



**High Performance
and
Driving School
Driver Training Manual**



sanctioned by the
International Conference of Sports Car Club

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Statement of Non-Liability

High performance driving and racing are dangerous. International Race Drivers Club, and International Conference of Sports Car Club, its officers, and members, the author and contributors assume no liability as to the accuracy of the contents of this manual, and or damage that may result, either bodily or to a vehicle, from the use and application of the material provided in this manual.

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This manual is a compilation of experience dating from about 1970 to the present, January 2004. It replaces an appreciated effort by Dan Cathcart who wrote his version in 1990. Though I've done most of the "writing" of this edition, I am drawing on a number of sources listed in the Suggested Reading List, Dan's original manuscript, my many friends who have debated racing and teaching techniques, and my friends and mentors who have shared their stories (of success and failure) with me. Beside my own racing experiences others who have directly or indirectly contributed to this book are:

Steve Justiss
Mike McDaniels
Miles McDaniels
John Blackwell
Jim Blackwell
Alan Russel
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Jeff Clark
Hugh Golden

Wes Hill
Jim Hill
Ross Bentley
Wes Tipton,
Mike Helton,
Bill Vine

Thanks to all of them, and I hope this convinces you join our club racing community.
-André Gene Samson, Author, Editor, and Illustrator

Who are the IRDC and Conference?

The International Race Drivers Club (IRDC) is a Seattle area Member Club of the International Conference of Sports Car Clubs (ICSCC or Conference). Founded in 1970, IRDC hosts races at Pacific Raceways in Kent, WA. The purpose of both IRDC and Conference is to provide a place for people to get involved in sports car racing, and compete on a regional level. Conference sanctions a Championship Road Racing series at venues in Washington, Oregon, and British Columbia, Canada.

Regional club racing in Conference is based on many roles. One role is for those who love driving and want to challenge themselves, one is for those who love building cars or are enamored with a Marque of car, and one is for those who want to race for a Championship. This is achieved through Production Car Classes based on power to weight ratios, Spec Classes which develop their own rules often to minimize expenses and encourage new drivers, and Class structures that parallel other organizations to maximize on-track time, with no or minimum modification to cars.

Conference is a community that offers and builds camaraderie within its participating members. IRDC's motto is "Together for Racing", and many Senior drivers offer new drivers help, and mentoring through

what can become life long friendships. Though racing is expensive, through camaraderie and a "racing family" Conference offers the greatest value for limited budgets to experience Regional Road Racing.

There are many ways you can start racing. If you enjoy building cars, with a small investment in money and time, almost any street car can be made into a legal Conference Production race car. More often it is most cost effective to buy a used race car. Some car owners rent race ready cars and mentor you through the Novice Program and beyond. Two or more owner/drivers for a car make racing more affordable, and split the work. Others barter crew time in return for seat time. Regardless of how you start racing, joining the community is a first step toward getting to race.

In addition to races, IRDC offers these High Performance and Competition Driving Schools open to the general public. The school offers car enthusiasts the opportunity to learn additional driving skills, as well as the performance limits of their cars, and is a prerequisite for a competition license with Conference.

If at the completion of the course you are not ready to begin racing, but would still like to get involved, IRDC has monthly meetings, and every race weekend there are a number of race support positions you can volunteer for.

You can find updated information about Conference,
the season's schedule, forms in .pdf format,
and a discussion forum at:

icscc.com/

IRDC has a web site with relevant club news at:

irdc-racing.com/

The Goal of the Course . . .

is to have too much fun and, get you hooked on club racing! But it is also an introduction to the scientific art of high performance driving. It is a first step if you want to pursue racing, but also an important opportunity to increase your awareness and safety driving on the street. Most everything you learn in this course can be practiced on the street at legal speed limits. We will introduce you to theories, concepts, and a physical skills set we feel is most important in safe and predictable high performance driving.

The concepts we want you to become aware of if not learn are:

- Smooth input of all controls every moment you are driving
- Discipline, concentration, and patience, to create focused consistency
- Cooperation between passed and passing cars, even racing we are sharing the track
- Looking down track, recognizing peripheral vision, full awareness
- The Line, where are you right now?
- Turn in, how smoothly can you achieve car set?
- Apex, how close, how early, or how late?
- Track out, maximize exit speed, with car set.
- Points of reference, what are you looking at?
- Sight pictures, what are you seeing?
- Self-correction, if you are recognizing your mistake, you are getting the idea.

This course is an opportunity to make known, what for you might be unknown. Regardless of your experience, the most important tool you can bring to this course, and to driving in general, is an open mind, and the willingness to ask questions, of others and yourself. If at any time you do not understand what is being communicated, ask a question.

It is also an introduction to discipline and concentration. Regardless of the enjoyment and eye candy value of movies like *The Fast and the Furious*, *Driven*, and *Gone in 60 Seconds*, the stunts in those movies were performed by professional drivers most of whom understand all the concepts we will introduce you to. Their first goal is the safety of everyone on the set.

Unlike the stories in the movies, here in real life your first goal, whenever driving, should be the safety of everyone around you. During the track sessions of this course, beside trying to make sure you are having fun, we will be looking for an attitude of maturity and self-discipline. High performance driving is an incredibly fun activity we feel privileged introducing you to.

With insurance rates ever increasing, we need you to respect the sport, leave the bravado at home, and bring your most serious and open desire to learn.

In return for that discipline and concentration you will gain more awareness, with less distraction, more comfort and enjoyment in all your driving.

IF YOU ARE GOING RACING your goal for this course, beside showing your driving and learning ability, is to prove to your instructor that you will be an aware and predictable driver. Instructors will be less concerned with how fast you are, as they will with how smooth you are and how aware you are with what is going on around you. Chances are it will take seat time racing to get up to speed, we expect that. At the end of the day your instructor has to ask one question for you to advance to the Novice Program, "Would I want to race with this driver?" or to be more accurate, "Is this person safe and responsible enough to go racing?"

The more you acknowledge worker's signals, flags, signal clear point bys when getting passed, give a courtesy wave when passing, show a disciplined approach to learning, and generally act responsible and predictable, the easier your instructor can answer that question. The number one concern of faster drivers when passing a slower car is that the driver of the slower car; knows they are getting passed, gives a very clear point by, and holds their line. (In racing a slower driver may point by one side, but the overtaking driver(s) can choose which side to pass on, hence the importance of holding your line)

The Goal of this Manual . . .

is to help you successfully complete this course. As much as we'd like, it cannot cover advanced driving skills in depth.

Mistakes are avoided by experience.

Experience comes from making mistakes.

We can learn from our mistakes, but the least expensive way is to learn from other people's mistakes. If you are at all serious about becoming a better driver, but especially if you are moving on to racing, read as much as you can about driving, racing, and car development. There are a number of books listed in the Suggested Reading list at the end of this manual. If you are reading this early enough and don't already have the books we've listed as priorities, get and read at least one of the three numbered priority books, before the ground school, preferably *Going Faster*. They are not a prerequisite, but will help in your self-education, and help you get more out of this school.

Before the School

Before you bring your car to the track, it is vital that you have it inspected by a competent mechanic to ensure everyone's safety, and your successful completion of the school. At nearly every school, there are one or two cars that experience some type of mechanical difficulty, some result in failure to complete the course.

Make an appointment early enough so your mechanic has time to repair problems. Be sure to tell them that you are going to take this class. At minimum have the mechanic check each item on this list.

For safety

- _ Seat belts secured, no frayed material, in working order for both the driver and the passenger
- _ Wheel bearings
- _ Brakes and Brake lights
- _ Suspension
- _ Steering
- _ Battery tie down
- _ Tire condition, tread depth, and air pressure

To ensure you complete the course

- _ Engine compartment, and lubricants
- _ Gearbox and rear axle lubricants
- _ Wipers

Your car will undergo tech again at the track, so anything that does not pass tech (the Safety section of the list above) will disallow you from taking part in the on-track session.

You will need a DOT approved motorcycle (M), or auto racing (SA) helmet in good condition, constructed in 1985 or newer. If you don't have one, or cannot borrow one from a friend, some will be available at the track. Bring extra clothes for warmth and protection from rain, plenty of drinking water, fruit juice, and snack foods for energy.

Comfortable shoes with narrow soles that let you feel pedal pressure are helpful. Thick soled running shoes, though comfortable, can catch on pedal edges and will not give as much pedal feel. If you don't want to buy racing boots yet, wrestlers and some volleyball or track shoes (without spikes) can be an inexpensive alternative. Even if the weather is inclement, on-track sessions might be driven with both front windows down, thin gloves that can grip the steering wheel can help keep your hands warm. Dress in layers, the morning track tour can be very cold, yet you will work up a sweat when driving. Also handy is a tarp to cover

the loose items that you remove from your car.

On the morning of the track session leave enough time before getting to the track to eat breakfast, fill the gas tank, a spare can or two if you have them, and to check and or fill the tires to their cold sidewall rated limit. There is no pump gas available at the track during schools. A tire pressure gauge and torque wrench with socket for wheel fasteners can also be helpful.

The Ground School Classroom Session

The Ground School classroom session will begin on time. Be sure to come early to check in with registration. Don't forget to bring this manual and pens or pencils with you.

The day class is usually 10-Noon, brown bag lunches provided, then 1 to 3pm. The evening class is usually 6-10pm with pizza before hand.

Here is the ground school outline:

I. Introduction: Welcome, explain the IRDC/Conference organization, introduce the "staff", outline the schedule for the track day, poll the students goals, state the rules for the ground school. Outline the time to be devoted to various subjects during the ground school, state the rules/conduct of the track event (how to get there, check in, schedule, passing, safety, groups, technical inspection, track walk, time on track). Cover the outline of the Drivers Manual. Cover the rule book and differing rules for various organizations (SCCA, SOVREN, NASA).

II. Concepts of track driving: Discuss the map of the track, a standard turn (entry, apex, exit), the "line" concept, weight transfer (using a wheel, tire and volunteers), braking, threshold braking, heel and toe, all other inputs, smooth is the goal, the first few laps, you and your instructor, safety once again, the rules of passing, the rolling start and how racing differs from track driving.

III. Break and one-on-one discussions (1 hour Lunch for the day class, short break for the night class)

IV. Communications. Flags and safety

V. Videos of Pacific Raceways at freeway speed and Formula car speed). Emphasize Section II subjects.

VI. Race craft.

VII. The Novice Program. ICSCC License Director

VIII. Review and open discussion.

At the Track

On the day of your on-track sessions, get to the track early having already eaten breakfast. At the track, proceed to the paddock area (see map), and park in an

available space. Check in with registration where you will receive the remainder of your registration packet, be given a technical inspection sheet, and sign the Release Waiver. Crew and guests must also sign the Release Waiver, and minors have to have a signed Minor Release Form. Return to your car, open the doors, hood, and trunk, hatchback, or tailgate, (yes we've had station wagons, pickup trucks, and SUVs complete the course) and empty the interior and trunk of all loose objects, including the spare tire, jack, tools, etc. (wrap them in the tarp you brought). Place the tech inspection sheet on the driver's side dash board.

There will be a mandatory Driver's Meeting. **IF YOU MISS THE DRIVER'S MEETING YOU WILL NOT BE ALLOWED TO ENTER THE COURSE.** Next is the track tour, the skills circuit, then the driving sessions. Keep your schedule handy all day and be alert for bullhorn announcements, driver's meetings, corner observation walks, or chalk talks throughout the day. Your registration packet should have a schedule for the day.

Bring to the on-track session:

- _ D.O.T. approved helmet (or Snell M or SA)
- _ Comfortable clothing and shoes for driving
- _ Rain gear and warm clothing when not driving
- _ Duct tape for headlights
- _ Drinking water, beverages and snacks
- _ Tarp

Other items that might be helpful

- _ Torque wrench and socket to fit wheel fasteners (including special keyed adapters for antitheft fasteners)
- _ Sunglasses or tinted helmet visor
- _ Extra fuel
- _ Oil
- _ Brake fluid
- _ Coolant
- _ Glass cleaner
- _ Paper towels
- _ Air pump
- _ Tire gauge
- _ Money for runs to the auto parts store

What to Expect

High performance driving is thrilling, period. But when you first begin you will most likely be overwhelmed by the amount of information you are asking

your brain and body to process. It may even feel like mild shock. It is natural during and after your first sessions to ask yourself "What am I doing here?" or "What just happened?", and you may feel ready to quit. Don't, literally or mentally!

High performance driving requires processing very specific bits of information from a rapidly changing environment, gathered by all five of your senses as quickly as possible. At just sixty miles per hour you are travelling at 88 feet per second, a football field in 3.4 seconds. Double the speed to 120 m.p.h., a speed many newer street cars can approach, and the same football field is gone in 1.7 seconds. As you progress through the day you will realize you are acclimating to the speed on the track and the speed which you have to process your new experiences. At the end of the day realize you also have to acclimate back to "freeway" speeds.

If you do feel you are getting overwhelmed, take a few deep breaths, try to relax your body, shoulders, arms, hands, and at the next available opportunity drink some water or juice, and eat a snack.

If you feel you are getting caught out by mistakes, think of a humorous situation, laugh a little, then "re-boot" yourself, relax and try honing a skill you feel you've gotten a good handle on.

Courage is the ability to force yourself to do something that you know can well and truly frighten you.

-Carroll Smith

Beside learning driving techniques you are also going to learn some about growing your courage. It is you who will be finding your boundaries and pushing a bit beyond them. Take that home with you too.

After the morning sessions, if you feel you are not connecting with your instructor, don't be afraid to ask the Chief Driving Instructor for a different teacher. Sometimes you need to hear the same information in a different manner.

The on-track sessions can be a real eye-opener, or a real eye closer. Some students come to a school thinking they want to race, and by the end of the day feel it's too intense. Some think they are just going out to drive fast, and realize they can't wait to get racing. Be prepared for many reactions, but again if you feel like you've had enough seek out an instructor to help you debrief before leaving

We all learn in different manners. It can be helpful if before the on-track sessions you can figure out how you learn most effectively, verbal descriptions (auditory), drawn pictures (visual), or how something feels (kinetic).

Expect to grin, a lot.

Workers, Turn Workers, Turn Marshals

READ THIS VERY CAREFULLY. All of the workers who you will encounter in club racing are volunteers (you or your friends may become one). They might receive some travel or lodging money, or a raffle gift, but none are getting paid. We cannot do a thing on the racing surface if we do not have enough workers. If you are ever seriously in need they will go to great lengths to help you, even jeopardizing their own health.

THANK A WORKER ANYTIME ANYONE OF THEM HELPS YOU. That means the registrar who takes your entry fee, the tech inspector who weighs your car, the Driver's Services helper who photocopies your group results, the pre-grid marshal, and especially any corner worker. A "Thanks for working" will always be appreciated.

Club racing is a community you are choosing to participate in. You will find most people in Conference actually want to help you. Treat them like gold and your experience will be much richer. And consider bringing along friends who are interested in racing but don't want to race themselves, to become a worker.

Rules of the Road

Some of these apply whenever you are driving anything, period. Others only apply to this school.

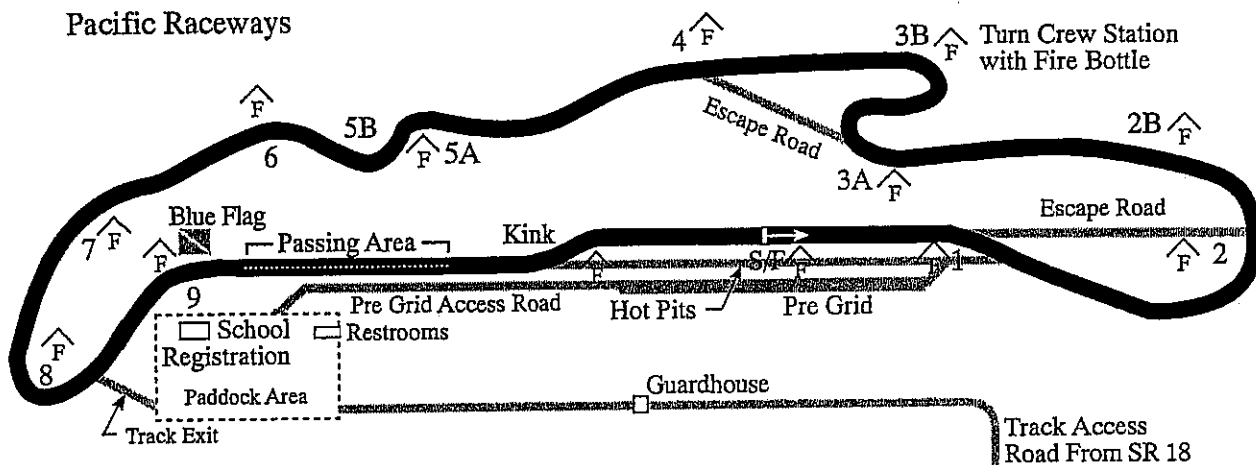
1. **PASSING IN DESIGNATED AREAS ONLY!** Absolutely no exceptions to this rule. If you competitively pass another car on the track, you will be removed from the school without a refund.

2. **WATCH THE TURN WORKERS.** When approaching a corner look for color or motion, i.e. a flag, displayed standing or waving, or a turn worker reacting or running to a situation. If you see any of the above, slow your car so you have complete control and acknowledge the turn workers with a wave.

3. **MAINTAIN YOUR DISTANCE.** You must maintain a minimum distance of 100 feet between cars. (6 or more car lengths).

4. **BLUE FLAG RULE.** For the school, the only place you will see a blue flag is before the designated passing area. If you receive the blue flag, you **MUST** use the right lane and let the car or cars in the left lane pass you. Your car may be faster on the straight, but you may be holding up cars in the turns. **DO NOT RACE** in the slow lane. Reduce your speed and allow as many car by as you may be holding up. Usually up to three cars can pass. Point-by each car.

5. **HOW TO GET PASSED.** Part of your discipline is knowing what is going on all around you at every moment. Learn to be aware of cars behind you. Starting a few turns before the passing area, *after* each turn when on the short straights glance in your mirrors and judge the relative distance between you and the cars behind you. If you are holding up cars or those behind you are gaining rapidly, be prepared to receive the Blue Flag.



Adjust your speed so you can complete the turn before the passing zone AND safely steer to the slow right lane. **ONLY AFTER YOU HAVE COMPLETED THE TURN**, and are in full control of your car approaching the slow lane, reduce speed while pointing by faster cars. Continue to point by cars with **REPEATED OBVIOUS POINTING** until near the lane's end, then increase speed and merge with the faster traffic. Some drivers point-by by holding out the window the number of fingers for the number of cars they expect to pass them. As each car passes they reduce the count by one. You can usually let up to three cars pass.

6. **HOW TO PASS.** The only way you may pass another car is if the slower car is in the slow right lane and you are in the fast left lane. (See Blue Flag rule). You may not pass any car that is in the same lane as you! When approaching the merging section watch for a point-by. No point, no pass. When you have completed the pass, **GIVE A QUICK COURTESY WAVE TO THE OTHER CAR.**

Should you find that you are stuck behind many slower cars and can't pass enough cars to get to clear track, enter the hot pits. The Course Marshal will find an open spot for you to go back out with some space around you. Also if you approach a car that is obviously having mechanical problems and is trying to get to the track exit, slow down, follow the car until the next short straight section of track, look for a White Flag displayed at a turn station signalling the workers know there is a slow vehicle on the track, or look for an obvious point-by, then pass with extreme caution.

7. **GO SLOW ENOUGH TO LEARN.** Driving school is not a race. Learn the line and corner exits first. Only then gradually work up your speed. Take your time, push your boundaries with control, learn, don't scare yourself, or your instructor.

8. **EXITING THE TRACK OR NURSING A SICK CAR.** As you approach the exit of the track, or are entering the pits, or if your car is experiencing mechanical problems that have slowed your car significantly, **RAISE YOUR HAND OUT THE WINDOW** as high as you can, to signal those behind you that you are slowing or exiting the track.

If for any reason you must stop somewhere on the track, or your car is on fire, try to **COAST TO A MANNED TURN STATION**, try to get your car as far off the driving surface as possible and in a position of safety. If you can't coast to a manned station, **FIRE BOTTLES ARE KEPT AT THE MANNED AND**

UNMANNED TURN STATIONS. But the closer you can get your car to workers, the sooner they can tend to you or your car.

9. **ESCAPE ROAD.** If for any reason you must take an escape road off a corner, you must stop at the end of the road and wait for a turn worker to signal you back onto the track.

10. **SESSION END.** After the checkered flag, slow down for a "cool down lap" for both the car and for you. You will have been driving faster than normal, slow down more than you think you should. It can take a bit to acclimate to "freeway" speeds again. Use the brakes as little as possible. Be sure to **WAVE AT THE TURN WORKERS.** They have a saying, "NO WAVE, NO SAVE".

EXITING THE TRACK, PROCEEDING TO YOUR PIT, AND PARKING.

Unless your car is overheating or having other mechanical problems, it can be helpful immediately after leaving the racing surface to drive your car on pit access roads at as slow a speed as possible to allow the hottest parts of the car to cool some more before parking. Some newer cars and cars with turbos should be left to idle for a short time to circulate cooling oil through critical parts.

DO NOT PUT ON THE PARKING BRAKE! Doing so may fuse the brake friction material to the discs or drums. During High Performance Driving brakes can get much hotter than on the street. Instead, after you have shut off the engine, leave the car in gear, and or block a road wheel with something to keep the car from rolling.

11. **INSTRUCTORS DRIVING YOUR CAR.** It is often helpful to have the instructor drive your car for a few laps. It is sometime much easier to show you a driving technique than to verbalize it. It is entirely optional to have the instructor drive your car. Remember, it is your car, and you will pay for it should it get damaged during this school no matter who is driving.

Fitting the Car

Proper seating and steering wheel positions are essential so you can feel what your car is doing and can control the car without having to hold yourself up with the controls. When seated you should be comfortable and relaxed with as many controls as possible easily in reach. But sometimes you have to compromise.

First adjust the seat bottom so you can fully depress the brake, clutch and throttle, and comfortably rest your left foot on the "dead pedal" if your car has one,

or inner fender bulge. When depressing a pedal use the ball of your foot.

Next adjust the seat back so when you extend an arm over the top of the steering wheel, your wrist breaks at the rim of the wheel. Then place your hands on the steering wheel at the 9 and 3 positions with your thumbs up on the rim, not hooked over the spokes. With your hands at 9 and 3, turn the wheel to the left and right, and make sure your elbows do not jam into the seat back and limit your steering movement. Adjust the seat back as appropriate then try other adjustments so you can also reach all the gears without straining against the seat belts.

While driving keep your hands at 9 and 3. Don't rest your elbow on the car door window opening and don't rest a hand on the shift knob. For some sharper corners you may need to start the corner by sliding one hand down to the 6 o'clock position, but you will still unwind the steering wheel with two hands without shuffling.

Mirrors

There are two theories with mirrors. The one most of us learned is to set the outside mirrors so you just see the edge of the rear fender in the inside edge of the mirror. This gives you a clear view down the road behind you with more angle than the inside mirror.

A new practice is to set the mirrors pushed out further so you see what is in the blind spots. Then by the time an overtaking vehicle is out of the mirror, it is in your peripheral vision. It takes some getting use to.

Try it on the street before the track session to make sure you are comfortable with the new position. Otherwise stick to what you are use to.

With a full view multi-panel Wink brand mirror inside the car most drivers find that they can read entirely from side to side of the car and return to using the outside rear view mirrors to their old position to get a little more angle down the road behind their car.

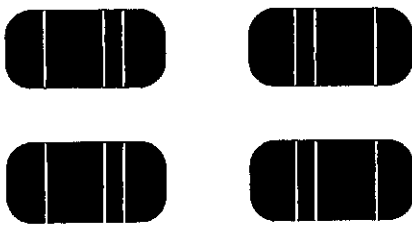
Eyesight and Awareness

The primary senses used in high performance driving are sight, touch and hearing. (smell and taste are occasionally used in recognizing a problem, like smelling tire smoke, or tasting coolant overflow from car ahead of yours, but aren't often, if ever used to drive faster)

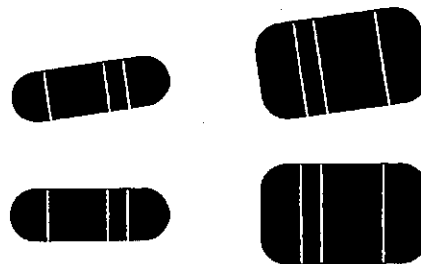
Though sight is the most important sense, it is less a function of being able to focus on a single object as it is an awareness gathered from your focused and peripheral visions. The further ahead you can gather information, both near and far, the faster you can drive.

You may notice this on the street when a large vehicle changes into your lane ahead of you. You may drop back or change lanes so you can get a better line of sight ahead. Too you may notice in fast moving traffic, you look through the windows of the car ahead to look for brake lights on cars further ahead. Or perhaps on a gentle freeway curve you scan even further ahead to see if traffic is flowing quicker in another lane. You are trying to judge what the best course of action is.

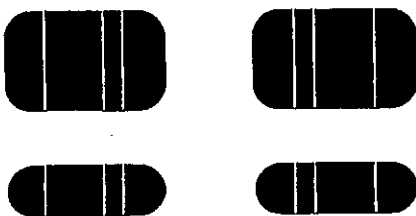
Weight Transfer effect on tire contact patch (simplified)



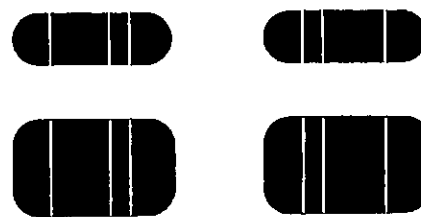
At rest



Turning left



Braking



Accelerating

This concept is the basis for high performance driving and we will remind you often to LOOK UP, LOOK AHEAD, or LOOK DOWN THE ROAD. When driving off the nose of the car you cannot gather enough information far enough ahead to process and anticipate what input you want to give the car. Look as far down the road as conditions allow, as well as being aware of what is in your peripheral vision, to give you more time to process your points of reference, and build a sight picture.

Though there are many drivers with physical impairments, if you need contact lenses or glasses, wear them. Be careful of combining sunglasses with tinted windows and or tinted helmet visors. Too many tints can reduce your visibility too much, including through the back and side windows.

The Stable Platform

In reading about the Stable Platform Theory you will find a car described as a table with four legs, or if you could imagine four scales one at each wheel of the car, or . . . the point being that a car when not moving has a certain amount of weight on each tire. In walking, skiing, dancing, or hobbling with a sprained ankle, you change the amount of weight each part of your foot bears with each footfall.

When a car starts moving, the amount of weight on each wheel changes. When accelerating weight transfers to the back wheels of the car, when turning the car rolls to the outside of the turn and weight transfers to

the outside wheels. When braking the front wheels increase their loading. Like a waitperson carrying a tray of food, sudden changes in direction result in spilled food, so too a car spills stability when it changes direction too suddenly. This not only upsets the car mechanically making its ability to work as designed less efficiently, but directly translates to the driver feeling less confident in their anticipation of how to control the car.

Hence the goal is to MAKE ALL DRIVER INPUT SMOOTH. Which doesn't mean slowly, just that you must balance how quickly your input is with how smoothly it can be made.

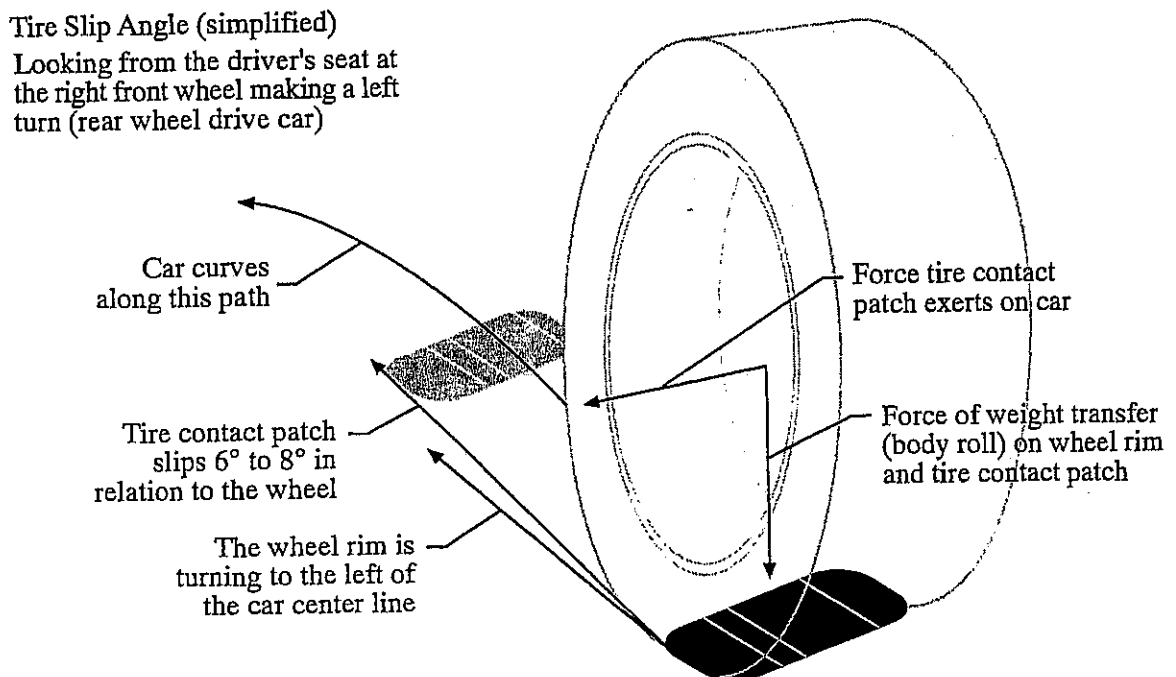
The Circle of Traction

A tire is capable of a certain amount of grip, i.e. traction. Each tire produces a contact patch roughly the size of a 3 x 5 inch index card. All four tires combined produce a friction area less than the size of this page. When cornering you are managing the available grip. As tire and environmental conditions change, so to does the grip each tire can produce.

Tire conditions that affect tire grip include: internal air pressure, temperature, condition, construction, tread depth, compound.

How much weight is on a tire also changes traction. Weight load changes include: suspension settings, acceleration, braking, turning, how abruptly your input is, and aerodynamics.

External environmental conditions also affect



traction, which include: road surface, road camber (banking), elevation change, weather conditions, air temperature, track temperature, spilled fluids, car aerodynamic and wind conditions (including air movement created by other vehicles).

A tire can only apply 100 percent of its grip taking into consideration all of the variables mentioned above. A dragster for all intents and purposes uses 100% of its grip to accelerate. In road racing we apportion the percentage of available tire grip between braking, cornering, and straight acceleration. In keeping with the Stable Platform practice, we want to transition between these three conditions as smoothly as possible.

Threshold Braking

This is the practice of applying as much brake as possible at the start of braking, and gradually releasing brake pedal pressure to transition to turning as smoothly as possible. You can practice the theory on the street when coming to a full stop, by gradually releasing brake pressure timed so at the stop line, the car doesn't rebound at the moment it comes to a complete stop.

Stomping on the brakes too suddenly upsets the car by transferring weight to the front too abruptly, and makes modulating brake pressure more difficult. You should maintain as much brake pressure as possible without locking up a tire. When a wheel locks, it loses 30% of its traction. If lock up should occur, release brake pressure slightly to unlock the wheel and again modulate pedal pressure to increase braking to maximum effort. So, think **SQUEEZE ON THE BRAKES**.

Trail braking is the practice of timing your brake release and initial turning input to overlap. It is an advanced technique and will not be taught in this course. During your track time do all of your braking in a straight line, and leave a small cushion of track to account for emergencies.

Cornering

First some nomenclature.

POINT OF REFERENCE: A specific point that a driver looks at to time their driving inputs. During the school there will be cones on the outside of some turns to mark brake points and pairs of cone set up as "gates" for you to drive through showing some sections of the line. These are a learning aid, but they can be knocked over, or moved, and the gates will be removed by afternoon. Use them early in the day, but try to find immovable objects for reference points like color

changes of pavement, seams, gouges, ripples, bumps or other marks in the road. Skid marks are a good warning sign or heads up for what not to do, but they will eventually be erased, don't use them as a point of reference.

SIGHT PICTURE: An overall image a driver sees to time their driving inputs. Usually made up of consistently learned and used Points of Reference.

BRAKE POINT: An immovable point of reference (hopefully on the road) that you look at where you begin braking.

SLIP ANGLE: When cornering, the difference in angle the wheel rim is pointing and the direction the tire is moving. Between 5 and 10 degrees most efficient between 6-8 degrees.

GATE: A pair of cones marking a position on the track you are meant to drive.

TURN IN: The point at which you begin to turn, or wind the steering wheel the direction you want the car to turn.

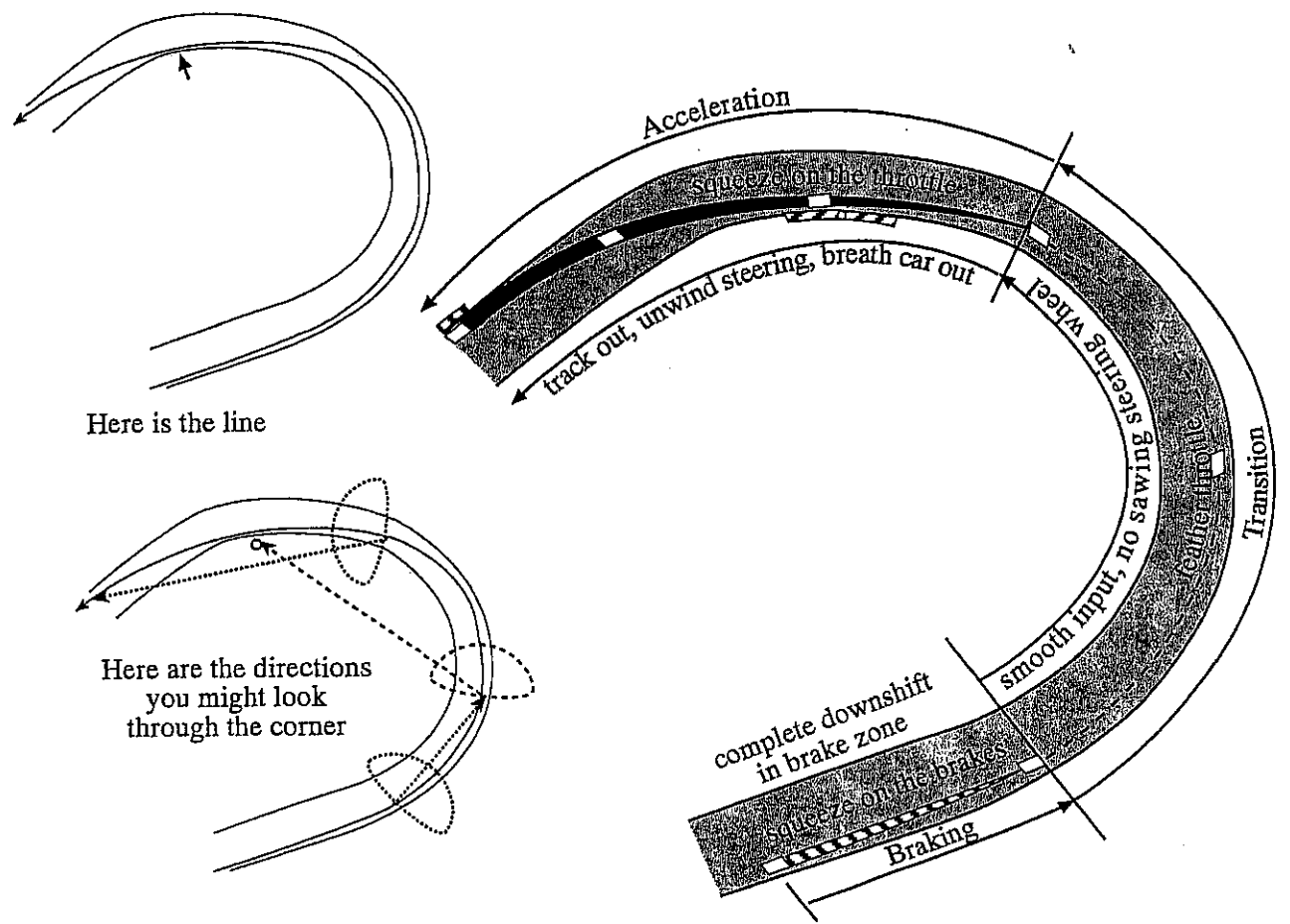
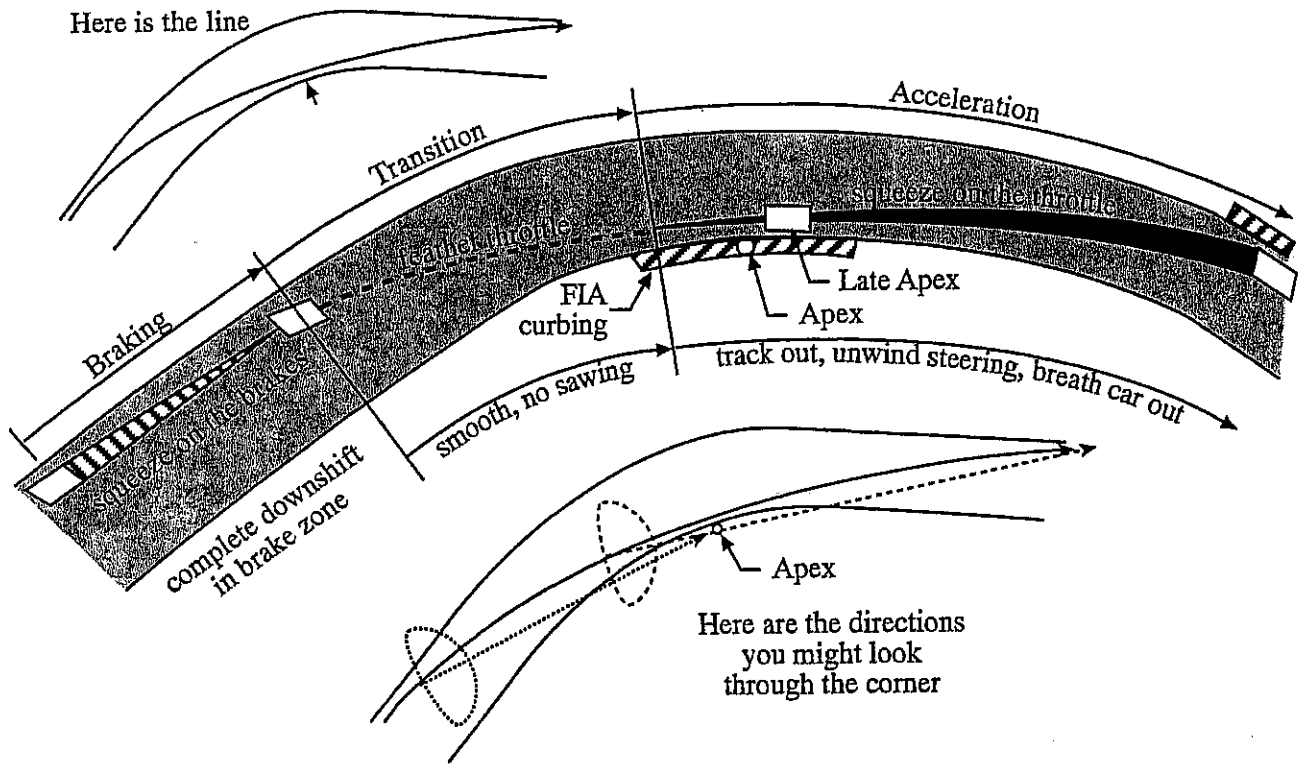
APEX: The point in a curve where the car comes closest to the inside edge of the road. For the purposes of this course you should always use a "late apex". The most common mistake a beginner makes is to apex too early. Often combined with too much speed, an early apex will not allow for enough road surface at the exit of the corner for the speed you are carrying and you will drive off the track.

TRACK OUT: The point at the end of the curve where the car touches the outside edge of the track. Also, the path after the apex your car describes to reach that point.

UNWIND THE STEERING, BREATHE THE CAR OUT, DRIVE THE CAR OUT: The gradual deliberate straightening of the steering wheel to transition the car from turning to going straight. This is opposed to allowing the steering wheel to slide through your hands. Just as you turn the steering wheel in the direction you want to turn a car, you also unwind the wheel, or if you will un-turn the steering wheel.

LINE: The path you drive your car relative to the road's edge, prior to, through, and exiting a corner. The line can vary depending on car and track conditions. Also the path used around an entire race track.

TRANSITION: The time between braking for entering a corner, and the gradual pressing of the accelerator to exit a corner. During Transition you may be feathering the throttle for a short moment, to a number of seconds, while you make slight deliberate steering adjustments. Also any period of time where one steady state



of motion changes to a different state of motion, transitionally from turning to going straight.

FIA CURBING: This is a slightly raised "curb" next to the racing surface. It is usually painted with wide stripes. It is usually placed where cars often put two wheels off at the apex and exit of a corner and so dig "gutters" or ruts next to the racing surface. Sometimes called Dragon's Teeth, or Rumble Strips.

FIA, Federation Internationale de l'Automobile: A sanctioning body that oversees international racing.

TWO WHEELS OFF: Having driven a car so two wheels are not on the racing surface.

FOUR WHEELS OFF: A car that is no longer on the racing surface at all.

SQUEEZING ON THE THROTTLE: The deliberate pressing of the accelerator over a small segment of time as opposed to flooring the accelerator too quickly.

UNDERSTEER: Also known as a "push". When cornering, the front wheels lose traction and the car continues to go straight. You can compensate for the condition by easing off the throttle, which transfers weight to the front wheels. If you lock the front wheels under braking, the car will not turn. Ease off the brakes to allow the front wheels to roll. In a front wheel drive car if the front wheels are spinning from too much power being applied, ease off the throttle to increase tire grip.

OVERSTEER: The opposite of understeer, referred to as being "loose". The condition where the rear wheels of the car lose traction causing the car to rotate (spin out). To correct for oversteer quickly turn the steering wheel in the direction of the skid, try not to lift off the throttle.

FOUR WHEEL DRIFT: Also known as being "neutral" or "hooked up." Where a driver has balanced the slip angle of all four tires, thus the yaw angle of the car, to achieve maximum cornering speed.

SET: A cornering state where the car is very stable, and the driver feels very confident in his or her control of the car. Also "Working the car" or "getting the car to work"

YAW ANGLE: When cornering, the angle between the center line of the car and the direction the car is travelling.

So let's try to straighten out this cornering thing. Literally. Pun intended.

It's a pretty safe bet that you cannot turn into your driveway at the same speed that you can take a freeway exit, which is slower than you could drive a straight freeway with no traffic. Traction and drivable

surface are what limit your speeds. So it goes that the more you can make a driveway entrance like an exit ramp, and the more you can make an exit ramp like a straight freeway, the faster you can drive.

The basic theory to cornering as quickly as possible, is to create as large an arc as possible through a corner by starting at the outside edge of the track, turning down to the inside edge of the track, then steering back to the outside edge of the track. Your original driveway turn has straightened more to a smooth exit ramp, and your speed can increase as a result. Where the basic theory breaks down is, combining the Stable Platform theory, the variables of available tire traction via the Circle of Traction, and corner priority, the quickest line often varies from the theoretical line. Your instructor will be showing you the accepted line around the track, and can give you the reasons why that line varies from theory.

For the purposes of this course, by using a late apex, you should complete the hardest turning input of a corner before the apex. Once you reach the apex, you should be back at full throttle and beginning to gradually unwind the steering wheel as you exit the corner.

Steering

Your steering inputs (as all your control input) should be as smooth as possible. When you first start working a car through a long corner it is natural to saw at the wheel a bit to test if you are approaching the limits of tire adhesion. Recognize that you are doing it, listen to your teacher saying you shouldn't be doing it, then work at smoothing things out.

Shifting

The macho powershifts seen in the movies usually result in one thing, damaged or broken shift linkage, or at worse a broken transmission. You want to have empathy for your equipment and hard, too fast shifts do not lower track times significantly enough to outweigh the risk of damaging the car. Believe it or not you want to time your upshifts as much as your downshifts. Shift smoothly and purposefully without rushing, which usually results in missed shifts (which results in over-revved engines, but hopefully not broken engines, another reason to squeeze on the throttle rather than pounce on it, you can limit somewhat, how much you over-rev.) There is a speed just under "snicking" the shift lever that seems to work best for any transmission not having difficulties.

When downshifting you need to match the engine speed to the speed the driven wheels are rolling.

Double clutching when downshifting is easier on the transmission even if the gearbox has synchros. For the purposes of this course we want you to **COMPLETE DOWNSHIFTING AND BRAKING IN A STRAIGHT LINE**. It is easiest to shift straight from top gear to whatever gear in which you will be cornering. Rowing down through the gears was necessary when cars had poor brakes. The engine revving sounds romantic, but is no longer necessary unless you are driving a car with four wheel drum brakes or are nursing a car that is losing or has lost its brakes.

Heel and Toe is covered briefly in the Advanced Driving Technique section at the back of this book. We will not be teaching it in this class, nor is it required to pass this course. It is thoroughly covered in *Going Faster* listed in the Suggested Reading List. If you are comfortable practicing Heel and Toe on the street you may use it during your on-track sessions.

Off Course or Controlling Skids or Spins

Should you drive off course, keep the front wheels as straight as possible, ease off or maintain throttle, hold your line and turn gently in a direction of safety. Try to regain the track as gently and as shallow an angle as possible. If the wheels are turned sharply on the dirt, they'll hit the pavement and abruptly steer the car into a spin.

If your car should go into a skid, (start to spin) quickly turn the steering wheel into the skid. Try to stay off the brakes but maintain or ease off the throttle. If you are able to catch the first slide, be ready for a slide in the opposite direction caused by momentum (tank slapper).

Should you lose complete control and you have gone past the point where you can catch the spin, simultaneously push in the clutch and brake pedals, to keep the engine running and **COMPLETELY STOP THE CAR. GUNNA SPIN, TWO FEET IN**. Only after you have come to a complete stop, and gotten your bearings, look for a turn worker to give you signals, and proceed as they direct. Don't allow the car to roll slowly back on to the driving surface.

A Session

Before going on the track each session check:

- _ Wheel fasteners (with a torque wrench and socket if you have one)
- _ Tire pressures
- _ Fluid levels
- _ Secure loose items in engine compartment
- _ Gas cap if you refueled
- _ Clean windshield
- _ Brake pedal pressure
- _ Remove any interior items that became loose during previous session
- _ Restroom stop?

Treat the first lap of any session as a warm up lap. Drive and corner at moderate speeds to get heat in the tires and ease on the brakes to get some heat in them too. After the Checkered Flag slow down for a cool down lap.

A Learning Strategy for the On-track Sessions

Believe it or not, you are going to teach yourself high performance driving. Your instructor is there to guide you, and offer corrections. But you are the one driving the car, making the mistakes and learning how to more quickly correct your mistakes.

A good mantra for the day is **IN SLOW OUT FAST**. Be judicious entering a corner so you can hone the quality of your line, consistently hit a late apex, control your track out line, and maximize your exit speed. In other words, learn to exit the corner first.

In the morning the schedule looks like you won't have enough track time, and yet at every school a number of students don't even use all of their allotted time. It's tiring, and especially stressful when you are just starting.

Following the morning drills, during your first session your goals are to learn the line around the track and to show discipline by keeping your speed in check, and show that you are aware of what is happening around, and behind you.

During your second session, speeds will increase as you refine your line, start to build confidence, think quicker, and emphasize looking down the track.

By the third session you will be self-correcting, increasing speed and building a sight picture.

In the fourth session you should be able to call out your mistakes as your instructor does.

Other learning aids you can consider are to split the

third or fourth session into three sections. The first section concentrate on your visual senses, what are you seeing, how far down the track are you looking, how soon can you find the apex point of reference, or your track out. The second section concentrate on your hearing, listening to the engine, hearing the tires squeal, noting if the brakes make a particular sound. The third section concentrate on your kinetic sensations, notice the G-forces on your body, your grip on the steering wheel, are you using your knee to brace yourself in corners.

Discuss these ideas, or other goals with your instructor before going out for a session.

Flags and Boards

There are several types of flags and boards used to signal drivers of conditions on the course. Flags and boards are displayed at manned turn worker stations. Signal the worker with a wave to acknowledge you received the warning.

The condition being signalled is in effect all the way to the next manned station not displaying that, or any other condition. Meaning the same flag might be displayed or a more extreme condition may exist at successive turn stations, so do not return to high speed until you are past a manned turn station where there is no flag, or the green flag.

Flags are displayed either waving or standing. A waving flag means the condition is extreme. A standing flag means the condition is stepped down, or that you are approaching an extreme condition.

All described here may not be used at this school, but you should know them. At this school the meaning of some flags differ slightly from when used in racing. Following are brief explanations that relate to this school.

GREEN: Waved at start/finish or where the Course Marshal is to start a session, or after any safety condition to indicate that the course is again open and clear.

YELLOW: Danger, Slow Down, reduce speed and be prepared to stop, no passing. When waving indicates extreme danger. Again, no high speed driving from the turn station where the flag is displayed, past the incident itself, and up to the next manned turn station that signals the track is clear, i.e. no flag. There might be yellows or more extreme conditions at back to back manned stations.

DOUBLE YELLOW: Not used at this school. Displayed at all manned turn stations. Full course caution with deployment of the Pace Car.

BLUE WITH A DIAGONAL YELLOW STRIPE: Held steady or possibly rocked slightly to get your attention. Use the Slow right lane in the designated passing area.

YELLOW WITH RED STRIPES: Oil, or other debris such as a cone, car parts, gravel, grass, or any substances that may be slippery. Use extreme caution when you see this flag. Usually only displayed for two laps, then may be removed though the condition might still exist.

BLACK WITH ORANGE DISC: Meatball. Possible mechanical trouble of which driver may be unaware. Complete lap at reduced speed and report to hot pit area.

SOLID BLACK: Furled (rolled up) and pointed in your direction, indicates a driving infractions has been observed. This is a warning only and you do not need to exit the course.

If the flag is displayed unfurled (open) with a number board displaying your car number, you must report to the Chief Driving Instructor for consultation.

If displayed unfurled with the board "ALL" it means the session has been stopped. Proceed around the course at a reduced speed and come to complete stop in the hot pit area.

WHITE: Emergency or any vehicle that is travelling at a greatly reduced speed. You may pass the vehicle at a greatly reduced speed with extreme caution but do not return to high speed until past a manned station signalling the track is clear, i.e. no flag or green flag.

RED: Session has been stopped due to an extreme emergency condition. It may be used in conjunction with a waving solid black flag in the turns. Come to an immediate and controlled stop with regard to other cars. Clear the circuit as well as circumstances permit. Do not drive past a red flag.

CHECKERED: Indicates the end of the session. Proceed around the course for the "cool down lap" and go back to your paddock.

Boards that may be used:

"LIGHTS": Turn on your lights for safety.

5 MIN: Time remaining in your session.

"LL": Last lap. The checkered flag will be displayed on the next lap.

If You Are Going Racing

Once you have successfully completed this driving school, you can apply for an ICSCC (Conference) Novice Licence. Some people choose to repeat Driver's School more than once even though they passed. A Novice License makes you eligible to enter Conference Novice races held in conjunction with Conference Championship race events. Novice races allow you to develop skills in novice-only practice and race sessions. The novice races are held under the observation of IRR (International Road Racing) "Senior" license holders. These observers report to the License Director. Their comments on the novices' skill and behavior are considered when reviewing progress toward achieving an ARR (Area Road Racing) "Intermediate" License.

After you apply, there is a Novice manual similar to this manual that will guide you through the Novice Program. Many Senior drivers and Race Officials make themselves available to answer your questions, and to help you complete the Program. Their interest is that you become a safe, fast, and predictable driver.

Requirements for an ICSCC License

This is only a general description of the process. Check with ICSCC License Director and License Registrar for the official process.

You must be 18 years of age or older. You must be a current member of ICSCC, and a current member of an ICSCC Member Club or Affiliate club. You must complete a physical exam by your doctor and have them fill out the appropriate form. Send in the completed license application with two passport photos to the ICSCC License Registrar (not the License Director) along with the required fee. A License Application is available at this school. Forms are also available on the ICSCC web site: ICSCC.com, in .pdf format.

Once you have sent in your License Application, you will receive your ICSCC Novice License with your competition number (this is your car number), and the latest copy of the ICSCC Rule book. Make sure you read your rule book carefully and often. You are responsible for understanding and obeying all of the ICSCC rules and regulations.

Advanced Driving Techniques

If you have signed up early enough you may be able to teach yourself some of these techniques before the school. You do not need to know these to pass the school, but if you are going racing you will want to master them. If you haven't been able to master them do not try to learn them during your on-track sessions.

Double-Clutch Downshift

The purpose of double-clutch downshifting is to downshift as smoothly as possible, while upsetting the car's stability as little as possible. The goal is to match the engine speed to the speed the driven wheels are turning (actually matching the rotating speeds of the input and output shafts of the gearbox). Think of it as making two downshifts to get to one lower gear.

It is easier to do than to describe, but the process is:

Ease off the throttle while you . . .

Squeeze on the clutch

Shift to Neutral

Ease off the clutch while you . . .

Blip the throttle

Squeeze on the clutch while you . . .

Shift to the lower gear

Ease off the clutch while you . . .

Squeeze on the throttle

If you are skipping from top gear to a much lower gear, be sure to slow the car to a road speed that is compatible with the lower gear before easing off the clutch.

Until you are completely comfortable with the shifting pattern of the transmission, again as with all your control inputs, ease off the clutch in a smooth timed motion. If you've mistakenly selected too low a gear, then dump the clutch, the car will be traveling too fast for the driven wheels which will over-rev the engine, and with rear wheel drive, create low traction (oversteer) which can cause the car to spin.

Easing off the clutch allows you to re-depress the clutch when you hear the engine beginning to overrev, or the gearbox beginning to "over-whine." After you are comfortable with a shift pattern, then increase the speed you complete your up and down shifting.

On the street, provided you are not driving at an engine RPM that is unsafe for the lower gear you are shifting to, you can practice double clutch downshifting while maintaining a constant speed.

Heel and Toe

Heel and Toe allows you to brake and downshift at the same time. The process is the same as double-clutching above except that you are applying the brakes with the ball of your right foot, while you blip the throttle by rolling the outside part of your right foot.

The pedals have to be set laterally so your right foot can cover both the brake and throttle. The pedals must

also be set so at maximum brake pressure, the brake pedal is at the same height as the throttle pedal.

Modify the double-clutch description from above with the additional steps (pun intended) in italic:

Ease off the throttle then,

Squeeze on the brake while you . . .

Squeeze on the clutch

Shift to Neutral

Ease off the clutch while you . . .

*Blip the throttle by rolling the
outside of your right foot*

While still braking . . .

Squeeze on the clutch while you . . .

Shift to the lower gear

Ease off the brake while you . . .

Ease off the clutch while you . . .

Squeeze on the throttle

Ah, such poetry. *Going Faster* has photos of the process.

When you are learning, don't get so involved with trying, you forget to slow the car down enough to make the turn.

Conclusion

Regardless of your natural ability, how well you learn, or what driving level you aspire to, there is no replacement for seat time. Read as much as you can, study races live, or on TV, practice your skills set when ever you can, come work a corner. Conference and IRDC is the place where you can begin, and live racing for the rest of your life. Come join us.

Suggested Reading

There are many books, and some videos, available about automobile driving and racing. The ones listed below are recommended by those interested in helping new racers get started correctly. Anything written by Carroll Smith is worth the price, his books define the saw, *the more you learn, the more you realize how much you don't know*.

Every book has a slightly different tone, descriptive, and illustrative style. Asterisks represent eventual must buys numbered in order to buy. If you have enough time, get *1 or *2 to study before the ground school.

Driving

Chronological (sort of). The older books still have very relevant basic information and are a joy to read for those who like to know how the modern theories developed. Knowing your roots, so to speak.

The Racing Driver, Denis Jenkinson, (The best older text in many driver's opinions)

Sports Car and Competition Driving, Paul Frère

Competition Driving, Alan Johnson (Ignore his statement about not using the mirrors)

Castrol's Racing Drivers Manual, Frank Gardner (For those who like a dry Australian sense of humor)

*Drive to Win, Carroll Smith (What *Going Faster* gives in theory, *Drive to Win* gives in real world (sometimes harsh) experience. Overlook the implication that if you're not going to be an F1 World Champion don't bother racing. Not how to drive, rather what a driver "should do from the point of view of the car, the Engineer, Team Manager . . ." Just get it.)

A Twist of the Wrist, Keith Code and The Soft Science of Motorcycle Racing, Keith Code (Racing Motorcycles? They go fast, and stay upright. Great lessons on how to see.)

Bob Bondurant on High Performance Driving, Bob Bondurant School (There is a new fifth edition in color)

*1. Going Faster, The Skip Barber School (Book) (If you only bought one book, as of this writing, buy *Going Faster*; there is also a video by the same name)

*2. Winning A Race Driver's Handbook, George A. Anderson (Where *Drive to Win* occasionally thumbs its nose at Club Racing, *Winning* redefines what racing can be, that just participating, even at only the club level, even if never winning a race, just getting to drive and race at the peak of your ability is really winning)

*3. Think to Win, Don Alexander (You can judge this book by its title)

Local Authors

Inner Speed Secrets, Vols. 1-3, Ross Bentley & Ron Langford (least expensive and supporting your local authors)

Car Preparation, Designing and Building

The more you know about cars, the better you can troubleshoot handling problems. Besides these, there are also books available that cover building and preparing individual types (class) of cars. Try to look through them before buying to make sure they will be a value for you.

The Sports Car, Its Design and Performance, Colin Campbell

*Prepare to Win, Carroll Smith

*Tune to Win, Carroll Smith

Engineer to Win, Carroll Smith

Carroll Smith's Nuts, Bolts, Fasteners and Plumbing Handbook

Race Car Engineering and Mechanics, Paul Van Valkenburg (the later printings are updated)

*Four Stroke Performance Tuning, A. Graham Bell, 2nd Edition (thorough basic tuning practices in layman's terms)