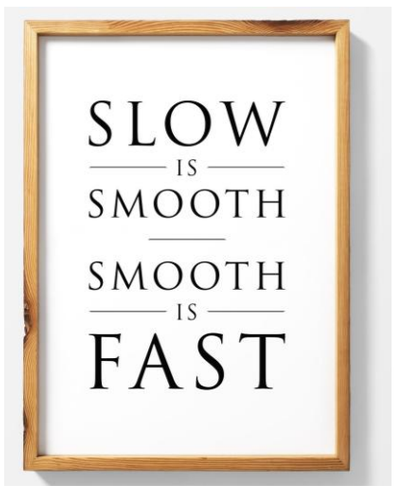
Slow is Fast

For the beginning driver (and most advanced ones) it is faster to be approaching the limit from within it.

The line around the cones should be such that there is no traction margin.

Once you have gone too fast into a corner you're done - it is simple physics, you must slow down to get back on the racing line.

“Feeling” slow is fast…..smoother transitions



Lot’s of folks say “slow is fast”……..it should be “feeling like it’s a slow run……is actually faster than a jerky fast run”. “Slow”, in this context, is the feeling of smooth transitions. Smooth turns into/out of the corner, smooth braking, and smooth acceleration. “Slow is fast” should actually be “Smooth is fast”.

As a newer AutoXer, it is better for learning and skill development to approach the “limits” of your car, tires, and yourself from “inside” the limits.

The option is to overdrive and over do and “just fail”. Overdriving doesn’t teach you much……..other than “don’t do that”.

So, approach your limits from within the limits and push those limits a bit at a time……..then you begin expanding your limits.

Choosing a car to autocross:

- What do you need the car for?
  - Family/Daily Driver (Street Classes)
  - Fun on the street, Fun to AutoX (ST & CAM classes)
  - Multi Use, Road Rally, Rally Cross (Street/ST)
  - Dedicated autocross car (SP, Prepared, Modified)
  - Road Race Car (All SCCA RR cars have a class in AutoX)
- What do you want to run for
  - FTD (Modified Classes, Kart)
  - Class win (look at national results and buy that car)
  - Against yourself: Buy anything, modify how you want, keep it safe and passing tech, and have fun

These are hard questions……but, very personal ones. There are lots of cars on the market and people like different things. Long time AutoXers have changed cars “just because” they’d like a different platform or driving experience.

Easy answer to this is “run what ya brung”……..or, drive the vehicle you have and work on “driver skills” then decide to modify or change cars.

Car set up

Tire pressure

- Reading tires

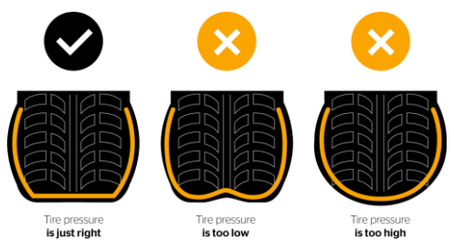
- White shoe polish or window chalk

How pressure affects handling

- More traction -- more tire on ground

- Increase pressure, Decrease Grip

- Lower Pressure, Increase Grip….to a point



Cost, Increase wear, decrease feel

How much pressure?

- Depends on tires, type of car, type of surface, front or rear of car

- Good starting point is 5 psi over mfr recommended for your car.

Tire pressure is a “make it” or “break it” kind of thing. As a new AutoXer, add more air to protect the tires from rolling over too far. Then as you gain skill, start looking for the “sweet spot” of air pressure, tire brands/style, and driving style. Different tires will favor different driving styles. Talk with experienced drivers to get a sense of their style and preferred tires.

“Chalk on the shoulder” is a fantastic method for checking air pressures against driving style and course configuration. You can grab those chalk bits or grease pens at your local Lowe’s, Home Depot, Menards, and, etc. They are useful to have. The technique will help you to build “intuition” as to how the combination of driving style/tire/course works and you could begin predicting how things work at a new course, site, event, etc.

Car set up: Modifications

What to take out before your run -- reduce weight (notes here)

Alignment

- Have a competent shop (or yourself) do a “performance” alignment
- Marque specific forums are good source for alignment specs for your car
- Ask CCSCC drivers who does their alignment and what specs they run

Tuning – Cold Air, Cat-Back Exhaust, sway bars, coil overs, etc.

The honor system -- and self-classification

Seatbelts & Harnesses

Note: some make sense……

First thing first……bring your car, air up the tires, and DRIVE it. Learn the sport and your car……then make changes.

Get some good sticky tires for AutoX as your first modification. Good tires will change the behavior of your car more than almost any other modification…..start here.

After tires, it’s where you want to put your $$$. It also depends on your car and how it comes from the factory. But, alignment, brake pads, maybe sway bar would be some “next” things to look at.

Note: Cold Air Intake on a stock motor usually doesn’t do much more than change the sound. However, it will bump you out of “street” or “stock” classes. Then you move into a class where more $$ is required to be more successful.

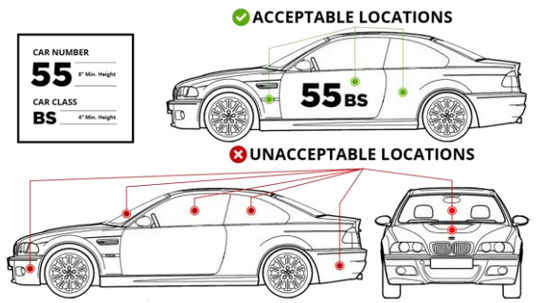
Check the rules for the limits of modifications in each category of classes before you run out and buy parts. Also, **Nitrous is NOT allowed**.

Personal note: I thought I knew “better” than my coaches. I had a factory Infiniti G37S and for the first 2 seasons I’d make modifications that changed the car for every event. I realized my mistakes with my 2nd AutoX car and took the approach to “drive the car as is” for a few events, then Tires, then alignment, then sway bar, then brakes, then…… I was much more successful in learning and campaigning the 2nd car than my 1st. So, listen to the “old folks” and your coaches……..it could save you lots of $$ and frustration.

Car set up:

Numbers and class

- Readable
- Unique per car
- Both sides
- Year long numbers



How much gas to run?

Cameras – must be “connected” physically to car

Car Numbers – CCSCC uses unique car numbers at each event. If you sign up to the event early enough, you can kinda pick your number. The club reserves 1-10 for the previous season Top 10 drivers. So, you can’t have any of those.

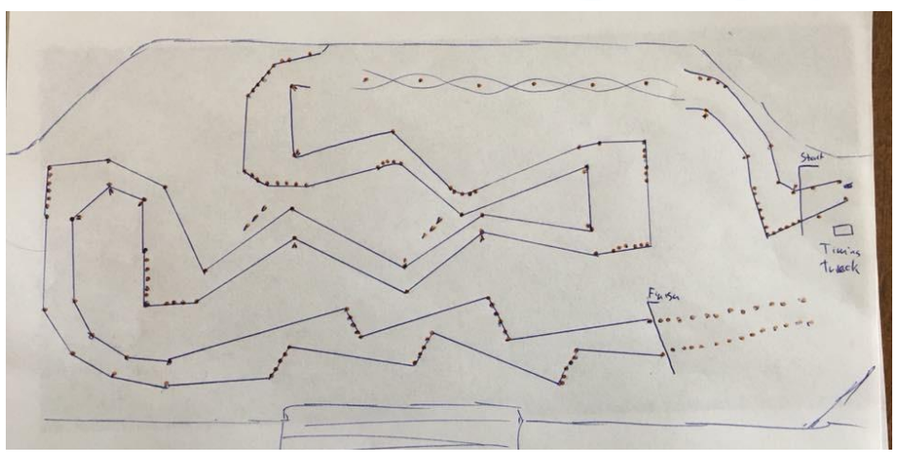
Contrasting number colors on your painted car. Blue Tape on white car…..awesome. Green Tape on Yellow Car…….not so awesome. Go to your local big box store and get some painter’s tape in a contrasting color to your car……the tape comes in a rainbow of colors.

Don’t put the numbers on your windows……..it’s painter’s tape…..put it on your doors……both sides of the car on the doors.

How much gas to have in your car??? As a newer AutoXer, I’d suggest a fuller tank than an emptier tank. Then, you just don’t need to worry about the gas level or running out. As a note, I typically fill up, drive to Rantoul (about an hour) and then drive the course. So, typically about ¾ tank is what I have when I’m driving on course.

Cameras – yeah….lots of folks want to record the excitement of their driving and share it with friends and family. 100% with you here, but, do it safely. The only cameras allowed are those ATTACHED to the vehicle. Also, those new “mouth held” cameras have been disallowed. So, find a way to suction cup mount the cameras or VHB to the windshield, etc. You **CAN NOT have your passenger hold** a camera and video your run……NOT ALLOWED. Plan ahead for the mounting.

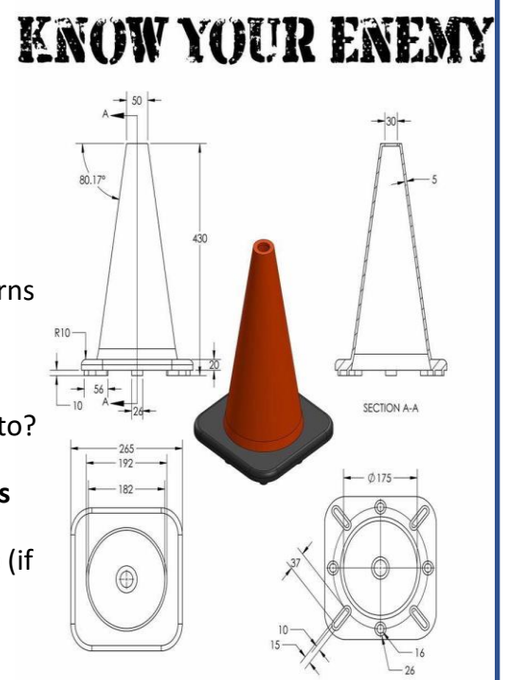
Reading and Understanding The Course



A diagram of a course. This diagram was created by the Event Chair to help folks setup the course.

Setup is typically on Friday afternoons about 3pm. Best part is you get a preview of the course. You don’t get to drive it, but, you can walk it and study it.

Walking the course:



What should you be looking for (cones)

- Optional Elements
- Increasing / Decreasing slaloms
- Increasing / Decreasing Radius turns
- What are the distances?
- Who to walk with / who to listen to?
- How many times? **>2 & 1 business**

Before you walk, review the course map (if posted) or make your own

Pay attention, don't shoot the breeze

Ask your instructor/coach about walking the course. Everyone does it a bit different.

Driving instruction

What and where you should be looking (eyes, hands, car)

Driver location (hands & feet)

Taking off from the starting line

- Go through the course in your mind while waiting
- Start in a reasonable time, but when you are ready
- Look ahead……and then, look ahead

Shifting gears…….Manual or Auto

Upshifting
- Release gas, press clutch, shift to higher gear, release clutch, and get back into gas…..but gas is not an ON/OFF switch. Roll into it.

Downshifting
Tricky to keep car from getting upset. Best when in braking zones.

Clutching
Confident and don't "pop" it. And, don't use it to control speed…that what the gas/brake is for.

Keep both hands on the wheel except to shift (9 & 3)

In a manual shift car……you only take your hand off the wheel to shift…….DON'T leave it on the shifter when driving. You lose the ability to control the car.

AutoX is generally a 2nd gear driving experience. Launch the car, shift to 2nd, and forget about the shifter…..just drive the course.

An auto trans may perform better if you put it in manual mode……you'll need to use the same basic rules as a manual……but, without the clutch.

Course Features: Slalom

Pointers, indicates which way to take the slalom

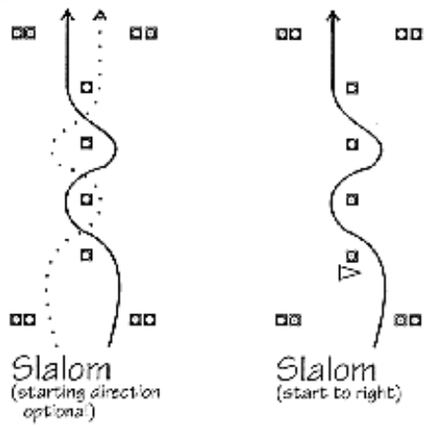
Pay attention to spacing. Offsets effectively shorten or lengthen spacing

“Get behind” the first cone

For longer slaloms 2nd-3rd cone gap is the important one watch the 3rd cone for gauging entry (See graphic)

Off course if you don’t alternate sides/**On course** if you hit the cone

Pointer cone ----------→



Your coach/instructor will talk more about this topic.

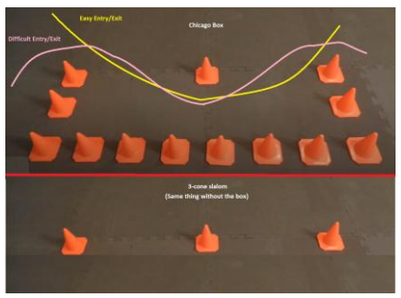
Course Features: Other Slaloms

Chicago box

- Really a 3-cone slalom with “distractor cones”

- Enter “behind” entry cone, look through exit, drive out

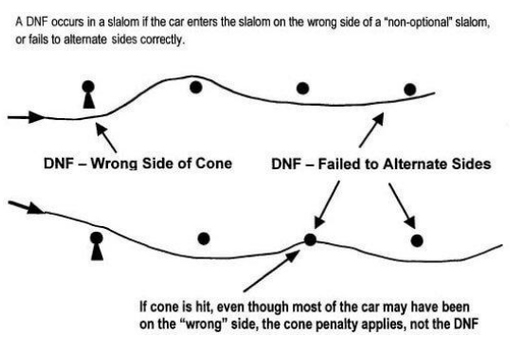
- Try to enter to reduce turn in so it’s just a 1 turn feature (don’t make the 1st cone a slalom)



Forced/Required Slalom

- Same as normal except enter opposite pointer

- Pointer doesn’t count if you hit it



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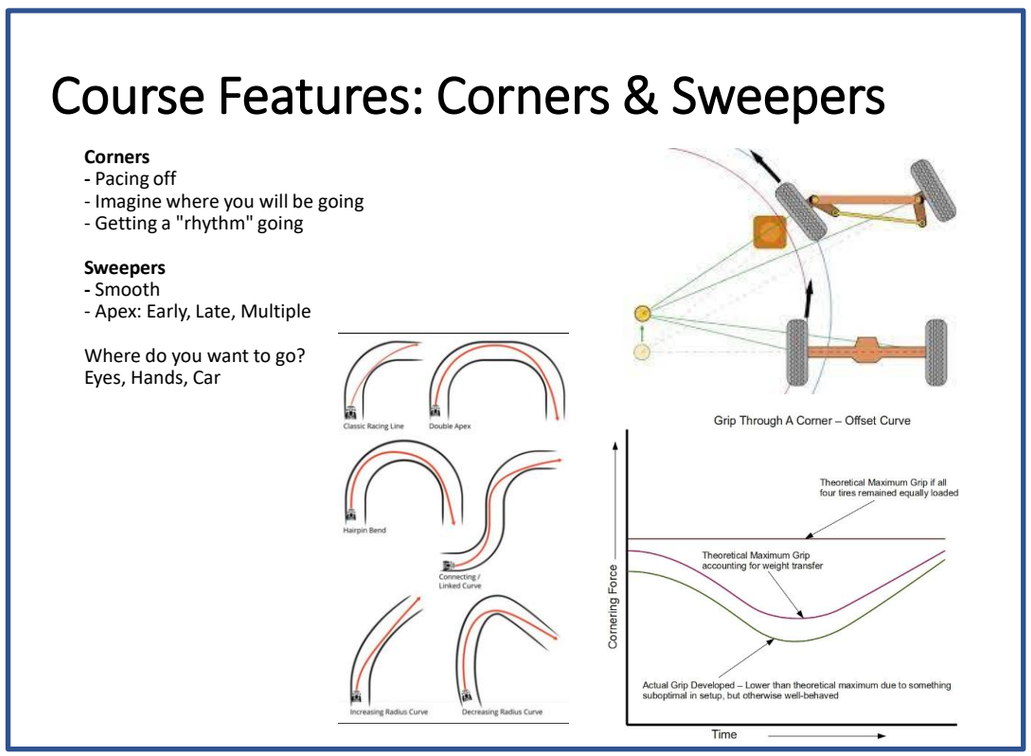


Note, the back tires will always cut inside the corner more than the front tires……..ALWAYS.

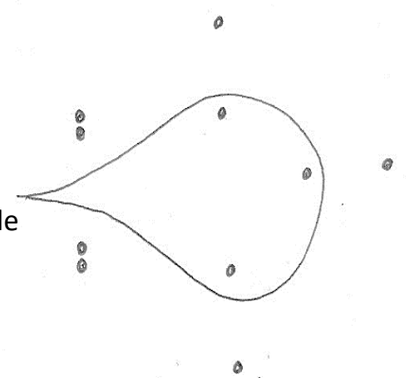
Large sweeping turns can be tricky. The driver needs to plan the “in” from a previous element, then the apex of the turn, then looking ahead to the next element will plan the corner exit. But, as we’ve learned……all of those parts will affect then next one. Keep in mind that the larger turns may be driven faster, but, they are very easy to overdrive and understeer just past the apex.

Your coach/instructor will talk more about this topic.

Course Features: Hairpin/Double Gate

Hairpins / Lightbulbs

- Slow Down
- Choose a line that suits your car
- Late vs early apex
- Consider what comes before and after hairpin to determine which side to maintain speed
- If optional, determine the best direction to turn
- NO Handbrake Turns! EVER!!!...EVER!!



Your coach/instructor will talk more about this topic.

Course Features: Gates

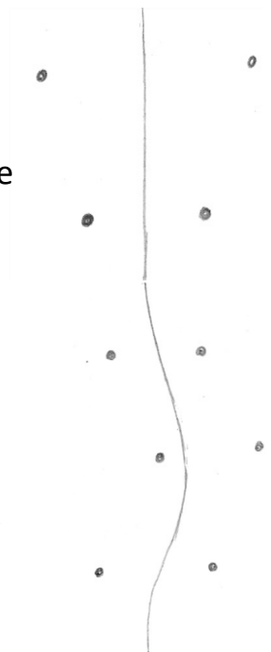
Look ahead and set up for the next one

What if you are going to miss it?
(Accept this run will not be a winning run)

- Don't back up….**EVER….EVER**

- Hit the pylon….on course vs DNF

- Drive intentionally to the next corner



Your coach/instructor will talk more about this topic.

Course Features: Finish

STOP racing! You don’t win after the finish lights

Cost of lights....Think $1,000

Watch the pylons in the chute

Large cones DNF run

Exit chute cones DNF run

Don't stop in exit chute unless directed to

Walking pace by end of finish/exit chute (<10 MPH)

Large cones at beginning (start) and end (finish) are where the timing begins and ends. You don’t need to speed after the finish cones.

General Course Flow

Always consider **what comes next** when planning lines

Generally **Shorter distance is faster** in AutoX

Pay attention to surface conditions, bumps can impact available traction and may require adjusting line

Identify 4-5 key cones/elements that will define your line and get those right

Generally, a turn only has **3 cones** that matter.

Setting up for these elements correctly allows you to drive the connecting elements more easily.

Maximize speed coming into acceleration areas. Speed given up on entry affects you the whole time you are accelerating.

An entire course may only have 25 “key cones”.

Plan your drive. AutoX is a sequence of elements. A better driver will “chain” the elements together so the exit of one leads to the entry of another.

As a new AutoXer…….you may think more “point n shoot” rather than chaining.

Helpful Hints:

Watch drivers in cars like you…..see if you can ride with them

Get where you can see others run (other heat, your heat)

Don't take the event nor yourself too seriously

Get to know an experienced driver who can mentor you

Read your tires after your first run, and 2nd, and 3rd

Adjust tire pressure until the car feels right

Once your run feels good, concentrate on your driving -- forget the pressures.

Watch the other drivers when you work the course.

They will show you what needs to be done……..and show you what you should not be doing.

See if you can ride with another driver. That's the best way to see the course.

More Helpful Hints:

Go over your run in your head as soon as you finish. Focus on where you can improve. Ask your mentor to watch your run **BEFORE** the run

Ask where you went off course, but don't ask the workers

Have fun and expect to get beat sometimes. Be a good loser

Be a good winner

Remember -- you are running mostly against yourself. Are you happy with your run?

Slow down to go fast

Don’t look like a police car chase on TV or the movies

Don’t overdrive your car or yourself

Your coach/instructor will talk more about this topic.

More Helpful Hints:

ANDY HOLLIS's "TOP TEN TIPS" - This "Top Ten" list was prepared by Texas autocrosser and Evolution School instructor Andy Hollis. It is a great overview of how to approach autocross driving.

1. Position first, then speed. Positioning the car perfectly is more important than trying to attain the highest potential speed. For example, you will drop more time by correctly positioning the car nearer to slalom cones than you will by adding 1 or 2 MPH in speed. Same with sweepers (tight line). Same with 90-degree turns (use all of the track). Also, position is a prerequisite for speed. If you are not in the correct place, you will not be able to go faster. Or at least not for very long!

2. Turn earlier...and less. To go faster, the arc you are running must be bigger. A bigger arc requires less steering. To make a bigger arc that is centered in the same place, the arc must start sooner (turn earlier).

3. Brake earlier...and less. Waiting until the last possible second approaching a turn and then dropping anchor at precisely the correct place so that the desired entry speed is reached exactly as you come to the turn-in point is quite difficult to execute consistently. Especially when you consider that you get no practice runs on the course, and the surface changes on every run, and you aren't likely to be in exactly the same position with the same approach speed on every run, etc. Better to start braking a little earlier to give some margin of error. And by braking less you can either add or subtract braking effort as you close in on the turn-in point. This will make you consistent and smooth.

4. Lift early instead of braking later. Continuing with the philosophy of #3, when you need to reduce speed only a moderate amount, try an early lift of the throttle instead of a later push of the brake. This is less upsetting to the car, is easier to do and thus more consistent, and allows for more precise placement entering the maneuver (remember #1 above).

More Helpful Hints:

ANDY HOLLIS's "TOP TEN TIPS" Continued

5. Easier to add speed in a turn than to get rid of it. If you are under the limit, a slight push of the right foot will get you more speed with no additional side effects. On the other hand, if you are too fast and the tires have begun slipping, you can only reduce throttle and wait until the tires turn enough of that excess energy into smoke and heat. Don't use your tires as brakes!

6. Use your right foot to modulate car position in constant radius turns, not the steering wheel. In a steady state turn, once you have established the correct steering input to maintain that arc, lifting the throttle slightly will let the car tuck in closer to the inside cones. Conversely, slightly increasing the throttle will push the car out a bit farther to avoid inside cones. It is much easier to make small corrections in position with slight variations in the tires' slip angle (that's what you are doing with the throttle) than with the steering wheel.

7. Unwind the wheel, then add power. If the car is using all of the tire's tractive capacity to corner, there is none left for additional acceleration. At corner exit, as you unwind the wheel, you make some available. If you do not unwind the wheel, the tire will start to slide and the car will push out (see #6 above).

8. Attack the back. For slaloms (also applicable to most offsets), getting close to the cones is critical for quick times (see #1). To get close, we must move the car less, which means bigger arcs. Bigger arcs come from less steering and require earlier turning (see #2). Now for the fun part... When you go by a slalom cone and start turning the steering wheel back the other way, when does the car start to actually change direction? Answer: When the wheel crosses the center point (Not when you first start turning back!) How long does that take? If you are smooth, it takes .25 - .5 seconds. Now, how long is a typical person's reaction time? Answer: about .5 seconds. Finally, how long does it take to go between slalom cones? Answer: Typically on the order of 1 second. Given all of that, your brain must make the decision to begin turning the steering wheel back the other way just *before* you go by the previous cone!!

Since this is a mental issue, a good visualization technique to get used to this is to think about trying to run over the back side of each slalom cone with the inside rear tire of the car. To hit it with the rear tire (and not the front), the car must be arcing well before the cone and the arc must be shallow. Attack the back!

1) Hands follow the eyes, car follows the hands. 'Nuf said.

2) Scan ahead, don't stare. Keep the eyes moving. Looking ahead does not mean staring ahead. Your eyes must be constantly moving forward and back, and sometimes left and right. Glance forward, glance back. Your brain can only operate on the information you give it.

Bonus Tip: Don't forget the stuff in between the marked maneuvers! Too often we think of a course as series of discrete maneuvers. There is typically more to be gained or lost in the areas that are in between. Pay special attention to the places where there are no cones.

More Helpful Hints:

ANDY HOLLIS's "TOP TEN TIPS" Continued

Since this is a mental issue, a good visualization technique to get used to this is to think about trying to run over the back side of each slalom cone with the inside rear tire of the car. To hit it with the rear tire (and not the front), the car must be arcing well before the cone and the arc must be shallow. Attack the back!

9. Hands follow the eyes, car follows the hands. 'Nuf said.

10. Scan ahead, don't stare. Keep the eyes moving. Looking ahead does not mean staring ahead. Your eyes must be constantly moving forward and back, and sometimes left and right. Glance forward, glance back. Your brain can only operate on the information you give it.

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References/Resources

Web Resources: (there are lots, here's a few)

- SCCA Website: http://www.scca.com

- Central Illinois Region SCCA: http://www.cir-scca.org

- SCCA Indianapolis Region: http://www.indyscca.org/

CCSCC Resources Online:

- CCSCC Website: http://ccsportscarclub.org

- CCSCC Autocross Schedule: http://ccsportscarclub.org/autocross/schedule/

- CCSCC Online Pre-Registration: Online Registration Tab on CCSCC website. http://motorsportreg.com is the site.

- Facebook Group – CCSCC Grid

NOTE: We've borrowed images from many different sites across the Internet. Thanks to everyone show's spent the time to create those.

From central IL, there's a few more clubs that might interest you:

- Chicago SCCA
- St. Louis SCCA
- Milwaukee SCCA
- Iowa SCCA

RUN Times	NOTES
1 _____	
2 _____	
3 _____	
4 _____	
5 _____	
6 _____	
7 _____	
8 _____	
9 _____	
10 _____	

Use this page and the backside for notes about the course. You can record your run times as well. Did you draw the course and make your own notes?