

# METRO NEW YORK REGION PCA HIGH PERFORMANCE DRIVER EDUCATION INSTRUCTOR DEVELOPMENT PROGRAM MANUAL



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### Notice of Rights

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MNY PCA's HPDE Committee is due thanks for all the work its volunteer members perform in keeping the HPDE hobby to the fore and helping Metro New York Region PCA members and other like-minded drivers access the track hobby. In particular Chief Instructor, Bill Rudtner, and 2023 DE Chair, Marvin Rosen, must be acknowledged for supporting the creation and provision of a comprehensive Instructor Development Program for the Region.

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### Note

This document is quite long. Like HPDE instruction, it requires commitment. As an aspiring HPDE Instructor or Mentor you need to read and understand it. Like HPDE instruction, there is some repetition. This is largely intentional, so that various sections can stand alone as references to help instructor candidates learn and even experienced instructors will benefit from review. This is not a driving manual, it is a manual to inform instruction. It is assumed that anyone using this manual already knows how to drive to the required standard. There are plenty of resources on High Performance Driving, including [Bob Bondurant on High Performance Driving](#), [Send It!](#) by Dion von Moltke, [Speed Secrets](#), by Ross Bentley, and [Going Faster](#) by Carl Lopez. Despite the length, this manual is not comprehensive or definitive. It establishes a minimum standard of knowledge and accomplishment for being a MNY PCA HPDE instructor and a representative of the MNY PCA HPDE program. We hope you enjoy and learn from this outline to instruction which, like HPDE driving, is a lifelong learning process.

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## Foreword

For at least as long as the Porsche Club of America (PCA) has provided a track and driver education program, The Metro New York Region (MNY) has offered High Performance Driver Education (HPDE / DE) to teach and encourage its members to safely and competently enjoy their Porsche sports cars on track.

The MNY PCA HPDE program has evolved over time to accept non-PCA members and cars other than Porsches at its HPDE events. A focus on safe track driving in which participants demonstrate mutual respect, driving precision and smoothness, and adherence to program protocols has been consistent throughout the program's history.

In broad terms, PCA Regional HPDE programs are dedicated to development, evolution, and provision of safe track protocols, interesting and relevant classroom instruction, consistent run group driving standards, comprehensive student evaluations, an inclusive and supportive social community, excellent in-car instruction, and above all FUN! Great instructors are the key to meeting these goals.

As part of its HPDE program, MNY PCA has by various methods created instructors from its best drivers who were willing to give back to the hobby and the club by teaching others how to drive correctly on track. With the advent of PCA National Instructor Training, MNY began to offer annual one-day sessions to help regional instructors gain a degree of consistent training so they could comfortably coach and teach with any PCA Region.

The rise of for-profit track organizations and increased paths to the track for more drivers has reduced consistency of track driver education and consequent adherence to protocols. At the same time, serious and conscientious recruits to the hobby are seeking more and improved instruction and coaching. It has become apparent to MNY and other successful PCA regions that more modern and professional training and continuing education of instructors is required.

Provision of a consistent supply of excellent instructors with a like sense of purpose is a primary goal of the MNY PCA Instructor Development Program (IDP). Other goals include providing continuing education to existing instructors, strengthening mutual support within the instructor corps, and provision of the finest high-performance driver training the club can offer.

The MNY PCA HPDE Committee agreed during 2023 to launch a formal IDP beginning in 2024. This manual marks the beginning of fulfillment, based on study of other track organizations' instructor training. Particular credit must go to Niagara Region PCA's highly effective and comprehensive IDP, on which MNY has patterned its own. Further acknowledgement must be made to the Motorsports Safety Foundation, which has provided support and encouragement of this endeavor.

## Introduction

Why would anyone want to be an HPDE Instructor? Why do you want to be one? Is it sensible or desirable to sit in the right seat of a high-performance car driven on a race circuit by a person with little or no experience of track driving? Are you willing to sit right seat with drivers who have adopted bad track driving habits or perhaps have no discernible sense of car behavior, others who seem to show a greater harmony with the car than you, and drivers at all points in between? Are you able to rein back a driver putting speed ahead of safety and, worse yet, one that cannot tell they are so doing? Can you help any and all of them safely improve and have even more fun? Do you *want* to?

Good instructors do all these things, and more, at every HPDE.

If you don't know why, and if you aren't sure you want to, stop right now. If you want to instruct largely because of pride or perceived status rather than satisfaction, for lower registration fees and the ability to self-tech, or if you think you should teach simply because you are fast, *please* stop right now.

If you wish to instruct because you want to give back to the hobby and the community, because you want to repay the dedication of your own instructors, because you want to help keep everyone safer on the track, because you believe you have something valuable to teach and feel you can learn from the experience while gaining greater enjoyment as a driver, please banish all doubts and continue with us. If you enjoy teaching and derive pleasure from the improvement of those you are coaching, even if their skill and ability surpass your own, we want you to stick around, graduate, and instruct with MNY. If you believe being an instructor will allow you to better help secure and improve the community of instructors and track enthusiasts, you have a home with us.

We will support you at least as much as you support us. To begin with, we will let you in on a little secret: Instructing adds a new dimension of enjoyment to the track hobby. Instructing is fun.

Mentors, you must be prepared to help ensure that your candidates are both competent to instruct and that they are doing so for the right reasons. Mentors and other instructors must help determine whether candidates are having fun, and help ensure they do.

Instructors are vital to every serious HPDE Program. Instructors ensure the program can accept new students, help guide those students up the ladder into solo driving, and coach them through the solo ranks to become advanced drivers. Instructors are necessary to identify and help create new instructors.

Like track driving, instructing is not easy. It is challenging but rewarding. To instruct is to take a leadership position within a community of the most committed enthusiasts. It requires outstanding communication and observational skills. As a Metro NY PCA Instructor you join a corps that prides itself on a consistently improving record of safety, good and courteous track driving, and camaraderie.

Welcome, and thank you.

# Instructor Development Program Outline

## Statements of Intent

The **goals** of the Metro NY Region PCA Instructor Development Program are to:

- Identify and recruit instructor Candidates and Mentors;
- Train Candidates to be effective, conscientious HPDE instructors through mentored instruction of real students;
- Encourage and help all instructors to maintain their instructional skills with ongoing development;
- Provide instructors with information relevant to PCA and general HPDE instruction with regard to the evolution of vehicles and the track hobby;
- Foster an *esprit de corps* within the MNY PCA Instructor Corps;
- Increase the fun quotient for MNY PCA instructors, students, and other drivers.

The MNY PCA IDP is run:

- With the oversight of the MNY PCA HPDE Committee;
- In accordance with the best standards and practices of PCA;
- By the IDP Director with the aid of the Chief Instructor(s);
- As an opportunity for any PCA Member who has been identified as a Candidate and admitted to the IDP;

Candidates and Mentors will be vetted and chosen by the IDP Director in consultation with the Chief Instructor, Assistant (or Co-) Chief Instructor, Advanced (Black) Run Group Chief, and IDP Assistant-Director if those positions are filled.

Candidates will be chosen based on their ability to meet the criteria and fit with the program laid out below.

While actively participating in the IDP, a candidate will be treated and regarded as an instructor.

The size of each IDP cadre will be determined by the number of available Mentors, the number of events left in a training cycle, and the number of available positions.

A Candidate must attend an MNY IDP Seminar before participating as a Candidate in MNY HPDE Events.

Each IDP Candidate will be coached by a different Mentor at three (preferably four) different MNY IDP HPDE events defined as complete IDP events, which must take place at multiple (ideally three) tracks. Before graduating, a Candidate must have successfully completed at least six (6), preferably eight (8), full MNY IDP HPDE days. The day of PCA National Training does not count to this total.

Whenever possible, a cadre and each candidate will complete the MNY IDP during the course of a single season, although this is not a necessity. If completed over multiple seasons, the candidate must attend at least two consecutive IDP track events in each season, and all IDP Seminars. Candidates must attend all IDP Classrooms and complete every training session at each designated track event at which they are present.

A candidate will be deemed to have successfully completed the IDP if given a passing 'grade' by at least three different Mentors, a Chief Instructor, and the IDP Director, and will graduate as a Metro NY PCA Instructor. While they will enjoy the benefits of being MNY Regional Instructors, Candidates will be expected to successfully undertake the PCA National Training Program to become a PCA National Instructor – preferably at a Training run by MNY PCA – at their earliest subsequent opportunity.

It is intended that the MNY PCA IDP will gain recognition from other worthwhile Instructor Organizations and that MNY IDP Graduates will thus gain other certifications through the Program.

IDP Candidates will be expected to graduate within the minimum period of the curriculum as outlined below. Those unable to graduate will be allowed to complete two full cycles of the IDP before being asked to withdraw and reapply.

The MNY PCA IDP Manual will be maintained and updated by the IDP Director.

Suggestions for improving the IDP and its components will be particularly welcome from MNY PCA HPDE Instructors, IDP Mentors, and IDP Candidates.

## IDP Criteria and Requirements

### To be accepted into the IDP as a Candidate, a person must:

- Show firm desire to be an HPDE instructor and help others of all skill levels to learn;
- Demonstrate competent and safe advanced (Black run group) driving or equivalent. Note: the overall pace of a prospective candidate's driving is not a factor in their selection for the IDP;
- Demonstrate and explain the skills and knowledge expected of an advanced driver, demonstrating consistency, accuracy, good car control skills, and understanding of the physics involved;
- Display high oral and written communication skills, in English;
- Perform with consistently calm on track, demonstrating good decision making;
- Be a PCA Member in good standing;
- Submit to the IDP Director the completed Candidate Application Form before the start of the first IDP class in which the driver wishes to participate. The form requires the recommendation of three HPDE Instructors including at least one Metro NY Region PCA instructor with a PCA National Instructor Number and one Chief Driving Instructor from a PCA Region or other track driving organization recognized by MNY PCA.

### Requirements of Candidates participating in the IDP:

- Commit to and attend all required seminars, HPDE events, meetings, and class sessions;
- Own a functioning communicator;
- Fully participate in all HPDE events designated as components of the IDP with a car including a passenger seat and equal restraints on both sides that has passed tech inspection(s) and can drive on track at said events.

### To graduate as MNY PCA Instructors, Candidates will consistently demonstrate:

- The ability to:
  - Keep students safe;
  - Help students learn;
  - Help students have fun.
- Effective communication with students, including initial contact (email(s), phone call(s), five-minute interview), pre- and post-session briefings;
- Appropriate, understandable verbal and hand signal communication in the car;
- Oral and written evaluation at the end of the event;
- Instructional ability to:
  - Stay ahead of the student;
  - Stay in control of the student;
  - Diagnose and correct student errors;
  - Apply confirming and corrective feedback;
  - Set goals and assign "homework";
- Determine, teach, and coach the student appropriately for their experience level and competence;
- Determine and adapt to a student's preferred learning style;
- Maintain a positive and professional attitude with the student, with other drivers and instructors, with event organizers, volunteers, visitors, and track staff;
- Ability to stay current on car technologies, event rules and procedures, and track conditions.



Criteria for IDP Mentors:

- Being a proficient, above average Instructor able to teach candidates everything expected from them, as above;
- Willing and able to simultaneously and effectively work with and develop HPDE students and IDP Candidates at a driving event;
- Absolute commitment to attend HPDE events at which they will Mentor.
- Ideally be able to present material in a classroom/seminar setting and in-car to the current IDP Candidates.

## IDP Schedule and Curriculum

This section outlines the intended IDP schedule and curriculum for a driving season and IDP Seminar. As with drivers, no IDP Candidates are identical. The IDP Director and a Candidate's Mentor(s) may modify the plan for any Candidate(s) and driving event for the benefit of the Candidate and/or the IDP.

### Instructor Meeting

(March or April, in advance of the season's IDP Seminar and first HPDE):

The agenda will be set by the CI(s), possibly in consultation with the DE Committee. Presentation will be by the CI(s) and area specialists such as the DE Chair, Safety Chair, Registrar, and Run Group Coordinators. The Instructor Seminar will offer education and information about the upcoming season. It will lay out goals and expectations for the Instructor Corps. It will allow instructors at least one public forum to discuss the program.

It is expected that the season's IDP Candidates and some identified as potential Candidates will attend.

### IDP Seminar

(March or April, between the Instructor Meeting and the first HPDE of the season):

The IDP Seminar is required for all Candidates and first-time Mentors. Ideally, all the season's mentors will attend.

The IDP Manual will be provided to candidates in printed form. Candidates and Mentors will be introduced to each other. The season's IDP plan and schedule will be explained to Candidates. The classroom components of the IDP will be provided in a seminar format. The IDP Director will lead the teaching sessions, aided by the CI(s) and Mentors, each assigned specific modules to present. Some in-class role play will be employed to help prepare Candidates for their in-car IDP experience. Mentors will share their perspective on important aspects of being an instructor. Candidates will participate using their experiences as students and solo drivers, and provide feedback on the seminar itself.

### IDP HPDE 1 driving event

- For most candidates IDP HPDE 1 will be the first instructed event of the season. Ideally it will be a two-day HPDE. If it is a one-day HPDE it will be combined with the entire next instructed event to complete the IDP HPDE 1 curriculum.
- For the IDP, the primary purpose of this event is for the Mentor to oversee and, if necessary, demonstrate and teach the Candidate all aspects of instructing at a MNY PCA DE. To a great extent it is to be hoped that the IDP Seminar will have sufficiently prepared the Candidate so that the Mentor will be able to provide guidance and oversight.
- Candidates will be paired with a Mentor for the event and they will be assigned a single Green run group student for the whole event. The pairing will be made with enough time (at least one week, optimally two) for the Mentor and Candidate to communicate and also make decisions outlined below.
- Candidates will attend classrooms and meetings designated by the IDP Director.
- Mentor and Candidate will work together, sharing most interactions with the student. The key exception will be in-car sessions since only a single instructor can occupy the car with a student. Mentor and Candidate will take alternating in-car sessions. The Mentor will decide who takes the first session; this will tend to depend on whether the Mentor believes the Candidate or the student needs greater initial assessment. In the case of a true first-time Green Student, the Mentor *must* take the first in-car session.
- Mentors will decide whether they or the Candidate will take the lead in contacting the student before the event and the initial interview at the track. Whomever leads will be responsible for fully including the other in all communications. It is advised that the Candidate take the lead.
- The in-car instructor is responsible for the pre- and post-session discussions with the student.

- Candidate must provide the student a Demonstration (Demo) Ride at least once during the event; preference is once per day.
- Mentor and Candidate will write the student's online evaluation together during the afternoon of the final day. The Mentor will take the lead in discussing the evaluation with the student. The Candidate will participate.
- Mentor will coach and provide feedback to the Candidate throughout the event. Candidates and Mentors will ride together, each driving at least one session during the event. When the Mentor is driving, the candidate will be expected to coach.
- Late on the final day, the Mentor and Candidate will discuss the latter's experience in the IDP.
- Mentor will complete their evaluation of the Candidate in consultation with the latter, and provide the IDP Director with a written evaluation thereof before departing the event.

#### IDP HPDE 2 driving event

- Candidates may not begin IDP HPDE 2 until they have completed the IDP HPDE 1 driving event. IDP HPDE 2 should be a two-day HPDE. If it is a one-day HPDE it will be combined with the entire next HPDE to complete the IDP HPDE 2 curriculum.
- If the Candidate's first IDP event was more than one day and if this IDP HPDE is more than a single day, the IDP purpose of this HPDE is for the Candidate to have different but typical instructing experiences.
- Candidates will be paired with a Mentor for the event.
- Candidates will attend classrooms and meetings as designated by the IDP Director.
- Candidates and Mentors will ride together, each driving at least one session each day.
- In the first session that the Candidate drives, they will provide the Mentor a demonstration ride as if the Mentor was a Green run group student with no track experience. In the second session that the Candidate drives, the Mentor will coach – not instruct - the Candidate on their driving and demonstrate coaching by so doing. When the Mentor drives, these roles should be reversed. *(These sessions could be performed at a Solo DE with agreement of the IDP Director, the Candidate and the Mentor.)*
- The Candidate should be assigned by the IDP Director, CI, or Mentor to check out solo drivers new to MNY PCA HPDE and help ensure they have been assigned to the correct run group.,
- The Candidate should be assigned by the IDP Director, CI, or Mentor to coach track drivers in the Blue (Beginner Solo) and/or White (Intermediate Solo) run groups. *(Some of these sessions could be performed at a Solo DE with agreement of the IDP Director, the Candidate and the Mentor.)*
- Mentor and Candidate will discuss Candidate's experience coaching at this IDP event.
- Candidate should provide a student a Demo Ride to a driver other than their Mentor at least once during the event; preference is once per day.
- Late on the final day, the Mentor and Candidate will discuss the latter's experience in the IDP.
- Mentor will complete their evaluation of the Candidate in consultation with the latter, and provide the IDP Director with a written evaluation thereof before departing the event.

#### IDP HPDE 3 driving event

- This will ideally be the next consecutive event of the season after IDP HPDE 2. This *must* be at least a two-day HPDE. By this point the Candidates will have completed at least four full days of IDP HPDE training.
- The purpose of this IDP HPDE is for the Candidate to demonstrate their ability to complete all essential aspects of instructing at a MNY HPDE event.
- Candidates will be paired with a Mentor for the event and assigned a Green, Yellow, or Blue run group driver. depending on the IDP Director's recommendation and the program's needs. In most cases it will be a Green student.

- Candidates will attend classroom sessions and meetings as designated by the IDP Director.
- Mentor and Candidate will work together, both present with the student at all times except in-car sessions. This includes all pre-and post-session discussions.
- Candidate will take the lead in contacting the student and the initial interview at the track, including the Mentor in all communications
- The Mentor will determine which sessions will be instructed by the Candidate. In most cases, the Candidate should instruct the student's first session on track each day, the Mentor should instruct the second session. The in-car instructor is responsible for taking the lead in pre- and post- session discussions with the student.
- Candidate must provide the Student a Demonstration (Demo) Ride at least once during the event; preference is once per day.
- Candidate will take the lead to write the student evaluation the afternoon of the final day.
- Candidate will take the lead in discussing the evaluation with the student, with the Mentor present.
- Mentor will coach and provide feedback to the Candidate throughout the event.
- Mentor and Candidate will drive together in their respective cars to coach each other and for the Mentor to evaluate Candidate's driving.
- Mentor will provide the IDP Lead with an oral and written evaluation of the Candidate, preferably by the end of the event's first day. This will include a recommendation for the level of student the Candidate will be assigned in their final IDP HPDE Event.

#### IDP HPDE 4 driving event

- This may be any event following the Candidate's completion of the prior three IDP HPDE driving events. This may be an HPDE of any type so long as it comports with the recommendations for the Candidate following their IDP HPDE 3. By this point the Candidates will have completed at least six full days of IDP HPDE training.
- The purpose of this IDP HPDE is for Candidates to demonstrate the ability to complete all aspects of instructing at a MNY HPDE event and to ensure they have instructed or coached at three different tracks.
- Candidates will be paired with a Mentor for the event and assigned a Green, Yellow, Blue, or White run group driver depending on the IDP Director's recommendation and the CIs' needs at the HPDE.
- Candidates will attend classrooms and meetings as designated by the IDP Director.
- Mentors will provide oversight and guidance for Candidates based on their interaction prior to and during the HPDE and the IDP Director's recommendation.
- Candidate will be responsible for all communication with student and keep Mentor informed.
- Mentor will observe Candidate's first interaction with "student" at the event.
- Mentor will be present and observe at least two of Candidate's pre- and post- in-car session discussions.
- In consultation with Candidate, Mentor will determine whether to take an in-car session with Candidate's student.
- Candidate must provide their student a Demonstration (Demo) Ride at least once during the event; preference is once per day.
- Mentor and Candidate will ideally ride right-seat with each other and provide coaching or commentary.
- Mentor will provide the IDP Lead with oral evaluation of the Candidate by the end of the event's first day.

Note on PCA National Training: it is expected that MNY IDP Candidates will successfully complete PCA National Training, preferably with MNY PCA, during the same or next season in which they complete the MNY PCA IDP (the same or next IDP cycle). Successful completion of PCA National Instructor Training prior to the end of their successful completion of the MNY IDP is not a guarantee of graduation from the MNY IDP Program.

## **Being an Instructor**

MNY PCA Instructors are responsible for providing a safe, fun, structured, and controlled teaching and learning environment at HPDE driving events in a courteous, friendly, and professional manner. Of these, safety *must* be most important.

The MNY PCA HPDE program endeavors to help all drivers improve their driving skills, and acquire a better understanding of vehicle dynamics and driving safety. This is especially so for entry-level students, those in the beginning run groups who are only permitted on track with an instructor.

The primary focus of most instruction is instructed students, but our solo drivers are no less important and deserve coaching from our instructors as frequently as possible. That includes instructors. Throughout this document reference to "student" means whomever is driving or otherwise taking instruction or coaching when you or another instructor is instructing. This includes you, when another instructor – perhaps your IDP Mentor - is coaching you.

Every one of our instructors is expected to adhere to set guidelines that help ensure the success of our events and attendees. Paramount to this is that students have a safe, fun, and memorable time during which they learn to drive ever better on track.

The criteria listed earlier in this manual describe what Instructors minimally need to do – what is required to graduate from the IDP. We expect that all instructors representing MNY PCA will consistently demonstrate a variety of attributes that characterize a good Instructor.

**Positive Attitude** - Always encourage your student. This is supposed to be fun; make it so. Send them home with a sense of accomplishment, a smile on their face, and an intention of returning to MNY PCA HPDE. There will be times when you need to be critical and even forceful, but you must balance that with positive or confirming reinforcement. Try and catch your students doing something right and let them know. A compliment at the right moment on track can do wonders. When debriefing, be as constructive as possible, versus being overly critical. Help the event be safe and successful by being part of the solution to problems. Remember as well: you should be having fun while instructing. Let the student know that too.

Be an ambassador for the hobby, event, and club. A positive attitude is contagious!

**Professionalism (Being Responsible)** - You are perceived as an authority figure and expert. Students will look up to you as a role model. They will model your actions and attitudes on track and in the paddock. For an instructor, cognizance of this is part of your situational awareness. Be calm and relaxed. Instructing is not about your speed, race training, or showing off. You are teaching your students how to handle all aspects of HPDE.

Smile, don't disparage, and always keep in mind to whom you are speaking. We do not all share the same sense of propriety and humor, and it is best to err on the side of politeness and care. Criticism should be gentle, constructive, and concise. Use discretion in discussing students, other drivers, and participants. The paddock and the DE hobby are surprisingly small communities. Work cooperatively with colleagues, especially in handling on-track situations.

You must uphold and abide by all rules and regulations set forth by MNY PCA governing our HPDE events. Do not undermine any facet of the event by freewheeling or putting yourself first.

**We are a Team.** If you feel that a policy or decision is unfair, unwise or unsafe, or have an issue on or off track that cannot be resolved quickly and amicably through mature conversation *please* bring it promptly to the attention of a

responsible organizer: a DE Committee member, usually a CI or Run Group Leader (also Run Group Coordinator [RGC]). At an event the final arbiter of issues will be a CI, Registrar, or the person designated Event Chair in consultation with each other if necessary.

When you register as an instructor, you must uphold your commitment, attend, and instruct to the best of your ability. Poor weather, a broken car, or a sense of ennui are not acceptable reasons for breaking your commitment. MNY PCA is notably flexible and lenient about emergencies and we will work with you when you have a justifiable reason for not attending or instructing. Similarly, we will be very grateful when you can step in and help a fellow instructor and the program when such emergencies arise. Partly for this reason, please do not plan to leave an event early. You may be needed to fill in for someone who is incapacitated.

**Be organized.** This sounds simple and by the time you begin instructing you will probably have your own track routines set. As an instructor, your routines will probably have to change. Your student's needs must be taken into account along with those of other students and instructors. You may never have been on track as many sessions in a day as you will when instructing. Your body may suddenly be subjected to twice as much track time as before and you will be involved in discussions, which can cause a time crunch. Your student comes first. If track time is lost it *must* be yours, not theirs.

Arrive at the track in time for Registration and Tech (as applicable) and well ahead of the Driver and Instructor meetings. Come well rested and ready for a positive experience. Make sure your car and equipment are fully prepared, including having your communicator charged and ready. Always bring spare batteries. Be prepared to remain at the track until all of your responsibilities for the day and event are fully discharged.

The student is your customer, your top priority for the event. Even though you should have communicated in some detail beforehand, meet your student as soon as you can. Treat them as an equal. Take an interest in them and their car. Be inclusive – are they alone at the event? Invite them to join something social after the track goes cold, introduce them to people in the paddock. If it is their first time ever, they will be completely unfamiliar with the processes and rhythms of an HPDE, and possibly overwhelmed. Please help them. You are creating camaraderie and welcoming them to a community, teaching a culture. Be a good listener and observer. Please always invite them back at the end of each event.

Ensure that you fully understand all on-track exercises and protocols for each day. **Never** miss a Driver or Instructor Meeting.

**Always be on time** for your student's sessions and all meetings. Agree on a time and location to meet for staging before each session. Ensure you go over your student's car prior to their first session, and check again through the day. Your safety is important. You need to feel confident in their equipment and your understanding of it. You ought to know something about their own understanding of it. Proper student debriefs are vital but not always convenient. MNY PCA very rarely assigns instructors more than one student, and then only with instructor agreement, but you may be asked to coach a solo driver or two even on a day when you are instructing. Arrange with your student to make time afterwards if necessary to hold or conduct a full debrief. Take the time to work with them off track, and be available to answer their questions. Be sure to fully complete their online evaluation forms.

Sign-off is not kiss-off! The student is your responsibility for the entire event. Even signing off a student does not release your responsibility for their safety and behavior on track. A CI's or Mentor's agreement with your sign-off does not reduce your responsibility. A student who is signed off to run solo should have an instructor in the car at some time during each day, if only to ensure continued safety and competence. It does not need to be for a full session. With a CI's or Mentor's agreement you may choose to take your own car on track to watch a signed-off student. You will often see instructors watching newly signed-off and promoted students from their own cars or from other vantage points around the track.

**Take Charge** - You are responsible for your student, for another person's well-being, education, and enjoyment as well as your own. Furthermore, you are taking some responsibility for the other people on track with you by ensuring your student is driving safely.

**Establish authority.** Firmly insist, rather than asking. Make sure your directives are clear, concise, and timely.

Set clear goals for your student before each run, and in the debrief after each session if possible. As they gain experience and competence, your students will help set their own goals. Assign "homework" between sessions.

Be careful not to mentally overload your student.

Remain engaged with your student at all times. Make sure neither you nor they lose focus. It is surprisingly easy for some people to become distracted or mesmerized even in a high-performance driving situation with which they are unfamiliar. You and they must maintain concentration.

De-emphasize speed. Allowing a student to over-drive means the instructor is not in charge. The student cannot learn while driving at their limit. De-emphasize speed for the sake of learning and safety.

Most students are seeking guidance and willingly follow all directions. Some are less pliable, and in rare cases may be difficult. Students are not allowed to compromise safety: theirs, yours, or anyone else's. In virtually all cases, you will have a sense of your student's attitude before you get in their car. Ensure they understand your attitude.

You are the boss. When experiencing push back from a student, the proper way to resolve problems is not on a hot track, it is parking in the pits. If they are intransigent, you may end their session early by parking in the paddock. Unresolved issues should be taken up with a CI or RGC.

Instill confidence in your students. You are their primary cheerleader and advocate.

**Continuing Education** - Always keep improving your own skills as a driver and teacher. Keep current. Learn new teaching techniques and philosophies. Learn about new cars and their characteristics. Learn about cars other than your own. Other instructors have much to teach; engage them in peer mentoring. Solicit and accept feedback from your students, other Instructors, CIs, your own evaluations. Remember to enjoy and learn from those with whom you share your experience and enthusiasm!

An effective MNY PCA HPDE Instructor embodies all the attributes and traits outlined above. It requires ongoing desire and commitment to help your students and yourself at each and every MNY DE.

**A Note on Speed and Aggression** – it is axiomatic in instructor training and throughout this manual that we must de-emphasize speed. We repeat that HPDE is not racing, it is not competitive, and this document refers to the activity about which we are so passionate as a hobby or enthusiasm, not a sport. We actively discourage reference by those new to what we do on track as racing, and we note that uncontrolled speed is very unsafe. Speed is ignored as a primary goal and may even come across as something bad.

Reality check: we all understand that speed is not in and of itself bad, and that speed is clearly one of the things that makes this hobby as seductive and enjoyable as it is. Drivers *do* to some extent necessarily measure their progress through their lap times, sector times, corner entry and exit velocities: speed. We must train drivers that speed is a by-product – the reward – for smooth, precise driving. For one thing, this is true. For another, we must focus them on good driving rather than fast driving to improve their learning and to maintain safety as the top priority. The speed

*will* come, but it must be controlled and it must come safely. To paraphrase three time F1 World Driving Champion Sir Jackie Stewart: “to drive fast, drive slow.”

Similarly, we refer to aggression as a bad thing. Obviously, some form of aggression is needed to progress in this activity. Without some form of aggression any driver will eventually plateau and never move further forward. Improvement *is* the goal. “Aggression”, however, has many connotations that are antithetical to good and safe track driving. An aggressive attitude is not desired on the track or in the paddock, and the word rightly implies anger and a lack of control.

The required “aggression” is better referred to as “hunger” or “ambition”. Hunger and ambition have a focus, suggest purpose, and an end point. Hunger and ambition connote calm, control, and positive progress.



## How to Instruct

Can this really be explained in a few pages of text? Probably not. It's not even likely it can all be imparted well through role playing exercises. That is exactly why the MNY PCA IDP is mostly about development of real experience, with real students, in a variety of cars, at multiple tracks. Nonetheless, some basic guidance is necessary. To begin, you will not be teaching your student to drive. You should be teaching them to drive better, and hopefully well. Above all you are teaching them to apply and broaden a skill they already have in a radically different environment than they are used to. Ask yourself: how is track driving different to street driving? The multiple arising answers and philosophies are at the core of what an HPDE instructor teaches.

### Short Instructions for Instructors

*Safety. Safety. Safety.*

Safety is MNY PCA HPDE's first priority. It must be yours.

Think Safety – ALWAYS!

*Have a plan!*

Instructing cannot be done *ad hoc* (by the seat of the pants). Every one of the many elements mentioned in this manual will be rendered far easier for you and the student if you have a plan. In the absence of an initial plan, draw from the Short and Detailed Instructions for Instructors sections of this document. They are written in hope of simplifying your tasks and keeping you, your students, and other drivers safe and happy.

*Do not overload the student!*

Remember that a student has an enormous amount to absorb during the course of a DE. The newer they are to the hobby, the more they must absorb quickly. Much of what is basic logic and second nature to you now as a track driver wasn't when you began. It's probably something of a mystery to your students, perhaps especially if they think it isn't.

Track instruction is increasingly bi-directional communication. At the beginning of your student's experience with the hobby you will be telling them what to do, and increasingly asking them what they are doing and why. As students progress, they will take more and more of the initiative in conversation, they will ask more questions and make more comments. When they have been soloed and you coach them, the instructor's role changes to one of greater assessment and advice with more input from the driver. If a student is reluctant to speak or unable to express themselves, you will often be able to provoke communication by asking questions. Be aware: people learn in different ways, and not all communication is verbal. Part of an instructor's job is to determine how best to communicate with the student.

*Communicate!*

Get as much information and understanding as reasonably possible prior to the event. Conversations by phone, email, or text before the event are invaluable. This is covered in some detail below.

During your first conversation with your student, generally ahead of the event, make sure they understand the Tech Form. Most of the Tech items are straightforward and self-explanatory, but you may be surprised by how little your student understands them or knows their car. This goes for advanced as well as novice students. It even applies to some solo drivers. It *cannot* apply to you or other instructors. Never make assumptions, always seek discoveries.

Even if they have taken it through the Tech line, help your student check their vehicle for loose objects and review basic mechanical components of the car. Part of the reason for this is to ensure your and their immediate safety, but it is also to instill the habit in your student. Are the wheels torqued correctly? Are the tire pressures set properly? Are the brakes in good working order with enough life on pads and rotors? Are their tow hook(s) in place? Never second-guess safety; don't make unwanted discoveries on the track. If in doubt, check with the Tech Chief or Safety Chair, or failing that a CI or RGC.

Even if your student has just come from a classroom session, and particularly if you did not attend with them, quickly review the flags and flag stations. Make sure your student understands what flags might be encountered before going on track. During the first day, if possible in the student's first session, point out all manned flag-stations. Ask a more advanced student to identify the flag stations for you during an early session, and whether they are manned. Even a novice should be able to tell you where the flag stations are during their first event. Advanced students must know their flags – meanings and required actions - without hesitation. This is a requirement even for being allowed to run solo in the instructed run group.

Tracks have emergency exits and "pull offs". Of the tracks MNY PCA regularly visits, this is especially true of Watkins Glen. Explain and identify them for your student while on track, ideally during their first day.

Review safety and emergency procedures. How do we deal with two wheels off? How do we deal with four off? Is the response to a slide always the same? What do we do in case of a spin? What do we do in case of contact? Is there a circumstance in which it is OK to exit the car when stopped on track, and if so when? Demonstrate passing signals, and have them show you how they will give them. What other emergency protocols exist? Where are the better and worse places to go off on track? What's the plan?

Be certain your student understands and practices all on-track protocols and help them through problems. Include best practices as well as minimum requirements. **It is an instructor's responsibility if their student fails to give passing signals, fails to give them properly, "drag races" a car they have pointed by, doesn't follow pit-in or pit-out procedures, passes without a point-by or otherwise unsafely, or follows another car too closely.** Consider what other on-track protocols and best practices exist and feed them into the student's actions as appropriate.

Stress the importance of a prudent out lap to (re-)establish the line, vision, heat tires, test brakes, and to build smoothness and consistency for the session.

Help your students be aware of traffic. All driving is a 360° activity, but awareness on track is even more important since things are generally happening more quickly and often more closely. Teach your student to be fully aware of their environment.

Teach your student to be aware of changing track, car, and driver conditions and how to adjust. To best accomplish this, get a sense of what the student is already noticing: ask questions and have them safely respond.

Help your student safely complete any driving exercises. To do this you must know about the exercises, which in turn means you must pay full attention at the Driver's and Instructor's Meetings.

While on track, coach your student on car position and pace, input smoothness, turn-in, braking points, track-out, and where to look. Remember, the newer a student is the less they can absorb at a time. Be sure not to overwhelm them; assess their driving and prioritize on what they need direction.

Leave your ego at home, and keep that of your student in check if necessary. HPDE is **NOT** racing. Everyone here is still learning, including you and every other instructor.

**De-emphasize speed.** It is impossible to overstate the importance of this, especially with students. Speed will come with good driving shown through awareness, smoothness and accuracy. Speed in the absence of these traits is unsafe. Allowing a student to over-drive significantly increases the chance of an on-track incident, and it indicates the instructor is not in charge of the student.

It is your choice whether to allow a student to record their sessions on video. If you do, ensure the equipment is properly secured. Do NOT allow a Green student to time themselves. If they have timing equipment permanently installed, ask them to switch it off. It is your choice whether to allow a Yellow student to time themselves, and if you do they cannot be allowed to place the readout so it is visible to them on track. Best practice is not to allow Yellow students to time themselves on track. If Blue and White drivers are timing themselves on track, consider whether you are comfortable allowing them to see the readout while driving. While live and predictive timing are useful tools in many ways, there is no need for them in a Novice/Beginner Student's car and they will likely distract and increase aggression. For Beginner and Intermediate Solo drivers there is value to timing, so long as it isn't distracting from your coaching, their learning and driving, or if it poses a safety risk. If an Advanced Driver is distracted by timing equipment, one must question whether they are in the correct run group.

Have a post session discussion of any potential safety issues you and your student may have experienced to model appropriate behavior. Include any such behavior you may have seen by other drivers – without disparagement. Include in the debrief as many positive things as possible that you noted in your student's driving, and gently note areas for improvement. Set goals for them for the next session and the remainder of the HPDE. As they become more experienced they can help you set the goals and priorities. When possible, employ Socratic method: pose questions to get them to explain what they experienced, what they think was good, bad, and what they think can be improved and how.

## Teaching and Learning

### How Adults Learn

Instructors must think of themselves as teachers and coaches. Some lessons and coaching sessions are given in the classroom. Many are given in the paddock. Obviously, the greatest number are given one-on-one in a moving 'classroom' at high speed. It is important to understand how people learn, how to teach adults, to effectively help the student develop skills and knowledge.

### Instruction Levels

There is a difference between teaching, instructing and coaching.

- Teaching is information input. It is usually done in a classroom, but some information can only be imparted in the car. You will primarily teach novice instructed students – those in our Green run groups.
- Instructing is a combination of teaching, correcting or giving feedback, demonstrating and coaching. This is what you will do most often, applying to those in Green, Yellow, Blue and sometimes White run groups.
- Coaching is drawing out information or skills that the student already has, the potential of which is unmet. It involves asking questions, generating thoughtful discussion, encouraging or asking the driver to "show me". Coaching is typically used with a better intermediate or advanced driver, those in the White, Black, and Red run groups.

### Learning Levels

When to teach, instruct, or coach is driven by the student's "Level of Learning" and their driving, often explained as follows...

- Unconscious Incompetent: Typical of a novice, they do not know what they do not know. This is everyone's starting point in any new activity. Help your student understand that track driving is different and do not expect high performance early on. This student requires a lot of teaching.
- Conscious Incompetent: Hopefully after one or two sessions, or at most by the end of their second day, a student is aware of how much they do not know and how difficult performance driving is. You will begin to instruct rather than teach this student.
- Conscious Competent: A beginner or intermediate student begins to understand what to do and will be consciously applying the instruction you provide. A student at this level will not apply everything correctly, and may require substantial repetition of some techniques.
- Unconscious Competent: An advanced student consistently drives well at a subconscious level with little, if any, extensive conscious thought. They may not be unconsciously competent in all aspects of track driving, but their essential smoothness and precision is consistent and effortless. Unconscious competence does not mean a driver is not thinking and concentrating. Coaching is appropriate for a driver at this level.

An Instructor constantly assesses their student's general Learning Level, their specific skill or knowledge, during each session of each day. An instructor should also be charting the student's progression, and the degree to which they are making connections between various techniques. A driver may be unconsciously competent at some things while consciously competent and unconsciously incompetent at others. There is a large continuum.

Assessment of a student's Learning Level is aided by context. You must stay aware of what the student is learning in class so as to not confuse them with your instruction. Ideally you will attend classes occasionally and remain fully aware of what our classroom instructors are teaching, and when. You should at least ask your student to review what they most recently learned in class. This also helps you know what to reinforce and check in a timely manner. Our classroom instruction is improved by your observant feedback of how and what the attendees are learning.

## **Learning Fundamentals**

“Fundamentals for Learning” are important basic conditions for learning. As an instructor, you should integrate them with how you teach and relate to your student. Learning is otherwise more difficult, if not impossible, especially for the novice or less experienced student potentially being overwhelmed with information.

- **Motivation:** Your students have to be ready and willing. They need clear objectives and purpose. Keep them aware, and focused on improvement. (It may seem self-evident from their presence that a student is interested in HPDE, but this is not always exactly true, and motivation is important to learning.)
- **Repetition:** Practice is necessary. We are always working on consistency. Don't practice until they get it right; practice until they can't get it wrong.
- **Fun:** Enjoyment is core to good learning. Keep the feeling light and positive.
- **Correct technique:** It is vital. Bad habits are hard to break, and good habits should be easy to learn. Reinforce positive performance without undue concentration on shortcomings.
- **Vivid experiences:** these imprint deepest and are learned best. Errors are learning opportunities. Be aware some errors cause psychological scars; help safely ameliorate them.
- **Most recent experience:** Recency correlates to memorability. Be on top of the situation – ahead when possible - and keep your instruction in the moment. Work on recurring problems as they arise rather than later when they have faded from recollection.

① Do you have any bad driving habits? Have you an example of a track error causing a psychological scar and how it was repaired? Do you know the last thing you *learned* on track?

## **Learning Process**

Your student will go through a circular, self-confirming “Learning Process” based on learning through experience:

- Have an experience;
- Think about the experience;
- Develop ideas and conclusions;
- Test conclusions in a new experience.

The Learning Process is scaled and will repeat over the course of a season, event, session, lap, or even between two corners. You need to be aware of the process your student is experiencing. Safely solicit feedback in real time and after sessions. Patiently help them as concisely as possible. Each student's progress will be different. Challenge your student with appropriate and attainable goals based on your observation and through discussion.

Some issues will persist in the early stages of the HPDE learning process. Identify the core issue(s) involved, and work with the student to find solutions. This process-oriented method of problem solving will serve them well throughout their driving career.

① Can you think of some potential persistent issues students may encounter? Did you encounter any as you learned through HPDE? Do you still have some persistent issues or concerns, albeit minor and hyper-specific?

The more thought you can give to these matters prior to observing each student, the better and more quickly you can help address them. Be careful to get to the root cause of any problem a student is having. It is not worth spending time trying to fix a mis-diagnosed problem that doesn't exist. Always try to include the student as a partner in their educational process. Remember that they may know themselves better than you know them.

## Learning Styles

Match yourself to the needs of the student. “Learning Style Theory” suggests that different students respond better to different inputs because we do not all learn the same way. Please remember: people often communicate using the same method by which they best learn.

- **Visual learners** do best by observing. Hand signals or even demonstration rides (more later) can be effective. Early use of landmarks may be indicated. Use of track maps and other visual aids can enhance off-track discussions.
- **Auditory learners** learn best by listening. Words in the car must be relevant to the moment and brief. Pre- and post-session discussions can be more extensive, and will be important for this learner.
- **Reflective learners** do best by thinking and modeling. “Homework” assignments such as mental imaging between sessions can work for them, so imagining perfect laps with all required inputs at appropriate locations can be effective. Have the student talk you through a lap offtrack, and when they can do so safely, while driving.
- **Physical, experiential or kinesthetic learners** learn by doing. The student is driving the car; heightening their awareness and sensitivity to what the car is communicating and how it responds to inputs may work best. Have this student focus on what their senses are telling them, and let them know what you are sensing and why.

People learn through a combination of these styles; you need to determine which are dominant. Remember that they may be able to tell you what kind of learner they are; remember also that they can be wrong. We tend to teach in our own primary learning style. Among your most difficult tasks may be to break that habit and teach by whatever method the student best learns. This saves time and reduces stress. It also improves bonding.

① What kind of learner are you?

Instructors must be alert to the possibility of inherent barriers to learning. This may be an actual learning disability such as dyslexia, but more likely it will be that a student is hard of hearing, has sight issues such as color blindness, and perhaps even a physical disability. You should be aware of such barriers through your initial email or phone contact before the event.

Every student at an HPDE event can and will learn if their instructor understands how they learn.

## Learning Curve

We are all conceptually aware of the “Learning Curve”, the graph tracing our skills and knowledge steadily increasing as we learn. Except, it isn’t steady. The curve is rarely a continuous upward path, there are ups and sometimes downs; the curve is more accurately a series of unequal-length steps. Rapid early improvement is typical of a beginner, usually followed by a plateau. If a student is not frequently participating in HPDE, the upward traces in the curve will tend to become shallower and the plateaus longer. The curve can trend down through forgetting or adoption of bad habits, and even through a lack of coaching – especially among Intermediate drivers. The early intensity of the learning curve’s upward trend also diminishes because the initial, basic skills are easier to develop than the more specific, nuanced, and exacting improvements available to the more advanced driver.

Every student will experience ebb and flow. Rapid early improvement breeds confidence and, even with better than average skills, at some point every student will struggle with the new speed and higher forces that good technique creates. Suddenly, what worked well seems not to work at all and frustration can set in. It is your job as instructor or coach to explain that proper technique has created this situation. There is a large upside. Keep your student focused on the goals. Evaluate whether and how to recalibrate expectations while noting that plateaus are proof of progress. Plateaus are also a time to enjoy one’s skills and prepare to progress still further.

Other reason for slowed improvement include a student's satisfaction turning to complacency, or even a failure to understand that they are not yet at the highest level they can attain. Some students may become bored, some scared, and some may even consciously or unconsciously decide that they are happy where they are. Unfortunately, complacency in this hobby tends to lead to diminished safety. A driver need not burn with a desire to go faster, but they do need to want to drive better – from which more speed will invariably result. It is your job as an instructor to help your student keep striving for their real, higher limits.

Conversely, the curve may abruptly jump upwards. Occasionally a driver will sometimes suddenly find they “get it” and have solved an issue of technique that has been dogging them for some time. This often relates to braking and cornering, and may even relate to a single corner on a particular track. Epiphanies usually result from intense and possibly tedious effort, perhaps during a period when the student believes their improvement has “stalled”. As an instructor one wants to recognize a driving epiphany and capitalize on it through praise and practice. Help your student repeat the thing that went right until it becomes unconscious and, usually, begins to transfer to other elements of their driving. Be sure to praise the improvement and the consequent repetition, remembering this is not an easy hobby and ‘sudden’ improvement is usually the reward for hard work.

We want the student to want to do the hard thing consistently, easily, gracefully, and efficiently. This should also continue to be your goal as a driver, no matter how good you already are.

### **Barriers to Learning**

Instructors must be aware of “Barriers to Learning”. We develop various ways to cope with challenges, and good track driving is a challenge for even the most natural drivers. It is your job to observe these common self-defeating behaviors, help the student get past them and back to successful learning. The most common barrier to learning among novices may be an unfounded belief that track driving is easy, and the emotional consequences of realizing that it is not. Other barriers include:

- Fear which can be of the unknown, of failure, of physical harm, and of appearing scared or foolish;
- Stress and Anxiety going hand in hand with challenge. They may hinder learning, or even freeze the student's progress;
- Self-Respect suffering in the face of repeated difficulty, it correlates with confidence;
- Defense Mechanisms which include: rationalization (justification of failure); resignation (excuses for failure); aggression (complaining, angry driving); flight (giving up);
- Impatience, Overconfidence and Resistance to Change because your student is probably successful and accomplished in other areas of life. Their self-image is probably of an expert rather than a student who may experience failure as they progress.

Part of your job as an instructor is to recognize a student's barriers to learning and help surmount them. High confidence in and good rapport with you will simplify the task.

Reassure the student that your job is above all safety and their development as a driver, for their enjoyment. Ensure they understand that they are your first priority at the event. Remind them that this activity is not easy! It takes seat time, instruction, and practice to learn. Mistakes are natural and inevitable. As needed, check their ego, bearing in mind this sometimes means it needs a boost rather than a reduction. Mistakes are a necessary aspect of learning.

Always have a plan before going on track. Know what you and the student will be working on each session. Do not lose focus on the plan as the session progresses, but be aware plans may need to evolve. Once a student is consistent with a new skill, insist that skill level remains high as they drive in later sessions. If a driver regresses, return to the basics.

Keep things simple on track. Work on one or two matters at most during a session; know what a third goal might be. Help your student to relax on track. Remind them they are on track to have fun. Remind them to relax and breathe (especially on straights), keep light hands on the steering wheel, and release tension where possible. Tension hampers clear thinking and awareness.

De-emphasize speed every chance you get. The student won't develop new skills going at their top speed. Beginning skiers don't start on the steepest mountain and archers don't begin at Olympic distances. If an instructor allows speed and number of cars passed to be a metric of competence the student will progress little further. Speed will come with mastery of the fundamentals. Speed is the reward for smoothness and precision.

As an instructor you will at some point have a student who is just not "getting it", and this will become a barrier to learning. The concepts and techniques discussed above should help you find a way to get through to that student and return them to the upward trend of their learning curve. Common elements in the techniques above include awareness and communication. Interestingly enough, these are among the traits you have demonstrated to become an advanced driver and now an instructor.

① Can you think of some other Barriers to Learning and solutions to them? Which have you experienced any and how did you surmount them?

### **Communication**

Communication is the imparting and exchange of information and ideas. Instructing is an act of communication. From initial contact before the driving event, to the written evaluation at the end of the event and even future interactions with their students instructors must communicate effectively or they cannot instruct successfully. Communication is best when tailored to the needs and capabilities of the interlocutor, be they a beginning student or an advanced driver. Like skill, communication exists on a continuum and there are no set levels, however Dion von Moltke of Blayze Coaching makes an apt and succinct generalization: communication to beginners is about survival and communication to intermediate and advanced drivers is about reminding.

### **Empathic Instruction**

High performance driving is a mental game – the most addictive of puzzles, if you will. Instructing adds another dimension or two to the puzzle. One of these is interpersonal. This manual has so far outlined some basics of *what* to instruct, and by providing direction on your demeanor and communication there is guidance on *how* to instruct. We need to examine the multifaceted act of instruction in the moment.

In the course of an event – often in the course of a single session – a good instructor will employ empathy to react and lead. Empathy is largely situational awareness of others' emotions, and as an advanced driver you are already situationally aware! Observing and getting to know your student is a vital component of the traits you may need to display as a good instructor, because there is far more than dispensing timely tips on driving.

You will have to adopt the mantles of psychologist, strategist, tactician, communicator, disciplinarian, nurturer, sportsperson, pragmatist, and student (at least), sometimes combining them, sometimes switching between them instantly.

**Psychologist** – you must determine the student's state of mind and adapt your instruction. An apprehensive student should be put at ease. An aggressive student should be calmed. You will have observed and asked your student their state of mind, but be aware it can change at any moment. The most important act of your psychologist persona is to ensure you are aware and in control of the student.



**Strategist** – plan ahead to stay ahead. You have clarified terminology, explained protocols, and set objectives for the track. Set the timing of your instructions. Make mental notes about progress and be prepared to help reach objectives by different paths. Be prepared in case reality renders your strategy unworkable. Discussion, demo ride(s), and assigned “homework” will all be shaped by and support your strategy, but most important will be student behavior and progress.

**Tactician** - prepare to change priorities quickly. Distraction, “Red Mist”, disquiet may all require that you immediately refocus the driver’s attention. This is the time for calm but firm, attention-grabbing commands. Some students will respond best to more direction, some to less, and some to a specific challenge such as “Slow down and hit every mark” or for a more advanced driver “Enter the next three corners off line”.

**Communicator** – be responsible for the proper flow of information. Constantly monitor the amount of information your student can absorb, and how. This depends on the individual’s capacity and experience. Ask if you are speaking too much or too little, but above all observe how the student is applying your instruction. Focus your guidance on driver inputs, the line, sighting, safety and track protocols, and especially awareness. Explanations about vehicle dynamics are best left for the paddock. Coach what’s about to happen. Ensure what you instruct is heard and understood by the student.

**Disciplinarian** – must assert authority and take control of the student if necessary. Such circumstances will be about safety: the student’s, your own, others on track and off. Repeated failure to follow directions or persistent poor attitude must result in a trip to the hot pits for a discussion or even an end to their driving session. This is an extreme but vital measure to ensure the student understands the seriousness of the issue and provide them the opportunity to better process your instructions. It is your responsibility to clear up any misunderstandings of what needs to happen, for everyone’s safety. Instructors who have had an off-track excursion typically had warning signs in advance. Do not ignore your instincts. If on-track communication is failing and safety is at stake, bring the car in.

**Nurturer** - acknowledges the difficult and frustrating aspects of the learning process and provides honest support and encouragement. Even prodigies require persistent practice to become experts. If 5,000 hours of seat time made an expert driver, one would need about 2,500 HPDE days: about 125 MNY HPDE seasons. Expectation of real proficiency after even 10 days is optimistic, yet some students begin with an assumption of immediate competence. Finding that their learning curve is not constant can be frustrating. Conversely, virtually every driver does things well for their level in every session. Along with instruction they need confirming reinforcement. Appropriate specific praise on a good apex, proper brake release, smooth inputs, and good awareness can do wonders to encourage your student build their success. Do not show any disappointment in your student based on their driving skill; they may generate enough of their own.

**Motivator** - encourages continuing improvement. Find incentives to help your student achieve milestones and their focus will sharpen. Keep challenges light to avoid stress. “Touch every apex and we’ll move on to our next goal.” When your student makes errors or expresses self-dissatisfaction, try “We all make mistakes, ease off a bit to get your rhythm back.” Never encourage your student to drive over their head. Motivators inspire students to improve their skills within their driving abilities.

**Sportsperson** - sets the example for good behavior. Showing respect for others on and off the track are qualities expected and required as part of the MNY HPDE culture. You can model this directly by never speaking poorly of another driver or instructor in the presence of any student and by noting courteous driving during demonstration rides. Passing protocols are based on being a good sport, which can be mentioned. The entire hobby is predicated on all drivers keeping each other safe through mutual trust and responsibility. If a real issue arises with another driver, go to the CIs at the track and keep your student apprised if they are aware of the issue. The community is at least as important as the individual.

**Pragmatist** - must assess if the relationship is working to the student's advantage. It is your responsibility to recognize whether they are benefitting from your instruction. If you think not, discuss this with the RGC or a CI. They may give you advice on a different approach or possibly recommend changing instructors. It is better to recognize and resolve the situation, than for both of you to have a bad experience. Remember: instructors are not expected to have all the answers. Self-awareness and desire to improve is the reason someone recommended that you instruct!

**Student** – as an instructor you must be open to new ideas and techniques to use and pass on. Every instructor has an opportunity to improve when in the company of a student. Check if you are communicating well for them, ask for their suggestions, don't be blind to the chance that you will actually learn from their driving. If your instruction doesn't evolve and improve, you are not being a good student.

As a Teacher/Instructor/Coach you play all these roles, often simultaneously. Teaching someone to find their way around a race track, using the car effectively, is a complex interaction between two people because you are not just a skilled driver giving directions. Recognize and leverage the difference.

## Detailed Instructions for Instructors

### Initial Contact

MNY PCA will try to provide your student assignment one to two weeks prior to the HPDE. They are provided by e-mail from a CI and include the student's e-mail address and, usually, their phone number. They will also be entered in the Club Registration Online Evaluation system. Students are not sent their instructor assignments and contact information. Assignments are not random. Sometimes in consultation with other DE Committee members, CIs make them based on a number of factors including the relative experience and needs of the students and instructors. The main reason for the timing is to provide you enough time to contact and communicate with your student. Your method of first contact is up to you, however e-mail generally works well and allows you to arrange a mutually agreeable time for a phone call.

Whether before or after your first contact with the student, please check if they have any online evaluations in ClubRegistration.net. If so, you will be able to see how previous instructor(s) have rated them and what they believe the student needs to work on next. Please bear in mind that anything entered in the private comments section is NOT to be revealed to the student.

An effective interview before the event is essential if possible. You will need to give yourself time and be prepared. A checklist of questions and information to impart is a good idea the first times you make first contact. This is your opportunity to set the tone of the relationship with your student, their expectations, and put them in the best possible frame of mind about the coming experience. For the student, you are also becoming the face of MNY PCA for the foreseeable future. Especially if the student has never attended an MNY PCA event, and even more so if it will be their first experience on track, you are personifying the club and the hobby. Above all, this is your first and one of your best opportunities to get information and lay the groundwork for a safe, fun event.

Remember: you are getting into a high-performance car with this person driving it. You are becoming responsible for each other's safety, but the principal responsibility is yours. You want to know as much as you can and establish a positive rapport.

Use the phone interview to gain as much background information as possible. The phone interview will provide the basis for further discussion when you first meet at the track. Remember your first time at an HPDE. It was probably confusing and perhaps even hectic. Even for experienced track rats, the first morning of an event can be slightly draining. If your student is a true first timer - a 'never never' – they may feel overwhelmed, so the more information you've gleaned beforehand, the better. Another element of this phone conversation can be to build a bridge between you and the student. You may have some shared hobbies or occupation – discuss these. Try to make a bond with your student.

MNY PCA has developed an HPDE Guide for New Attendees which should answer most questions of those new to the track and to MNY PCA HPDE. It is distributed by email to all registrants when they are confirmed for each event. It is also available to download from ClubRegistration.net and to download or read online at [https://metronypca.org/images/pdf/2024\\_Intro\\_for\\_New\\_MNY\\_DE\\_Attendees.v.2.pdf](https://metronypca.org/images/pdf/2024_Intro_for_New_MNY_DE_Attendees.v.2.pdf). Encourage your students to read the document as it will make your and their time at the track easier.

① Have you read the New Attendee Guide?

### Meeting at the Track

A phone interview isn't always possible. There can be late student assignments, last minute changes, or a student who doesn't want to speak by phone. In the last case, one can conduct a fairly thorough interview via email or even text correspondence. If you can't contact your student in advance at all, you must be prepared to do the whole interview on the first morning at the track. Have a checklist of items you want to review, both in mind and in writing. The minimum list should include Safety Issues, Vocabulary, Driving Position, Car Readiness and any important

information about the student before going on track. Continue the conversation after the first session on track. Get to know your student well; it makes instructing easier and safer.

Whether on the phone or at the track, find out what they like to be called. Some names are difficult to pronounce; repeat until you get it correct. Without being intrusive, learn their occupation, background, and interests. Ask how they got into the car hobby, the track hobby, and about other hobbies. The better you know your student's psychology and experience, the better you can instruct and the safer you will both be. As well, you will be better able to help the student have fun.

**Never be late for a student!** If you make an appointment to meet at the track, be early. When you meet for each session on track, be early enough that they miss no track time. If you need to cut your own driving time, do so. MNY PCA ensures that there is plenty of time for instructors to drive on track, generally including in all solo sessions. The student is your first priority.

First impressions are important. Greet your student at the track with friendly confidence. If they are new to track culture, help them feel knowledgeable and comfortable. They will also be new to the track at which the HPDE is held; show them around. Be enthusiastic and sincere. Make your student know you are glad to meet them and look forward to being their instructor.

Do not enter any situation without covering all pertinent information and establishing a clear plan. If the student is overly anxious to "get on track", take the time to discuss safety and control issues. If the student tries to rush you so they "don't miss track time" you will also be using this moment to communicate who is in charge. This is another argument for being early.

Appendix 1 of this manual outlines a wide variety of questions you could ask as part of the interview process encompassing pre-event and first meeting with your student. You do not need to ask every question, and may develop your own list, but it is always worth having some ideas. It even applies to the 'Five Minute Interview' you may need to conduct if you are unable to make contact before the event. Appendix 1 also has a sample interview questionnaire you could use.

Prior to your first session with the student, possibly while or just after the discussion at your first meeting, you must spend some time inspecting their car. This does not replace or relate to Tech Inspection. This is to ensure *you* are familiar and comfortable with the vehicle in which you are about to instruct. It is also a good way to learn your student's own familiarity with their car, and knowledge of cars in general. You will need to check the car has been cleared of all unsecured objects, have a look at tire type, condition, and pressures, brake pad and rotor condition, ask about or check wheel torques, and get a sense of the car's preparation. Ask the student about this to see what they know. You may want to advise on tire pressures, and with some students you may even need to show them how to make adjustments. You will not generally need to touch their car. This is also an opportunity to ensure the car has at least one tow hook in place, and to learn whether it has Automatic Braking / Lane Drift Correction / Lane Change Assist and how to disable them since they are not allowed on the track. Note: this does not include traction / stability control which should remain active on track, especially for students.

Remember to be upbeat and positive while being surreptitiously cautious. Compliment the student's car and show interest. Never get into a car unless you are comfortable it is safe. If you happen to find something that concerns you, discuss with the Tech Chief, Safety Chair, or a CI. Once again, this is a good reason for meeting as early as possible. In the case of a Green or Yellow student, you may have time to inspect the car while they are in their first classroom session, if you are not attending too.

### In the Car

It's time to get in the car with your student. Make sure you have your communicator with you and are prepared to explain its use if you have not already.

Check proper seat and mirror position. You may need to explain proper position to your student, especially with regard to their seating.

Ensure the side windows are lowered.

Check that you and your student are both correctly harnessed/belted with equal restraints.

Do NOT take the right-side mirror. The student must use their right-side mirror. If the side mirrors are correctly adjusted to clear blind spots, you can use the mirror by adjusting your head. You must become adept at this even when using harnesses and HNR systems.

Check that the car is set optimally: traction and stability control on, sport mode engaged if that is appropriate, all unwanted driver aids (Automatic Braking / Lane Drift Correction / Lane Change Assist) disabled. On cars so equipped, you and the driver must check they are disabled before every session.

Ensure the student holds the steering wheel at three and nine with a controlled but loose grip. With helmets on, check that your student's chin strap is fastened and be certain you can both clearly hear through the communicator.

Review the terms you will use on track as well as the hand signals in case your communicator fails.

Review your expectation for them to acknowledge your instructions and let you know if there is any instruction they do not understand. Make it clear that what you say in-car is not open to debate.

Review the mutually agreed upon objectives for the run session, which include safety and fun!

① Do you know why it is best to dissuade your student from hooking their thumbs over the steering wheel spokes?

K.I.S.S: Keep It Simple Stupid. In car instruction needs to be clear and concise. You cannot get words out quickly enough to stay ahead of a fast-moving car. You must not confuse the driver. You must keep your words brief. This may be the most difficult aspect of in-car instruction.

Among the reasons for classroom time and discussion between instructor and student off-track, and for getting to know how to communicate with this student, is that your direction and guidance in the car must build on rather than repeating the longer expositions of theory to help the student execute. The sentence you have just read is exactly the kind of thing to avoid in car. You and the student will be best served by an oral short-hand explained beforehand and re-iterated just before going on track. As well, situations will arise during in-car sessions such that time becomes even shorter. The newer a student, the more overwhelmed they will be by the activity. Your job as their instructor is to reduce any overload.

On track, your student will be learning outside your instruction. Their mind and body will be developing a sense of car balance and spatial position as they effect and interact with vehicle dynamics. You want to enhance rather than interfere with that.

Examples of simple commands include: “Brake”, “Off Brake”, “Turn-in”, “Throttle”, “Apex”, and “Track-out”. You may say “unwind” or “open the wheel” to describe decreasing steering input, “feather” to moderate throttle, “ease off” or “ease on” can concisely describe how to release or apply pedal inputs – so be specific. “Track-right” and “Track-left” describe car placement. Again, these work best if you have told the student what terms you will use and what they mean before getting on track. You must be consistent. Read through this small list of concise instructions and imagine using them to guide a student through a particular corner or corner complex. Even at half of your normal track speed, you will realize how little time there is to communicate everything.

You must get your point across. A calm, clear, even, firm (confident) tone of voice is best. Never yell. To some extent you will have determined through the off-track discussions how to speak to each student. Over time, you will develop a style that works for you and can be adjusted to meet student requirements. While we want consistency of instruction, we don’t need to make all instructors stylistically identical.

Anticipate potential problems before they happen. To direct the student clearly you may have to *calmly* escalate instructions in rapid succession such as “Brake, Brake Hard, HARDER!” Your student is most likely in the moment or thinking about the last corner, or perhaps traffic. To be effective and keep everyone safe you must be thinking well ahead of your student and the car, and you must maintain the level of situational awareness you ultimately hope to help your students develop.

The above list of common on-track terms is not comprehensive, so more complete vocabulary is provided in Appendix 2 of this document. The words used are far less important than that the meaning is conveyed accurately and quickly.

### **Save lengthy explanations for the paddock.**

When your student makes mistakes, your job is to remember them and focus forward. On the next lap tell the student what to do differently, not what they did wrong. When they improve, use confirming reinforcement. Try to make a mental note to discuss the error after the session, if needed.

If a more extensive discussion is required before the session ends, have the student pull into the pits. Focus on one, at most two, areas to work on per session to avoid overloading them. Bringing the student into the pits during a session is a technique to be used sparingly. The student deserves and needs their full track time, and you must be clear to the student that pulling into a pit box is not a punishment. Keep the longer discussion as short as possible and get back on the track.

If you look back and review how much this section contains, you will be reminded how much new information is necessarily bombarding a new student at the track. In this context, it is difficult to know how to place a discussion of teaching your students where to look. Despite all we sense on track through our ears, hands, feet, butts, occasionally even our noses, sight is the dominant sense and the most fundamental instruction is: **the car will go where the eyes are looking**. Drivers must keep their eyes up. Drivers must look in a way that leads their driving. Drivers must not only look but see. This is a constant you will weave through all levels of instruction and coaching.

With experience you will know where your student is looking, possibly better than they do. Despite referring to landmarks around the track, repetition, and the fact most people innately know that they go where they are looking, you may be surprised to find your student doesn’t know where to look and isn’t sure where to focus. This can even be true of solo drivers. Similarly, the instruction to “look through” a corner or the car in front may not be understandable to a student. Once a student is able to safely drive while also taking rapid instruction and providing running commentary, there are two exercises of great value. In the first you ask them where they are looking as they drive, in as close to real time as they can manage. This exercise can grow nicely from one in which you have students tell you where the marshal’s stations are and whether they are manned. In the second exercise tell them where you

are looking as they drive around the track. They will naturally look where you do. They will begin to learn to look further ahead, or it will help reinforce that behavior.

The initial goals of sighting exercises may be to improve the student's line and keep focus, but they have other effects. They can help drivers build situational awareness. More comprehensive instruction on where to look may include when to check mirrors and how to respond to what they learn, and we all know that active looking heightens general awareness. A second negative effect is that those who drive spending too much time looking at the mirrors (also called 'driving in their mirrors') – can easily become excessively concerned with what is happening behind them, may lose focus, and are forced to rebalance their attention. A third – positive - effect -is that drivers become less prone to distraction, and will more easily begin to drive track segments and complexes rather than immediate point-to-point. Again, as an instructor you must be sensible to when a student is ready for sighting exercises: someone who is struggling to keep the line in immediate point-to-point may not be ready to increase their vision; a student applying every input inappropriately and seeming flustered is certainly not. With your help, their time will come.

From the beginning, while your student is driving well within their immediate limits, try to incorporate hand signals while instructing verbally. This reduces the possibility of miscommunication. It also gives you and the student practice. If your student responds well to verbal commands, carry on with those as your primary communication. If they seem not to understand despite your best efforts, you must adjust your instruction accordingly. Hand signals may be more effective for your student. The speed and amplitude with which you move your hands can express the pressure and speed of pedal or steering inputs. Unobtrusive movement may work in a way words fail to penetrate your visual learner student. They may respond so well to your hand signals that you will even transition to using them almost exclusively on track. There is a section on hand signals below.

It is your job as an instructor to help your student understand; it is not the student's job to try and figure you out. Directly ask your student if your instruction suits them. Be aware that most will try to please and may say they understand even if they do not; you must pay attention to whether they really do.

If you are having persistent problems getting your student to understand, ask for help. MNY PCA has a wealth of instructor experience and we try to foster a strong community. We support one another. We are a team. There is a strong chance that another instructor – possibly one of your own – has experienced and solved the problem you have encountered. Neither track driving nor HPDE instructing are solitary endeavors.

### Feedback

We provide (and receive) feedback either to confirm or correct behavior: "Confirming feedback" and "Corrective feedback". The goal of feedback is improvement.

Confirming feedback is not the same as positive feedback. "Great job!" is positive feedback. It's complimentary, but unclear about what was done well. This may not result in more of the desired behavior. Confirming feedback might be: "Great job! Your brake release was smooth and perfectly timed; the car rotated just enough on entry for you to get to full throttle sooner than before." (Though that's a long sentence in-car!) Confirming feedback encourages the student to do more of the same. Confirming feedback is a meaningful reward.

Corrective feedback is not the same as negative feedback. It's the difference between saying, "Release the brake slower and more gently on the next lap," versus "that brake release was too abrupt". Most obviously, corrective feedback is constructive and advisory, it helps solve a problem. Negative feedback tends to seem more personal and punitive. It expresses disappointment and may even sound accusatory, which may provoke a counter-productive cycle of defensiveness.

### After the Session

Especially for a student, the time immediately after stopping in the paddock after a session is a cocktail of emotions and adrenaline. Additionally, they may be fatigued. You must set a calm tone and continue personal connection to

make the most of the debrief. Decide with the student whether to chat in the car or out. Remove helmets so you can speak face to face and make eye contact.

Ask if they need a drink and remind them to hydrate.

Prioritize and focus your feedback on the driving, not the person. Be very specific.

Note and discuss any serious safety issues or concerns first. Make sure the student is aware that these must be resolved promptly. Gently remind them safety is not just about the occupants of their car, there are other people on track, not to mention the marshals and emergency crews. Note that the car (probably) needs to be driven home. Despite the inherent seriousness of such a safety discussion, try to keep it positive and avoid frightening the student. If the error was really great or acute, you would have had them pull into the pits and discuss it during the session, so this is a learning opportunity rather than criticism.

The next priorities depend on what you noticed in the session and the stated goals for the session, day, and event. Emphasize the positives by confirming what was done well. When possible, relate that to the areas which need work, using their good driving elements as a guide to improvement.

Comment on the car's dynamics, feel, weight transfer, the throttle, brake, and steering inputs, and the driving line. When possible, frame the discussion in terms of smoothness and precision. Do not comment on or frame the discussion in terms of straight-line speed.

Discuss awareness of other cars and traffic flow. If the student gave or took point-bys, ask them how they feel it went, their level of comfort, and provide feedback if you have any.

If possible, relate the in-car debrief to what the student has learned in the classroom.

Try not to do all the talking. Although you are the instructor, the debrief should be a discussion. The student must be engaged. Students must be able to express their own thoughts, and you need to know what they are thinking and how they feel.

It is good practice to ask if they had fun and to tell them you did.

Accentuate the positive.

#### Listen Actively

You know a great deal about driving well or you would not have been invited to instruct. Chances are, you don't know everything. Learn from instructing. It is one of the most educational activities within HPDE.

Instruction is an act of communication, as explained. It cannot be overstated: communication is bi-directional. Learn from your student, and learn more about your student by listening actively.

When you ask your students how they felt about the session, remember to gain insight relative to their attitude (eager, confident, apprehensive) and learn more about their motivation. Ask if you are talking too much, or not enough. Make use of your student's responses.

#### Observe, Revise, Plan

Be cognizant of your student's condition.

Are they staying hydrated? Have they eaten?



What is their mental state? Are they tired, alert, anxious? This is likely to change from session to session and from day to day in an event.

Review how your students learn best. Does your experience with them validate their belief and your assumptions?

It is ideal to have a track map available during the debrief. Even if they seem able to drive the line, especially with your help, a beginning student is unlikely to know a new track well enough to be sure of corners by name or number.

Begin planning for the following session. Ask what the student would like to work on and offer guidance. Always encourage questions, seek feedback and check understanding.

In the unlikely event a student is not having fun – it does happen – find out why, and work with them to improve the situation.

① Do you know the names and number of the corners and straights at the tracks MNY PCA HPDE uses?

### Follow through

It is helpful to give “homework” after the day’s final session. You might ask your student to mentally drive the track when they are alone. This can be done almost anywhere. They should pick out brake, turn-in, apexes, track-out, and throttle application points. Their priority should be finding the exact line. Speed is irrelevant. Other possible “homework” might be practicing smooth inputs, again possible without being in the car. The more students think through and mentally model *good* track driving, the better they tend to learn. This even happens subconsciously, which is one of the reasons we strongly recommend students attend multiple days of each HPDE – giving what they have learned the opportunity to be fully absorbed.

Successive mornings of a DE vary for different students. Some seem to reset and the first sessions of subsequent days it may feel as if they have forgotten much of what they learned previously. Other students seem to have distilled all the learning and return driving better than they did before. Most students are somewhere in between. Beginner students usually do not drive as well as *they* expect on successive mornings.

Reiterate that track driving is not easy. Progress is slightly different for everyone, and “second day regression” is temporary. We say there is no substitute for Seat Time; it is called “SEAT TIME” for good reason.

The final session with your student should be motivational, relaxed, and particularly focused on the pleasure of track driving.

The final debrief of the event is a good opportunity to point out to the student how far they have come during the DE and to recapitulate their stated goals and what they accomplished. This is a good time to suggest and discuss perhaps three potential goals for their next HPDE.

If possible, review your student’s evaluation with them before submitting it.

Be honestly positive about progress even if you have to be highly diplomatic. We do not believe in ‘OSB’ and we want them to return!

MNY PCA uses online evaluations through ClubRegistration.net, the same site we use for registration. As an instructor you must complete an online evaluation of your student. Please also encourage them to complete an online evaluation of you. MNY PCA HPDE Registrars, Cis, and RGCs read all the evaluations.

### Hand Signals

In the days before high fidelity electronic communicators, instructors, co-drivers, and navigators used to communicate with drivers using hand signals. Since people learn in different ways, and communicators can fail, it is still necessary to know how to communicate with your student in-car using hand signals.

The Motorsports Safety Foundation video online at <https://youtu.be/XNsryE6aMgU?si=yFpvkzon6vwVBZa4> is an excellent quick reference for hand signals, with a demonstration.

Braking is represented by your left hand moving from barely curled fingers to a fist indicating speed and pressure of application, and back out to curled fingers to indicate speed and pressure of release.

Throttle is represented by your left hand, palm flat and fingers out, bending forward at the wrist from vertical to horizontal indicating speed and pressure of application, and back up towards vertical to indicate speed and pressure of release.

Steering is represented with both of your hands as if holding a steering wheel at 3 and 9, turning to mimic speed of change and correct angle.

Movement towards the correct line is represented by pointing the index finger of your left hand to where the car should next be placed.

A thumbs up signal from you indicates the student has correctly accepted your instruction.

### Other Non-Verbal Communication

Especially for the novice student, understanding that sometimes elusive and often ethereal concept of “smoothness” can be difficult, and how to attain it even more so.

Sometimes words and hand signals are not enough. This is most often true with regard to pedal inputs. In rare circumstances, and with due caution, one possibility is to indicate speed and pressure of brake or throttle application by squeezing the student’s upper right arm if in the car, or their hand if out of the car.

NEVER touch a student without first having asked and received their permission. Do this before entering the car. Even if you have received permission, let the student know when you are going to demonstrate in this manner before you do. Ideally, you should get their assent again.

In the rare circumstance where you might employ this technique in-car, be sure never to interfere with the student’s control of the vehicle or obscure their vision.

① Can you think of other non-verbal methods to demonstrate driving technique?

### Instruction Around New Technologies:

It seems odd referring to essentially ubiquitous safety systems as “New Technologies”. The underlying technology – ABS – has been available on street cars for over fifty years. Nonetheless, they have become significantly more sophisticated and need to be addressed from the perspective of instruction.

Anti-lock braking systems (ABS), traction control, and dynamic stability control (DSC) can be great learning tools. When they operate, ask the student if they felt it and why it happened? If they are unaware of these systems intervening, teach them to feel their effect on the car. If necessary, a demo ride can focus showing the difference between the car intervening and good technique. Avoid car interventions except intentionally. The goal is for the student to learn to drive on pace with the systems not intervening.

There is a significant safety issue with these systems. Newer cars are more capable than most students. The fact that ABS and even Traction Control are allowed in some major racing series sends a strong message. They can make the student feel secure. Unfortunately, they disguise poor and even dangerous driving if the student does not realize or understand their action. As well, to paraphrase every vehicle operator's manual "these systems cannot overcome the laws of physics". There is a limit to what they can achieve and they provide no useful warning from the car when the limit is approaching. Safety is NOT an option! You must help your student recognize that the car's technology can enable them to drive far above their ability and this is a BAD thing. The goal is never to have the nannies intervene.

You will likely have to rein in a novice so they can build skills without depending on the car. Confidence can overcome a more advanced – especially intermediate solo - driver's skill level. You will need to raise their awareness of nannies and coach them to avoid intervention while maintaining pace. An advanced driver should be fully aware of car interventions and able to drive at an appropriate pace without intervention.

Whenever you are riding with a student in a car that has these systems, make sure they are ON. In some cars, especially newer high-performance models, there may be selectable settings which adjust more than the threshold of intervention. Some also adjust power, suspension including ride height, throttle sensitivity, differential action, even aero settings. The less experienced and skilled a student, the more conservative, less aggressive these settings should be.

## Demonstration Rides

You must take your Green or Yellow (instructed run group) student for a demonstration ride in your own car, no more than one run group up from their own. You must do this at least once per event. There is little reason not to do it once per day. Remember to abide strictly by the rules of the run group in which you are driving. There is no need to drive beyond 7/10ths while keeping within the prevalent speed of the run group; you and your student already know you are likely quicker than them and you are demonstrating smoothness and accuracy. There is no point moving too fast for them to follow what is happening. Especially with a student – as opposed to an intermediate or advanced solo driver you are coaching – you do not want them to try and closely mimic what they experienced when you drove. Even if their car is equal to it, their own skills likely are not. It is advisable to give demo rides to instructed students after they have driven *at least* two sessions themselves.

Do NOT over drive on a demo ride. Period.

MNY PCA advises against instructors driving their student's car. Your skills should be such that you can feel what their car is doing from the right seat and know why. Unless something genuinely mysterious is taking place, there should be no need for you to take the risk of driving what may be an uninsured vehicle on track. The student does not need to experience their car in your hands; it will lead them to try and mimic your driving and they probably cannot. They almost definitely should not. If you choose to drive your student's car, apply extra caution. No matter what they say, you invariably be solely responsible for any issues arising from your time driving their car.

Demonstration rides offer manifold learning opportunities.

For visual and experiential learners a "picture" is worth a thousand words and the demo ride with a proficient driver is the closest one can come to experiencing driving well without being in the driver's seat. This is the only opportunity to truly demonstrate good technique, lines, and inputs with complete control, command, confidence, and absolute smoothness, and with as much commentary as you believe worthwhile. Reflective learners generally derive a great deal of benefit from demo rides because they are able to think through the abstract and your specific driving methods without the distraction of driving.

Set a positive, open, and collaborative tone straight away. You are in command, but this is a two-way process. Most students will see, hear, and feel more when they are freed from driving, and they will also match their own experience in the driver's seat to what happens in your car. Ask them to observe your inputs, the gauges (if possible), to listen and feel the car. The student can ask questions during the demo ride and you can reply.

What you show your student should vary based on their experience level. There are nonetheless some key features of all demonstration rides.

- Most important is to model courteous track behavior. This is a critical time where your student learns about MNY PCA on-track culture from watching your etiquette.
- Always demonstrate a positive regard and patience for your fellow drivers. Give other cars extra space when passing. Drive at an appropriate pace based on your student's level and the group in which you are running. Consider your normal first lap pace as a reference. That is likely much faster than your student has ever experienced. Demonstrate smooth and relaxed driving while maintaining a dialogue.
- Explain where you are looking. They will be surprised just how far ahead (and behind) your vision is scanning. Talk about the traffic. Explain how you are planning to take and receive passes well in advance of them happening. Explicitly demonstrate how an experienced driver anticipates and controls the flow around them.
- If you have a beginner level (Green) student, reinforce track terminology. Use the same terms as when instructing your student from their right seat. This is a chance to identify flag stations when they first come into *your* view. Explain safe track entry and exit protocols, point out the blend lines, and any emergency pull-offs or emergency exits.

- If you have an advanced beginner (Yellow) or a solo (Blue or White) student, the demonstration ride will be slightly different. Drive your car at a conservative pace but something more appropriate to their experience level. You will know the areas on which they are focused on improving. Keep ahead of the student when you demonstrate a particular segment of track or technique. Don't be afraid to critique your own driving. This demonstrates self-awareness which is important for continued progress especially for intermediate (White) solo drivers for whom complacency most often sets in. It can also help drivers who feel discouraged by their own progress, but beware these students may over drive immediately after the demo ride on which they'd metaphorically peeked through a window but don't realize they don't understand what they have seen.
- The demonstration ride is all about teaching the student. It is not about your driving time, or giving the student a thrill ride. Explain how you plan for the demonstration to be about certain skills or lines you want to demonstrate and that you will not be going your fastest, or even recording times. We advise keeping your data/timer off or out of the student's sight. Do *not* go out for fast laps unless you happen to be coaching someone who needs to experience that. Be prepared to explain why they needed to experience that.

## Track Walks

Track walks are a great learning opportunity for any driver from novice to instructor. Professional racing drivers, including those in Formula One and IMSA, always walk a track before driving it at speed. Encourage your students to take advantage of all track walk opportunities.

Track walks are generally conducted by a CI, an RGC, or an experienced highly competent instructor. On rare occasions, a pro driving coach, pro race driver, or the track's own CI will conduct the walk.

The goal of track walks is to familiarize drivers with the features of a track that can't be seen or even felt at speed, and there are many. You would be wise to participate in track walks for your own benefit, and we expect you to accompany your student on a track walk when one is offered. You are in a unique position to bring the track alive for them on a walk because you have ridden with them in the car.

While listening to the track walk leader observe closely, ask questions, examine the surface, and sight it from different angles.

Look for:

- Curbs: which are friendly and which are not; what is their size; how are they shaped; are they slippery; are they well maintained; are there divots near the curbing and are they deep enough to be dangerous?
- Camber: where it begins and ends, where it is most pronounced.
- Elevation changes.
- Polished or other asphalt conditions. Touch the surface of the track or rub it with the sole of your shoe to check for different levels of surface polishing on and off-line.
- Drainage: where the water runs off or across the track; where water puddles on the track. This is useful for wet sessions, and also because camber, elevation changes or any feature of the track surface will affect the flow of water, they will affect the car in all conditions.
- Tire marks that indicate areas of common mistakes in corners or that tell you something about braking zones. Few marks in a braking zone indicate most drivers aren't braking as deep as possible, lots of marks indicate many drivers are locking up.
- Study shoulders to know which ones to avoid or that can be used.
- Dips, swales, and other sweet spots that affect grip.
- Armco, fences, walls, and other barriers.
- Run-off areas and gravel traps.
- Sight in the direction of travel and backwards. The amount of knowledge one can gather by looking backwards on a track is astonishing, and consider Blayze Coaching's technique of working backwards.
- Track walks are not always possible, however at many tracks one can walk the periphery inside the safety walls. Consider taking your student around if there is time, and watch how other cars are driving the track.

① What tracks have you walked?

## Things to Watch For (Teaching Opportunities)

These concepts are introduced to the novice, reinforced to the beginner, and should be second nature to the advanced driver. They nonetheless need reinforcement as the driver refines their skill.

**“Safety”** – No matter with whom you are riding, or on what your instruction is focused, make sure the student understands that new skills and concepts must be developed safely.

- Safety is *always* your first priority as an instructor or coach, *and* as a driver.
- Safety must *always* be the first priority of **ALL** drivers.
- It is your duty to ensure they develop – and experiment – safely. Learning is not effective and fun if it is unsafe.

**“Awareness”** – Awareness is the defining trait of the good driver; situational awareness is the first determinant for each promotion and progression.

- Every aspect of driving depends on awareness.
- Awareness is a mental function, informed largely by the senses.
- It is vital that you start very early to build a sense of acute 360° awareness in your student, especially given today’s high-performance cars that can almost drive themselves. Every sound, smell, undulation of the track, twitch of the car, whisp of smoke or dust cloud ahead is information that the driver needs to analyze and assess. Of course, they must be aware of flaggers and traffic, and anything else communicating with them.
- Every driver input is important. Help students build a keen sense of the relationship between input and outcome, of cause and effect. Then you can help them develop the skills that make driving safer and more satisfying.
- Awareness, very similar to Levels of Learning, ranges from: “I did not know that” through “I am aware of what to do and beginning to practice it” and “if I think about it, I can do it consistently” to “it’s automatic...no thought involved.” It requires practice to maintain and improve.

**“Vision”** is our dominant sense. Your eyes lead the way and control smoothness. Help place the student’s eyes further ahead.

- Have students look ahead as far as they can, and realize you may need to change the eyes back to where they should be, ie, the focus may need to be brought back slightly if a driver is missing the marks. Having eyes up gets drivers where they need to be and focuses concentration. It also improves anticipation, which protects against mistakes.
- Scanning techniques – controlled eye movement - are important to proper use of the eyes. A driver must look far ahead down the track, check mirrors, sight reference points, check each flag station on approach, and gauges on the on the straights. In traffic they must precisely monitor nearby cars, and at all times they should be generally aware of other cars’ locations. Moving the eyes in part to avoid “tunnel vision” or “target fixation”. Are you conscious of practicing these techniques? Do you continue to move your eyes behind the wheel on the street? Your student probably needs to be trained to whenever driving.
- You look through corners and other cars without thought; your student does not. The technique and reasons for it must be taught in the car as well as the classroom. For most students we are introducing a new way of seeing.
- When eyes drop, speed increases anxiety. When focus placement is inside reaction distance, eye movement becomes fixed; scanning for crucial information stops and anxiety increases. Increased anxiety can lead to fear and even panic. Panic driven inputs may be involuntary and wrong. Proper use of the eyes is crucial.
- Keep moving your student – of every level – towards better “Big Vision”.
- Here are some maxims regarding vision:
  - Eyes up and vision forward.

- The car goes where you look. Turn your head, point your nose. The hands follow the eyes.
- Scan, don't fixate. Look at and note everything, but concentrate on nothing in particular.
- Look 3 seconds ahead.
- Trust and use peripheral vision.
- Look past, around, or through the car in front of you. The future is more important than the past.
- The future is closer than you think!
- You can only drive as fast as you can think.
- A person creates everything twice, once in the mind, once in the execution.

① Do you understand "Big Vision"? Can you describe it?

**"Recognizing Fatigue"** Fatigue is a safety issue; treat it as such. Fatigue should be somewhat expected, especially from newer drivers. HPDE is more mentally and physically taxing than people realize. When any driver is exerting real effort their energy may drain rapidly despite high adrenaline. Your energy level will be higher than the student's and you must actively monitor them.

- Fatigue is normal, no driver should be ashamed of it.
- Dropping eyes, missed marks, reduced driving smoothness, inability to maintain the line properly, and excessively reduced speed may be indications of fatigue. Silence from a previously communicative driver, especially failure to acknowledge your instructions, can be another indication as may any other noticeable change in behavior. You may hear your student breathing more heavily through the communicator. Fatigue erodes driving ability. That is no mystery. Focus is diffused or lost. It usually focuses concentration on the body and away from the driving. Your student has to develop awareness of fatigue. Use the "Three Mistake Rule": if you notice three successive mental or physical mistakes, more may have gone unnoticed. Have the driver slow down and re-focus, or go into the pits depending on the context.
- Fatigue is not only something for which you are watching. You are teaching the student to recognize their own fatigue and the importance of monitoring it.

**"Recognizing Red Mist"** Aggression has no place on the track. Every driver is responsible for the safety of every other driver, and instructors shoulder even greater responsibility. HPDE is not competitive. This manual refers to it as a hobby rather than a sport for that reason and to de-emphasize speed.

- No one drives better angry; calm and deliberate driving yields the best results.
- Aggression diminishes focus and awareness despite the fact it may seem to heighten both. It generally results in over-driving, and is inherently dangerous to everyone on track.
- Aggression becomes apparent in a number of ways, most obviously in the demeanor of the driver and in the way they are driving. The symptoms are very often the same as those of fatigue, as are the results. They may include following other cars too closely, refusing to give point-bys, weaving or doing anything else that counts as persistently poor track etiquette, and may be as simple as complaining about other drivers or not being pointed by as quickly as they wish.
- The aggressive student must be reined in immediately. As well as safety, this is an issue of your control over the driver. If they will not calm down and follow your instructions you need to bring them into the pits. A stern but friendly chat should work. If not, you must feel comfortable ending their session early: park them and have a chat with them and a CI or RGC if warranted.
- Like fatigue, you must both watch for aggression and teach from it. You must (re)teach that the track is not a place for aggression. As well, you must teach the student to recognize the differences between excitement and aggression. You should also teach that aggression noticeably reduces driving skill and increases mistakes.
- You do not want to prove that your student was aggressive by having them put you and the car into a wall. Don't laugh: it has happened.



**“Mistakes”** must be seen as opportunities for learning; sometimes they are the best opportunity for learning something truly new.

- A mistake is not a failure unless the student refuses to admit and correct it. You must help your students learn from their mistakes.
- You need to make sure your student’s errors don’t result in unsafe incidents or situations; and that they can learn from the experience.
- Push their comfort zone in a reasonable manner so that when mistakes occur - no lap is perfect - they are small enough to manage. Your approach should be that a mistake results in a correction and loss of speed, not a spin or wheels off track.
- As a coach, particularly, you need to teach how to safely approach limits in order to learn. This is likely to result in some errors, but with preparation they should be safe errors. This is something well worth discussing with peers, including CIs.

Common Mistakes: (Applies to all driver levels)

### **Behavioral Errors**

- Over-driving – too hard too soon on the throttle or carrying too much speed into a turn. How much speed is too much? When it keeps the driver from positioning the car precisely as planned and/or when the driver is not in full control with a margin for error and/or when the driver’s focus is at or behind the car’s position. Carrying too much speed into a corner may feel fast, but it prevents positioning the car properly.
  - The reason for over driving is pushing too hard, usually a misbegotten attempt to go fast rather than driving smoothly and accurately. Over driving can result from frustration, fatigue, overconfidence.
  - Pushing too hard increases fatigue and often overconfidence; it can provoke anger and disappointment.
  - Beginners should not expect to have expert performance.
  - Experienced drivers should expect to spend practice time refining existing skills.
- Showing off – dangerous, obstructs learning, demonstrates a poor attitude: take command and adjust the driver’s attitude.
- Aggression – dangerous, obstructs learning: take command and calm the driver.
- Anger at others slowing, or “misbehaving” students, or at their own mistakes – potentially dangerous, reduces awareness, emotionally self-destructive, distracts from required focus, leads to poor decision making and consequent errors: calm student on track, pull into pits if necessary. Stay calm yourself!
- Dwelling on mistakes – distracts from correct focus and reduces concentration in general: focus student forward, help correct error on next lap, discuss error(s) when in paddock.
- Panting or not breathing regularly – potentially dangerous, suggests fatigue or fluster: begin with calm, deep breaths on the straights and see if there is improvement.
- Unpredictability – extreme inconsistency on track preventing you and others trusting your student on track, which is dangerous: determine whether behavioral, often manifested through indecision, poor decision making;
- Failure to accept instruction - probably dangerous, pull into pits to resolve and end session if necessary. Discuss further in paddock and with your peers as needed.
- Unresponsive student – potentially dangerous, hard to teach and hard to control. You cannot control a driver who is not responding to your instruction: pit and re-establish control, end session if necessary.

### **Driving Errors**

- Not driving the line – missing turn-ins, apexes, track-outs, incorrect position in straights, putting wheels off track: keep eyes up, look ahead, look through corners, relax grip.
  - Does the driver understand the concept of the driving line?

- Does the driver know this track's driving line ?
- Can the driver describe the line as they drive?
- Driving the line of the car in front - mimicking car ahead and replicating its errors: scan the car ahead, don't focus on it, drivers should always drive their own line.
- Driving the mirrors – over-concentrating on the cars and track behind, often out of fear or excessive concern about faster drivers: Do scan all the mirrors for motion or flashes of color, but not at the expense of knowing what is ahead; teach best places to look behind; teach peripheral vision; teach proper track protocols and etiquette.
- Chopping – too rapidly pulling back online in front of car one has just passed: give the slower car room, enter upcoming corner off-line if need be to avoid chopping, count two beats beyond where one thinks one should return to line.
- Inconsistency – not using the track and applying inputs in the same ways over multiple laps (do not confuse with progressive improvement or experimentation), usually combines with missing points and the line, a lack of accuracy: return to basics, concentrate on a particular corner, complex, or segment, eventually changing or expanding the track area of focus applying same techniques.
- Unpredictability – extreme inconsistency which prevents you and other drivers and instructors trusting your student on track, which is dangerous: determine whether behavioral or driving unpredictability and apply same corrective as inconsistency, with greater urgency.
- Missing flags – dangerous - driver is unaware and will have differing awareness than other drivers, may come upon a track situation unaware, not looking ahead, not scanning, and/or concentration lapse: return to basics, review flag stations and flags, perform sighting exercises.
- Not using all of the track – may cause inconsistency or indicate line is not understood again, student not looking ahead and not sighting correctly, student may not understand basics of car placement, straightening track, maximizing radii, may indicate fear and lack of awareness: determine cause(s) and address.
- Mismanaging chassis and contact patches – student doesn't understand what car is doing, and/or relevant physics and weight transfer: review the physics and be prepared to explain, teach student how to feel and balance the car by describing what you are feeling, can be addressed partly through demo ride.
- Too tight grip on wheel (death grip) – student is tense, and/or scared, makes smooth driving and rapid reaction more difficult, tension of driver transfers to the car, increases fatigue: remind student to loosen grip, even flex hands on straights, demonstrate proper technique in paddock or on demo drive.
- Poor shifting (stick) – mis-shifts, jerky shifts, incorrect gear choice, misunderstanding of how to drive a manual, rushing, lapsed concentration, fatigue, cannot feel the car: review technique and why gears are changed, how to choose correct gear, calm the driver and remind them slow, smooth, and correct is better – and faster - than sloppy and incorrect.
- Poor shifting (footwork) – popped clutch, uneven brake and throttle application, poor heel-toe, upsets car balance and dynamics and can even cause a diff lock, makes line accuracy difficult and smoothness impossible, increases fatigue: describe, explain, and demonstrate smooth throttle, brake, and clutch actuation with constant pressure and constant change in pressure as applicable. Inputs need to be smooth and smoothness may need to be explained.
- Poor shifting (PDK) – incorrect gear choice in manual mode; review purpose of gear changes, have student use and observe PDK in automatic mode to learn driving basics before choosing manual change, if you are not familiar with PDK seek help from your peers.
- Activating ABS/DSC – incorrect inputs or over driving, ensure student knows they are invoking these systems and explain why it means they are not in control of the car to the degree they believe; if appropriate let them know that the car has saved them from something, slow them down, experiment with thresholds to teach driver where this limit is. (If it can be expressed without focusing the driver on speed, one might note that activating these systems are making their driving less smooth and also slower, and also that it would be thoroughly dangerous to turn them off since their intervention is proof that the car is being over driven.)

## Instruction and Coaching Challenges

### **Margin for Error and Finding the Limits**

Mistakes are a proof that a student is trying, probing the limits. The instructor must help the student minimize risk and provide a “**Margin for Error**”. That means keeping the student within the limits of their capabilities, not at them. Everyone makes mistakes. F1 World Champions rarely claim to have driven a perfect lap. Practice and learning from mistakes are key to mastering a challenge.

The required Margin for Error depends on each student’s experience, familiarity with the track, condition of the track, condition of the car, and the sum total experience of others on track at the same time.

The required Margin for Error can be reduced through high awareness, practice, coaching, and more practice.

Advancing as a driver, a student is able to reduce the Margin for Error while remaining safe, consistent, and controlled.

To be safe a student must know and practice track protocols, be courteous and respectful of other drivers, have 360° awareness, see and respond correctly to flags, have a plan for the session, and know when to come into the pits.

To be consistent a student must hit their marks, driving smoothly with precision. Their steering, brake, and throttle inputs are always appropriate and timely.

To be controlled the student actively drives the car at all times with full engagement. They do not over drive. They maintain self-control. They know what the car is doing and why, and adjust accordingly. They are aware of and correctly manage changing conditions including the track, brakes, tires, traffic, and their mental and physical states.

A major challenge to Margin for Error is speed. Speed is fun and addictive. Speed is an inducement to take up the track hobby. Speed is *not* a measure of HPDE driver skill. Speed reduces the Margin for Error. Everything happens more quickly. Driving with more speed requires more precision, increased awareness, and excellent car control. Speed is the reward for smoothness and accuracy. The harder the student pushes, the more Margin for Error is needed. Low-risk speed comes with competence.

Do not let the student be seduced by the adrenalin rush. Good track driving is about making good judgments. “Judgment” is not a sensation. Judgment is based on experience and knowledge. It takes the form of thought. Motion generates feelings too, but the feelings of going fast are usually a distraction; feel fast sensations are often quite unrelated to actual speed.

The limits for instructed students are low and the Margins for Error must be high. Until they have a degree of innate (unconsciously competent) skill with the many background tasks of track driving, their limits should remain low, and probed with extreme care. Nonetheless, we should always be teaching correct technique and avoid bad habits that need to be undone later; our mission is to teach them well and encourage safe progress in their application.

How does we help more advanced drivers build up to the limits? Blayze Coaching’s Dion von Moltke proposes one method called “Work it Backwards”. This is a good method for drivers at almost every level, if you can make it work for them. The less experienced a driver, the more help they need to apply it. This is the progression:

- Study a track map and videos to determine corner priorities (is it a fast in or fast out corner, why?)
- Begin with conservative brake zones, determine correct lines and minimum speed locations.
- Get a feel for grip in heavy / threshold brake zones.
- Find track out reference points and full throttle application points.
- Work on the brake release point to find the limit in slow speed, lower risk corners.

- Find the end of brake zone reference point(s).

Note the obvious: this method is cautious, analytical, highly planned, depends on awareness, places each track segment into broader context and connects the segments to those before and after, and delivers speed only at the end of the process.

① Do you know what differentiates a “fast in” from a “fast out” corner?

### **Handling the Unexpected:**

#### ***Expect the unexpected!***

Be aware and prepare: have a plan, but be prepared to change it. Handling the unexpected begins with situational awareness.

The track is a 360° environment where anything can happen instantly. You *must* know what is going on around you at all times, perhaps even more so as an instructor than as a driver. You need to teach your student to do the same. As the student’s second set of eyes and ears, you should be ahead of the student concisely relaying this information as needed. **Trust your gut.**

The unexpected will happen. Be prepared in order to help maintain control. Experience will help: learn from your and others’ unexpected situations.

Take the time off track to talk through some likely scenarios with your student. Discuss how to anticipate, understand, and react.

Stay focused you should usually know when your student is about to have an unexpected situation, or someone else is about to suffer one around you. You need to be able to anticipate what a student may be thinking and what they may do. **Trust your gut.**

If you do find yourself in a student’s car that is out of control, remain calm and in control of yourself. Give clear precise commands – not suggestions - to the student, for braking, throttle, steering, where to look and, worst case, both feet in. Don’t just watch it happen. Use your expertise to help the student lessen the severity of the incident. A note: until this happens to you, chances are you will not realize just how rapidly such situations unfold, nor how inaccurate your recollection of them may prove. Mental modelling in advance should help.

### **The “Challenging Student”:**

There are two types of particularly difficult student. The first is one that will not take instruction, the second is one that cannot.

Students that will not take instruction are often aggressive on track, outwardly over-confident, unconscious of safety, and focused on speed. They may be uncommunicative. They may believe they are inherently great drivers, possibly better than you. They may be careless of those around them. Especially when combined with a very powerful car, these students can obviously be dangerous. While you must treat them with respect, their safety and YOURS is too important to allow them leeway. Hopefully you can assess their attitude prior to meeting at the track and improve it through discussion. If they still seem recalcitrant in the paddock or fail to heed your instructions, you must assert control over such students politely but firmly. Instructed students are not allowed on track without your agreement and participation as their instructor. You cannot be intimidated by them, and if they manifest unacceptable behaviors on track you should not hesitate to pull them into the pits for a discussion, into the paddock if that fails, and to consult with CIs or RGCs if the issues persist. In most cases students respond to a metaphorical firm hand applied in the pit lane.

If a solo driver behaves in this manner, you should pit them and if necessary park them in the paddock and feel comfortable taking the step of exiting the car. Immediately inform a CI or RGC. No driver who has been soloed should refuse to take and attempt to apply instruction on track. It will either have been requested by them or mandated for them by a CI or RGC.

Students that cannot take instruction are quite different. They are less likely to be identifiable before you meet at the track unless they have revealed a learning disability or similar. Their attitude on the phone or in the paddock may give a hint. A persistent lack of understanding in discussion may also be an indication that a student cannot take instruction. Firstly, review the Barriers to Learning and determine if any apply. This may solve the immediate problem. Did they and you misidentify how they learn? It can require triangulation to get that right. Consider and investigate whether the problem is even more basic communication. Yes, you may be the issue and, as noted, some instructor-student pairings simply don't work. Fortunately, this is rare.

You will eventually have a student that is really struggling because they just do not "get it". In this case your communication may be fine, but their comprehension or their ability to execute on instruction doesn't materialize as expected. They may not even realize they are not executing correctly! Be in no doubt: this is a difficult situation. It doesn't mean you are failing. It may not mean they are failing in a general sense. You will need to go back to interpersonal basics and try to determine exactly where the problem lies. Making progress with them will require a team effort from you and your student, so begin by forming a team with them. Don't forget too, you are part of a larger team: seek advice from your peers.

In some such cases you will probably need to provide a demo ride early in the event, possibly before they go on track at all. The visual and dynamic information are very important to this student. Drive as you would in the beginner group.

If a student refuses to drive themselves – it happens occasionally – take them out for a demo ride in their own run group.

This is a circumstance in which to consider driving their car if they wish, so long as they have track insurance that covers their instructor and you feel confident. You may need to begin each session with this student by driving their car for a lap or two before handing them back control in the pits. Keep any driving of their car to a minimum and maximize their own track time. The student will necessarily have agreed to what you are doing but keep in mind they probably wish to drive as much as possible and may question the track time they are missing. Remind them demo rides are instructional time on the track when they ride with you.

If it is appropriate, move the student down a group to allow for slower speeds on the track.

Have the student approach corners using slower speeds, earlier braking points, slower entry, focusing on the exact line, apex, and track out point. The student should use slow hands to initiate the turn. If necessary, rest your hand on the steering wheel as a guide through the turn. Stop this as they improve. You don't want to become a crutch. The goal is a smooth, precise arc through the corner.

Set a "target speed", not a speed limit, for the straights (it is the same thing but sounds better). Use the pits frequently as an extension of your instruction. If the student is making errors that need correcting, note them and pit to discuss what could use improvement in a "classroom" that is not moving.

Ask the student to explain what they think happened before providing your own thoughts. You will gain insight from their perception. Provide some confirming feedback related to areas on the track. Return to the session and have fun.

For the student who cannot take instruction, coming into the pits often enables you to immediately and clearly provide feedback on only a single thing and discuss improvement with immediacy and the ability to see the results. For this student, the end of the session may be too late since the problem will have happened too long ago. This challenging student will likely require a more extensive debrief. You will likely need a track map, possibly the large one in the classroom at all tracks. Reinforce the line, references, and flag stations. Subtly assess and emphasize situational awareness. Ask the student where they did well and what can be improved, and try to learn why they have answered as they have. Is their assessment the same as yours?

Remember, they probably do not know what they do not know. If your student cannot describe where specific improvements are needed, they will have a difficult time making them. The goal at this point may be to give them that understanding, possibly with a highly descriptive demo ride in which you ask and check what they understand and what they feel without them having to concentrate on actually driving. Keep the student relaxed and upbeat. Reinforce that this is a skills-building exercise. It will allow a safer learning curve for them and everyone else on track. You can be firm and have fun at the same time, but you must keep it fun.

The student who cannot take instruction is one you should accompany to their classroom sessions. It allows greater bonding, shows that you are committed to them, that you are still learning too, and gives you a further opportunity to observe them and how they learn. It also provides you points of reference for your in-car instruction. This can unknot the communication bind.

Is the root problem that this student is scared? There are many forms to fear: they may be uncomfortable, unnerved, embarrassed, overwhelmed, tense, even isolated. If appropriate, help them be more social at the event firstly with you and then by introducing them to others in the paddock. Let people know your student is making good progress when they are. Help them feel at ease and more confident. This alone may enable them to begin taking instruction.

Consider that something similar may also cause a desirable change in the attitude of the student that *will not* take instruction. Aggression on track dissipates and becomes unacceptable to a student who is not anonymous. We are a community of enthusiasts. Community members take care of each other, because they want to.

While you are orchestrating this rather complex experience, keep assessing your challenging student after every run. Only continue working with them if they are safe, have a positive attitude, are learning, and remain predictable. If the student is not making progress, not following your directions, or has no idea what they are supposed to be doing on the track, talk to a CI or RGC.

If you wish, or the decision is, to have another instructor ride with your student, give that instructor a full update of the student's issues and instruction that you have already provided. Maintain contact and learn how their new instructor is getting along and what they are learning. This will improve your progress as an instructor.

In extreme cases a driver may be asked to leave an event, far more likely because they *will not* than because they *cannot* take instruction and virtually always for reasons of safety. This will not be your decision, but it will be made in consultation with you. You will record your interactions, assessments, your student's attitude, and their behaviors in the student's online evaluation form. Highlight the issues that led to the decision. Write in a neutral tone. State your observations of the student's capabilities and your opinion of their capacity to improve. If appropriate, offer the opinion that they could safely return in future, and what they should do to prepare for that. If you genuinely feel 'OSB' for this student, be prepared to justify this opinion.

Most of us have worked with challenging students. In almost all cases they can be helped to progress and become safe learners within the hobby.

## Signing Off a Student and Check-Out Rides:

MNY PCA has six run groups representing a continuum of driver skill and experience:

- Green: Novice / Beginner Student (an instructed group)
- Yellow: Advanced Student (an instructed group)
- Blue: Beginner Solo
- White: Intermediate Solo
- Black: Advanced Solo
- Red: Instructor

Usually, Green and Yellow run together on track, Blue and White run together on track, and Black and Red run together on track.

At all-solo events and in all-solo sessions, any of the solo groups may run together.

Progression from Green to Yellow and from Blue to White occurs through a written promotion by a single instructor in consultation with a CI or the Run Group Coordinator (RGC) of the group into which the driver is being promoted. In the case of instructor candidates proposing such a promotion, it would be handled jointly by the Candidate and Mentor in consultation with a CI or RGC.

Progression from Yellow to Blue – Promotion to Solo – and from White to Black – Promotion to Black – requires two checkout rides, each by an instructor. If both instructors agree and a CI or RGC concur, a written promotion is entered.

When a driver is promoted to the Blue run group, they are signed off to solo throughout PCA and will likely be allowed to solo with any other track organization.

**NEVER** promote a student to solo unless you are thoroughly confident they can run with any such organization and competently teach themselves new tracks.

All promotions are to be entered in the online evaluation system, and also in the promotions book if present. A promotion that is not entered in the online evaluation system and validated by the registrar, a CI, or RGC has not taken place. It is your responsibility as an instructor to ensure promotions are correctly recorded in a timely manner.

Progression from Black towards Red occurs when a Black run group driver enters the IDP. The driver is styled a Black Instructor or IDP Candidate until they have graduated from the IDP, successfully completed PCA National Instructor Training and been assigned a PCA National Instructor number. Black Instructors and Red Instructors may both run on track in the Red run group. It is expected that any driver promoted into the MNY PCA Black run group has the driving skills to become an instructor.

MNY PCA HPDE Online Evaluations are contained within [www.ClubRegistration.net](http://www.ClubRegistration.net). When instructor assignments are made for each HPDE and communicated by a CI, you will be associated with your student within the system. When you log on, you will be able to navigate to your student's evaluation form, and expected to complete it within a timely manner following the DE. The timing for IDP candidates is explained in the Curriculum section. Ideally all instructors will complete their student evaluations and promotions before they leave the track at the end of each event. They must be completed within a few days following the event. Instructors who fail to complete student evaluations and promotions will likely not be invited to instruct for the region again. As the system is set up, any instructor can create an evaluation for any attendee. This allows instructors to evaluate and promote students or other drivers not assigned to them before the event. As noted above, students may evaluate their instructors

through the same system. We strongly encourage you to log on as soon as your student has been assigned to read any previous evaluations of them.

Green students must have an instructor in their car whenever on track. Yellow students may be allowed by their instructors to run anything from a session to a day solo in the Yellow run group, with the agreement of a CI or RGC.

If you allow your Yellow student to drive a session or partial session solo, debrief them immediately after they return to the paddock. Ride with them again the next session or before the end of the day. If you allow them to drive solo the first day of an event, ride with them the first session of the second day, or for a single-day event on the last session of the day.

Make sure they understand that a sign-off to drive solo in the Yellow run group is temporary and part of their progress. It is NOT a promotion to the Blue run group. It is not a sign-off to solo with any other PCA Region or at any other track. Whenever you allow them to drive solo, stay in touch for the balance of the event. They are your responsibility for the entire event. Sign-off is not kiss-off!

If your Yellow student is promoted to the Blue run group – promoted Solo - stay in touch for the balance of the event. If they ask you to ride with them in their new run group, do so. They are your responsibility for the entire event. Promotion to Solo is also not kiss-off!

You may be asked to check-out a driver, which means ride with them and assess their skill level. MNY PCA checks people out for two reasons. The first is to ensure they should be in the run group into which they have been placed. This is usually done when a driver is running with MNY for the first time. We need to check that they really are safe enough to run in the group. Occasionally, you may be asked to check out a driver about whom doubts have been raised, or who has not been on any track for a long time. Other check outs are for promotion to the next run group.

If you are asked to take a check out ride you may have very little time for a “Five Minute Interview”. Make sure you at least ask about their high-performance driving experience and car. Once you are in the car do NOT take anything for granted about their driving ability, awareness, safety and conduct on track despite what they claim or others offer. Always judge everything about them as a driver for yourself. Be prepared for anything!

### **Promotion Criteria**

Skills required for promotion from Green to Yellow:

- Demonstrates understanding of and adherence to MNY PCA HPDE Safety ethos.
- Exhibits good track etiquette and consideration for other drivers.
- Drives the line accurately and consistently.
- Is predictable on track.
- Drives at an appropriate pace for the group.
- Inputs increasingly smooth.
- Makes few mistakes and can self-correct.
- Stays calm in traffic.
- Anticipates slower cars in front. Reacts accordingly.
- Does not follow too closely.
- Communicates well with instructors.
- Does not give or accept late passing signals.
- Gives passing signals promptly and visibly. One signal per car.
- Passes with good safety margins.
- Displays full knowledge of procedures, flags, marshal stand locations, and driving terminology.
- Student is safe to drive alone in Yellow Group.



#### Skills required for promotion from Yellow to Blue:

- Willing to be promoted to Solo.
- Demonstrates full understanding and compliance with Metro New York DE philosophy.
- Knows the line and is consistent and predictable.
- The student has developed very smooth inputs, especially under braking.
- Uses good vision especially in corners with eyes up.
- Has 360° situational awareness.
- Looks through corners, developing "Big Vision".
- Carries reasonable momentum into corners.
- Drives at a speed consistent with the group or higher.
- Practices effective "Heel-and-Toe" down-shifting – for manual gearbox cars.
- Demonstrates competent car control and recovery skills.
- Is fully aware of all flag meanings and procedures automatically.
- Gives visible, prompt, and courteous passing signals.
- Good driving record for a minimum of two events.
- Calmly deals with fast traffic and close passing.
- Begins to demonstrate "Trail braking"
- Practices accelerating from the apex of a turn through track-out
- Can talk instructor fully through a lap.
- Can competently drive offline.
- Knows and can use rain line.
- Can drive safely and correctly without instructor input.

#### Skills required for promotion from Blue to White:

- Desire to be promoted to White.
- 360° situational awareness.
- Displays a courteous, respectful attitude, without intimidation or aggression.
- Does not over drive.
- Demonstrates safe, consistent decision making.
- Requests continued instruction and demonstrates ongoing improvement.
- Drives the line flawlessly and effortlessly.
- Very smooth inputs at all speeds.
- Demonstrates good brake release.
- Correctly uses trail braking, throttle steer, heel-and-toe.
- Uses appropriate vision techniques for higher speed throughout track.
- expected to carry considerable momentum through corners.
- Can safely vary the line in any corner (to avoid debris for example).
- Calmly deals with cars in close proximity.
- Drives at a pace appropriate to group and approaching car limits.
- Can demonstrate the "Rain line" and understand the concepts of that line
- Can demonstrate unconscious competence through multiple laps – ideally a session - for instance by holding a discussion with instructor unrelated to the driving.

#### Skills required for promotion from White to Black

- Desire to be promoted to Black.
- Always drives without aggression, respectful and courteous to others.
- Provide very smooth inputs at all speeds.
- Demonstrates expert vision skills by looking well ahead. Continuously scans down-track for points of emerging information.

- Uses brakes minimally but wisely.
- Understands and carries considerable momentum through corners.
- Has mastered trail braking, throttle steer, and heel-and-toe.
- Can easily handle closeness of other cars without losing focus.
- Drives at a pace appropriate for the run group and approaching the situationally safe limits of their car.
- Balances car flawlessly.
- Can describe and show their limits without leaving track.
- Can fully describe their actions on track and their reasons for them.
- Shows consistent unconscious competence while driving as outlined above.
- Constantly pursues improvement on track.

## Appendix 1: Student Interview Questions

Everything you ever wanted to know about your student and weren't afraid to ask.

There are more potential interview questions than there is time to ask them. To a great extent, you must determine for yourself which are vital for you to know and the order in which to ask. Between pre-event and paddock discussion you will probably know most of this information by the end of your first day with a student and quite probably much sooner.

### Motivation:

- Why does the student want to drive on track? How did they come to this hobby? What is their history with car enthusiasm?
- Have they driven on a track before? If so, how many track days and where? What was their most recent event and was it in this car?
- What are their goals from the track hobby? What are their goals for this season? What are their goals for this event? What are their goals for your first session in car together?
- Whatever their goals for the event, make sure they understand that two of yours are safety and fun, and you'd like them to concur.

### Mental and physical state:

- It is vital that you ask whether there is anything you should know about the student before going out on track, for example color blindness, diabetes, or a learning disability. This question may also draw useful responses more psychological than physiological. The more you know about the student the safer you both will be.
- During your first conversation at the track, remember to ask them the most basic question: "How are you feeling today?"

### Personal context:

- Where is home? Are they at the track alone? If not, who is with them? This provides an opportunity to be actively inclusive even if they have come with a partner, friends, etc.
- Do they prefer the track hobby be more social or solitary? If they want to meet people, introduce them around.
- Ask about their learning style. Get the student to talk about themselves, about their other hobbies, about their interests. Hobbies that relate quite directly to track driving and the skills involved include autocross, skiing, flying, motorcycling, surfing, and biking.

### Automotive knowledge:

- Ask what they are driving, how long they have had the car, whether it is modified, how it is prepared, and whether they do their own work. Learn what tires are mounted, their condition, how they were chosen, and what pressures they run on the street. You should suggest pressures for them to set when they reach the track. Even by phone or e-mail these questions are useful to help get them considering things they did not realize are important.
- If they do not work on their own car, find out who does. Especially with a novice, there is a good chance you know more about their car than they do, or at least how modifications and preparation are likely to be felt on track.
- Other car related questions include the type of transmission, brake pad compound and age, rotors, when the brake fluid was last flushed. There is a good chance they do not know; we want you to know these unknowns and perhaps get answers.

- Ask if they understand what ABS, traction control, and stability control do and how to set them. Remind them that they must stay on when on track. Ask if their car has automatic braking, lane drift correction, lane change assist and understand these must be turned off on track. It is the driver's responsibility to know how to disable these automatic driving functions.

#### Driving knowledge:

- If the driver has a manual gearbox you can ask whether they know how to heel-and-toe and whether they practice on the street. If they have an automatic or PDK, establish how they set the electronics that control the shifting and whether they know what difference the settings make. Their answers will help correctly set your expectations.
- Ask if they understand the basic concept of the driving line and using the whole track. Find out if they know the terms turn-in, apex, and track out and ask generally where in a corner one shifts, brakes, and accelerates. This may be an opportunity to prepare them for the basic ways in which street and track driving differ.
- Do they know and understand HPDE passing protocols?

#### Track and Event knowledge:

- Ask whether they have been to the track at which you will instruct them. Ask whether they know it, and if so how well. Can they identify corners by name and number? Have they watched video of the track? Have they run at the track in a Sim?
- Do they know the meanings of the flags? Do they know where flags are shown?
- Do they know the HPDE passing zones at this track?
- Do they know the staging and pit procedures? Are they aware of blend lines and how to use them?
- Do they know how to get to the track? Do they understand the tech procedures before and at the event? Do they know about emptying the car before going on track? Do they know the event schedule and where to get it? Do they know their run group?
- If they have never been to the track they will not know where the paddock is relative to the track entrance, pit entrance and exit, or garage if there is one.
- Ask if they know where the classroom, tech line, concessions, and lavatories are, and tell them!
- Be sure they know where the Driver's Meeting will be, and that attendance is mandatory. This goes for their in-class sessions too.
- Ask whether they are sharing a car, and determine whether they understand the procedures for that. If a student is sharing their car, be prepared for a little added complexity to your days.
- If you know where you will be parked at the track, tell them as far in advance as possible. Make yourself accessible.

MNY PCA HPDE sends out and otherwise makes available on [MetroNYPCA.org](http://MetroNYPCA.org) and [ClubRegistration.net](http://ClubRegistration.net) a good deal of information covered in the questions above, especially related to venues, events, and procedures. Other PCA regions do likewise and basic procedures are similar. If your student knows none of the answers and is surprised by the questions, it may be an indication that they are not preparing for the event with the attention you want. Help them understand the importance of preparation.

Most students are well prepared and have paid attention to the available information. They may not understand it fully, but they tend to be hungry to learn. Even the most excited may also be slightly nervous, possibly even scared. When speaking with your student prior to the event, try to create some humor, this relaxes people and it also helps you gently establish who will be in charge at the track. To be clear: the student controls the car, but you must control the student.

Stress safety over everything else. Quizzing your student on safety and emergency situations will help reveal their knowledge or lack of it, though an in-depth exam on safety during your first conversation is probably not necessary!

Such discussion reminds a more aggressive student of the dangers and the need to build skills and knowledge before speed.

During discussions, be sure to check if the student has questions for you.

Always be enthusiastic and reassuring. You are the greatest determinant of how positive their experience will be. Your initial interview(s) with your student set the tone and help you make sure you both have fun. It's why you are both at the track.

## Sample Basic Interview Questionnaire

### Driver

Is this your first HPDE?

Why do you want to drive on track?

What are your goals for the track hobby?

What are your general goals for this event?

How many HPDEs/track days have you completed?

When were you promoted to this run group?

What tracks have you driven?

Have you driven (current track) before?

With what track organization(s) have you driven?

When was your last HPDE / track day?

How do you feel about this DE? Excited? Nervous? Anxious?

Do you have any physical limitations that may affect your time on track?

(Color blindness, Vision issues, Hearing issues, Diabetes, etc.)

Do you know how you learn best?

(By seeing, By hearing, By doing, By thinking, etc.)

Do you have specific goals for this DE, things on which you wish to work?

(Smoothness, Precision, Line, Vision, Braking, Shifting, Throttle, etc.)

### Car

What is your car's make, model, year, color?

What kind of transmission does it have?

How do you generally change gears?

(Manually or Automatically as applicable.)

What is your car number?

What, if any, modifications have been applied to your car?

(Engine, Suspension, Aero, Brakes, Interior/Safety)

What tires, brake pads, rotors does your car have?

When was your brake fluid last flushed/bled?

Has your car been through the required pre-event tech and is your tech form signed and stamped? If not, you MUST get this handled before the event!

Do you know where you will be parked at the track?

### IMPORTANT

Tell them your main job is safety, to help keep them and others safe.

Tell them your top priority for the event is THEM.

Tell them your car information and where you will be parked.

Set a time and location for your first meeting at the track.

Make sure they know you will not be late, so they should not be late.

\*\*\*Ask whether they have any questions for you.

## Appendix 2: Track Terminology

### An Instructor's Glossary

The words you use are less important than that they are understood by the student and that you use them consistently. Swapping between terms that mean the same thing can be confusing. It can be worth working with the other instructors – your mentor especially at an IDP HPDE – to use the terms they prefer so the student is not constantly adjusting. Ask the student with which terms they are familiar and which they prefer.

#### Driving

- Brake - slow the car down
- Light brake - slow the car down a little.
- Modulate the brake pedal - brake, release a little, then brake etc. (for rougher surfaces) prevents lock up if the car has no Anti-Lock Brake System (ABS).
- Squeeze the brake - gently adding pressure to the brake.
- Feather or lift off the brake - gradually reduce pressure on the brake pedal.
- Locking up – braking to the point that the wheels no longer rotate.
- Threshold braking - brake hard without locking up the wheels or engaging the ABS. The threshold is the point just before lock up. Threshold braking is for controlled rapid deceleration.
- Trail braking – braking lightly and with decreasing intensity while turning in to a corner. We trail and trail off the brake to help balance the car at higher loads and control understeer, oversteer, and rotation. Trail braking is for improved cornering.
- More gas, or throttle, or just gas or throttle - accelerate the car.
- Squeeze the throttle - gently adding pressure to the throttle, a constant depression of the gas pedal.
- Feather or lift off the throttle - reduce speed by lifting off. A constant release of the gas pedal. Not abrupt.
- Shift - to change gears
- Upshift - go to the next higher gear.
- Downshift - go to the next lower gear.
- Heel and toe - using the right foot to depress the brake pedal and blip the throttle at the same time. Used during a downshift to match engine speed with transmission speed. A necessity for a smooth transition.
- Blipping the throttle - a quick stab of the throttle to rev-match - raise the engine RPMs - in order to downshift without abusing the drivetrain. Performed when the clutch pedal is depressed.
- Popping the clutch - letting the clutch pedal up fast, abruptly.
- Feather the clutch - letting the clutch pedal up slowly at the point of engagement, rather than popping the clutch.
- Riding the clutch - keeping the left foot on the clutch pedal.
- Bite or engagement point – the place in the clutch pedal travel when the clutch actually engages or disengages the flywheel.
- Power shift - keeping the throttle fully depressed while upshifting (not recommended).
- Turn in - to enter a corner
- Turn in point - location of initial turn into the corner.
- Early - turned in too soon, correction at the apex is necessary.
- Late - turned in too late, reducing the radius entry to the corner and possibly requiring otherwise unnecessary inputs.
- Crabbing or 'cheating in' - moving from the edge of the track before beginning a turn. This narrows the track and usually results in an early apex.

- Tighter - add a little more steering input to be closer to the apex.
- Hold the apex - stay on the apex longer, necessary with an early entry.
- Unwind the wheel - after exiting the apex, slowly bringing the wheel back to center.
- Track out - upon exiting the corner, bringing the car to the edge of the track.
- Track out point - the area on the outside edge of the track where you should be at the end of a turn.
- Handling - how the car is reacting to driver inputs.
- Understeer (push) - the car is not turning as much as it is being asked to. There is more adhesion, stick or grip in the rear than in the front.
- Oversteer (loose) - the car is turning more than it is being asked to. There is more grip in the front than in the rear.
- Bite - the amount of traction or grip a tire has ... synonymous with adhesion, stick or grip.
- Balance - do not add more gas, or steering or brake. Just be smooth and steady.
- Squeeze off the gas - release gas pedal a bit so as to transfer some weight from the rear to the front of the car.
- Squeeze on the gas - push gas pedal down a bit to accelerate the car and transfer some weight from the front to the rear.
- Late pass - a pass where the passing car cannot safely get back on line before the braking zone or turn-in for the next corner.
- Drive the Line – keep the car on the driving line to optimally circulate on track.
- Hitting your marks (or points) – correctly driving to the areas on the track where one changes direction and/or applies inputs. A shorthand for accurately driving the line and using the whole track.
- Use the whole track – correctly employing the entire width of the track to increase corner radii and drive the correct line.
- Throttle steering - using increased or decreased pressure on the throttle to assist in making a turn.
- Transition - change from one driver action to another, also refers to a move across the track from one side to the other.
- Smoothness – applying or changing inputs in such a manner that the balance of the car is not upset in any direction. Smoothness is felt in the absence of abrupt or particularly noticeable change in direction or velocity.
- Accuracy or precision – consistently placing the car where intended on the track. Relates to “hitting the marks / points”.
- Consistency – the ability to repeatedly demonstrate accuracy, speed, and smoothness. To a large extent it means driving the line well without having to make corrections.
- Brake fade – softening or spongy brake pedal combined with less deceleration for the amount of brake application. The brakes are working sub-optimally usually due to overheating and/or boiling brake fluid. Brake fade requires a longer braking zone and more cooling time between brake applications.
- Tires going away or going off - tires have less traction resulting in the car not turning or braking as well.
- Greasy tires – tires sliding due to reduced traction, often due to overheating. This can be controlled to some extent by reducing tire pressures, or by cooling the tires through smoother driving. It may also mean that the tires are old and must be replaced.

#### Physical track features

- Pit Out, or Entry to the track - where a car first enters the track and must stay off line until up to speed and it is safe to blend onto the driving line.
- Pit In, or Exit from the track - area on track where a car stays off line and slows down before entering the pit.
- Turn-in cone or marker - reference point at each corner that marks the entry to the corner.



- Apex cone or marker - reference point that marks the mid-point of a corner's apex.
- Track-out cone or marker - reference point that marks the end of the turn.
- Curbing - found usually in the apex and exit of a corner, and often at turn-in points. Has various configurations. Also referred to as "rumble strips", "gators" and by other descriptive terms. Corner curbs are usually painted.
- The Line - recommended route around the track that will properly position a car for the next turn while reducing the track length. Most cars on a track will be "on line".
- Off-line - anywhere on the track other than on-line. Cars will be off-line due to driver error, or for passing, entering and exiting the track, mechanical problems, marshal instructions, and through driver error.
- Flag stations - where flags are displayed to communicate with drivers. Some tracks also have lights.
- Run-off (areas) - places to the side of the track where cars can go if necessary.
- Passing zones - areas on the track where one car may pass another, with a signal (point-by).
- Landmarks – sighting points around the track giving drivers good places to look ahead as they drive the line. Cones and other moveable markers are useful for beginning drivers, but permanent landmarks are more useful for most drivers.
- Distance or brake markers - notations at the side of the track which advise the distance to the next corner's entry. Not found at all corners. These are permanent landmarks.
- Braking zone - area on the track where cars will be braking prior to and possibly while entering a corner. This usually refers to the area of hardest braking rather than later trail braking.
- Blend lines – painted lines on the track that mark areas where pit-in and pit-out protocols must be followed.
- Armco - physical barriers near the edge of the track to stop cars from going too far. We often refer to barriers of metal, concrete, fencing, though strictly speaking Armco is a corrugated metal construction like the "blue bushes" at Watkins Glen.

#### Miscellaneous terms

- Dropping eyes – inability to keep eyes up and look far enough ahead, a strong indication of driver fatigue.
- Brain fade - loss of concentration on track, usually due to fatigue.
- Red mist – aggression or anger on track, often associated with overdriving and competitiveness. Always a safety issue in part because it shows a lack of control. Competitiveness at an HPDE is always misplaced. (Red mist is antithetical to good race driving as well.)

① Do you understand pitch, yaw, roll, and rotation as they apply to vehicle dynamics? Can you explain them?

What other terms can you think of? Let us know so we can include them.

## Appendix 3: Instructing Quick Reference

Remember: driving is a continuum of skill with no abrupt change between groups.

Speed is the reward for smooth, precise driving.

Safety first.

### Instructing the Novice and Beginner Student (Green / Yellow Run Group)

#### *In Paddock*

- Proper driving position
- Setting the mirrors to clear blind spots
- Staging, pit-exit, and pit-entry procedures
- Flag meanings and actions
- Safety and emergency procedures - recognize and react
- On-track terminology and instructor hand signals

#### *On Track*

- Driving the line: turn-in, apex, track-out, transitions and positioning between corners
- Operating the car
  - Steering - hand position and movement
  - Accelerating - smooth throttle control
  - Braking – smoothness, brake timing, and pedal pressure
  - Shifting - up and down, shift timing, gear choice, clutch and stick smoothness
- Vision and awareness: eyes up and well down the track; noticing marshals, landmarks, mirrors
- Passing: point-bys, where and how, too soon, too late, being passed, safety margins
- Traffic: stay calm in traffic, anticipate slower cars ahead, give room, passing
- Car control
  - recognition and reaction to understeer and oversteer
  - smoothness and balance
  - consistency and accuracy
- Warm up and cool down laps

#### What to Expect from a Beginner:

- A beginner, will likely be concerned with following protocols and not holding up other drivers. Help with both to reduce their anxiety until it is autonomous.
- Be alert to changing conditions requiring adjustments to best drive a car. Help the student. Beware of student information overload creating lack of awareness. You must calmly anticipate, react, and guide the student's driving to ensure everyone's safety.
- Keep instruction simple, concise, and clear on track. Always default to the safest choice as you teach, instruct and coach.
- Teach your student to make the safest choices.
- Monitor the condition of the student. Fatigue, loss of focus, lack of awareness, lack of understanding, tension can all result in missed marks, flags, point-bys, etc. Inappropriate, inconsistent, or unpredictable driving may result. A student who loses focus must be brought in immediately.
- Help the student develop self-awareness of mistakes and triumphs; this is vital to progress. Self-analysis follows.
- Beginners will often drive in a jerky and inconsistent manner and the line can be a mystery, unbeknownst to them. Prepare to guide and explain in the simplest terms.

### Common Novice Errors:

- Not looking up and ahead
- Indecisive use of controls
- Jerky, abrupt inputs
- Inappropriate early apexes. Be aware of this since it can be dangerous!
- Crabbing (drifting away) from the track edge before initiating a turn
- Failure to let the car track out or pinching the exit of the turn
- Turning in before performing a needed downshift
- Mis-judgement of braking distances and effort
- Inconsistency as speeds increase
- Overly concerned with speed
- Traffic issues: stress about delaying others or not being pointed by, fear of other cars
- Mirrors: not checking or checking too much
- Missing flags

### When instructing a novice, you must have strategies for:

- Aggressive or timid drivers: keep student's confidence and capability in balance
- Overwhelmed drivers: calm them in car, pit to break the cycle.
- Trains: help your student manage traffic; drive through the pits to escape trains
- Incidents, spins, and wheels off: make sure your student knows correct procedures

### For the Advanced Student and Intermediate Driver (Yellow / Blue / White Run Groups)

Everything should be refinement, not instruction

#### Car Operation:

- *Steering* – Instruct on consistent and economical steering motions, proper hand position and movement. Steering inputs must be decisive but smooth.
- *Throttle control* – Instruct on proper timing for all situations, especially accelerating out of a corner for optimal car balance. Inputs must be consistent, decisive, and smooth.
- *Throttle steer* – Teach this more advanced technique of chassis balance and line control.
- *Braking* – The hardest skill to learn. Teach threshold and trail braking, proper pedal pressure in the brake zone, extending the brake zone and using the brakes to balance the car. Inputs must be consistent, decisive, and smooth.
- *Shift timing, heel and toe* – You should not need, but be prepared, to teach it (off-track only). Required for effective advanced driving.

#### Skills and Techniques:

- *Vision* – The student should be looking far ahead, no longer driving immediate “point-to-point”.
- *Increasing Awareness* – Instruct to develop 360° awareness.
- *Car Control* – Help the driver deal with variable handling situations.
- *Managing the contact patch* – Depends on the driver's feel for the car. Focus them on it and help them learn what they are sensing.
- *Passing* – The driver must be courteous, safe, and keep intervals well managed.
- *Handling close traffic and off-line turns* – Make sure the driver is prepared for all situations.

- *Smoothness and Balance, Consistency and Accuracy* – Emphasize the need for, and reinforce the achievement of these qualities.
- *Different Lines and Off-line Corner Entries* - Explore them with drivers. Develop their knowledge of different corner types including how to read them.
- *Awareness of Errors and Ability to Correct* – This capability is required for any driver to be allowed to solo.
- *Automatic command of all flags and their meanings* – requirement to be soloed.

#### Mental Preparedness:

- *Concentration, Judgment, Situational Awareness, and Decision Making* – These skills come with seat time, but you must help drivers develop them with your coaching.
- *Courtesy and Driving Camaraderie* – The driver has to see the other drivers on-track as peers and friends, not competitors, enemies, or obstacles. Your attitude sets the tone. No driver with a poor attitude should be soloed.
- *Self-Analysis and Receptiveness to Learning* – These are attributes that you can coach to, but drivers must decide for themselves whether to progress or plateau and stall.

#### **For the Advanced Driver ( **Black** / **Red** Run Groups):**

Further refinement with high expectations of learning which coaching

- Drivers in advanced run groups should have been exposed to all the skills and knowledge to be safe, consistent, and controlled on track. Nonetheless, any advanced driver, even a fellow instructor, can develop a bad habit or be able to improve some aspect of their driving.
- Useful practice is active not static. This should be aided by a coach.
- When in the right seat with an advanced driver, even one whose skills are superior to yours, you will be able to help. A good driver is one who has mastered the basics. When coaching an advanced student, always go to the basics for improvement opportunities.
- Use all the sensory inputs you get in the right seat, what you see, feel, hear and even smell to determine what to coach. Tell them what you observe. Ask questions, make suggestions. Review off track. You can even suggest a demonstration ride. If you are teaching or even instructing this driver on something beyond a novel technique, something is amiss.

① How would you surreptitiously test for unconscious competence?

## Appendix 4: Introduction to Data Analysis

A great coaching tool, if you know how

Motorsports Global Positioning System (GPS) data loggers are everywhere, from free phone apps, to sophisticated factory-installed systems. As an instructor, you should be familiar with the different kinds of data devices, and have a general understanding how data can be used with your students.

What follows is a fairly conservative set of suggestions for data use. In many cases, Yellow drivers and above benefit by using data analysis, so long as you feel competent in the driver's and your own interpretation of the data and instruction based on it.

### Student level

*Novice* - Data isn't appropriate for most novice students, it can be distracting and too much information. If your novice student has a data logger or phone app in the car, you might ask him to turn it off. However, some students learn primarily through visual and reflective means, and data can be an effective way to reinforce the curriculum and instruction. Find out the learning style of your student, and decide whether or not to use data with them.

*Intermediate* - This is where data coaching is most useful, for a couple of reasons. It's relatively rare for intermediate students to get one-on-one coaching, and so they often plateau at this level. Also, not all intermediate students struggle with the same problems, and data is a way to highlight exactly what the student needs to work on.

*Advanced* - As a driving instructor, it is unlikely you would be asked to analyze data from advanced students; this is a more specialized skill set. Unless data coaching is your specialization, you will probably be sharing your data peer to peer with advanced drivers and other coaches.

### Types of data loggers

There are so many different data logging devices and apps that it would be difficult to learn them all. We can divide data loggers into two categories based on sampling rate.

*1 Hz phone apps* - Harry's Lap Timer, CMS Pro, Hot Lap, TrackAddicts, Porsche Track Precision, and similar apps use the phone's accelerometer and GPS to track the position of the car once per second. This is referred to as a sampling rate (frequency) of 1 Hertz (Hz). Phones are capable of faster sampling rates, but the phone's operating system generally reduces this to 1 Hz to save the battery.

*10 Hz data loggers* - A proper motorsports data logger monitors the car's position 10 times per second. AiM, RaceLogic (VBox), MoTeC, Garmin's Catalyst, and other devices are typically 10 Hz or higher. Phone apps that use an external GPS antenna also may have a 10 Hz sampling rate.

What you can learn at 1 Hz and 10 Hz are very different. At 1 Hz, you can see how fast the student is going at different points on track, but not what they are doing behind the wheel. At 10 Hz, you can deduce exactly that the student is doing with their hands and feet.

### Data coaching at 1 Hz

If a student wants you to look at their phone app and interpret the data, the only things you can ascertain with any accuracy are lap times, top speed, and minimum speed. The reason is simply because the sampling rate isn't high enough. At 120 mph, the car is traveling 176 feet per second. A 1Hz sampling rate will not show the braking point with any accuracy.

Nevertheless, a 1 Hz phone app can be used to see how the following three variables differ from lap to lap:

- Lap and sector times - This can be a good measurement of a student's progress, or for large setup changes like tires or aero. If the phone app also includes sector times, you can use that to gauge how consistently they are driving.
- Minimum speed - The lowest speed in a corner is a useful metric, because it shows the most common intermediate driving error: over braking before a corner. A higher entry speed typically results in a faster lap time. Note that a corner leading onto a straight taken correctly has a lower min speed, so it's not safe to say

that a student should always aim to have a higher minimum speed. Therefore, you need to look at top speed as well.

- Top speed - Top speed usually relates to how well the student exited the previous corner, and to a lesser extent how late they got on the brakes. Therefore, looking over a student's top speed from run to run, and comparing that with cars of similar performance, is a good way to see how they are exiting turns.

### **Data coaching at 10 Hz**

If your student wants you to look at their 10 Hz data, you need to know how to read it. This is a specialized skill set, usually requiring a laptop computer, and it is not expected that instructors should know how to do this. For those willing to learn it is not difficult because most of what you need comes from only three channels:

- GPS position - What line is the student driving? Do they drive consistently? Do other people drive a different line?
- Speed/distance - How fast is the student going at this point on track? What does the shape of the speed trace say about their driving?
- Time/distance - How do the students' laps compare with each other? What are they doing right or wrong? What do other people do differently?

While other channels are useful (throttle position, steering angle, brake pressure, individual wheel speed, friction circle, etc.), they take time to analyze, and it is simply not something you would do in the context of an HPDE event. If you would like to learn how to read data, MNY PCA may offer courses on that in the future. They would be optional, but they might well have an extra cost. Are you interested? Can you help?

### **Data and the learning process**

Just like driving, data can be taught, instructed, or coached. When to teach, instruct, or coach is similarly driven by the student's "Level of Learning" as follows:

- Unconscious Incompetent - Too early to introduce data;
- Conscious Incompetent - Introduce data at a very high level: Data can be used to see your lap time, top speed, and minimum speed in a corner. All of this can be gathered with a typical 1Hz phone app;
- Conscious Competent - Ready to learn the speed trace, GPS position (driving line) and other data available at 10Hz;
- Unconscious Competent - Needs an introduction to the concept of data, and how being analytical about their driving will help them go faster. This student needs to be taught the fundamentals of data;

The cycle of learning: The "Learning Process" through which students progress using data is the same circular path they go through when learning anything:

Have an experience - Analyze the data from the experience.

Speed trace - to see their driving inputs

GPS position - to see their driving line

Sector times - to see if the changes they are making result in more speed

Long-G, friction circle - to see how well they are braking and mixing inputs

Develop ideas and conclusions

Test conclusions in a new experience.

### **Learning style**

Match what you do to the needs of the student. "Learning Style Theory" suggests that different students will respond better to different inputs:

- Visual learners do best by observing. Use data for GPS position, speed trace, and sector times;
- Auditory learners learn best by listening. Use classroom sessions and pre and post session discussions to focus the student on listening to the tires as a means of understanding the data;

- Reflective learners do best by thinking. “Homework” assignments such as mental imaging between sessions can work for them. Have them imagine perfect laps with all their inputs at appropriate locations. While off-track, have the student talk you through a lap using the speed trace. Use data to help recall what was happening. Was the car oversteering or understeering? Did they make an adjustment to the driving line?
- Physical, experiential or kinesthetic learners do best by doing. The importance of data is harder to explain to this student. Show the data (you might use Lat-G and Long-G) but relate this to how the car feels in direct relation to their driving inputs. This requires more time to do well. Is the steering wheel heavier? You are pushing the tires - understeering. Are you fighting traction on acceleration? You are oversteering.

### **Barriers to learning**

People develop various ways to cope with challenging situations. These can be barriers to learning. Data can be a useful way for the student to overcome and get back to successful learning. For example, by showing a student that it is possible to brake 100' later, or to go through a corner 10 mph faster, that may help them get over the fear or other barrier holding them back. It is worth noting that this is what the Garmin Catalyst tries to do.

### **Data-centric instructing**

As an instructor, you may take various roles described in the Empathic Instruction section earlier in the document. Data can be used to enhance some of them:

- Strategist - Set objectives based on data; brake hard then soft;
- Tactician - Use data in drills, like the no-brakes drill;
- Nurturer - Use data to show what the student is doing correctly or consistently;
- Motivator - Use data to show that they can reach goals; string together an optimal lap;
- Pragmatist - *If* data works with this student, use it;
- Student - All coaches should learn data fundamentals.

### **Using data to overcome common mistakes**

- Missing apexes – Easy to see in the GPS position, and also in the speed trace by looking at where the student’s minimum corner speed is.
- Over aggression – Can show up in the data as late/deep braking and then over/understeering out of the turn. This may simply be bad driving, it doesn’t always mean aggressive driving.
- Over driving – Too hard / too soon on the throttle or carrying too much speed into a turn. Shows up in the data as a wavy corner exit.
- Not using all of the track – Easy to see in the GPS position.
- Mismanaging chassis and contact patches – Seen in the friction circle. How well are they filling the bowl?
- Shifting – Missed shifts are easy to spot on the speed trace.
- Foot work – The shape of the brake trace should be linear. A “stepped” brake trace indicates bad heel-toe.

### **Data for Instructed Students**

Teaching Green students about data leads to information overload. Arguably, the only data they should be concerned with are provided through their vision: marks and landmarks.

If you introduce data to senior Yellow students, do so with extreme care. Lap times are the first thing you might introduce, because they are a measurement of their progress. Do NOT encourage these drivers to compare lap times.

Once a student can use but not abuse lap times as a data metric, introduce things you can see at 1Hz phone apps: max speed at the end of straights, min speed in a corner, sector times (if the app supports that).

### **Data for Beginner and Intermediate Solos**

Blue and White drivers are ready to look at the speed trace, the GPS position, and sector times. It's too complicated to introduce any other channels. Because of this, braking data may be the most important thing that Blue drivers should look at. It is likely the most important thing on which they are working. To the extent you are using data to help drivers in these run groups, you need to give serious consideration to what and how much such data they should be using and whether they are yet capable of safely applying what they learn. Ultimately, their own perceptions and understanding of what a car is doing are far more important; data is a refinement tool.

### Operating the car

*Steering* – Instruct for consistent and economical steering motions. Steering inputs must be decisive but smooth. This can be done with data (steering angle).

*Throttle control* – Instruct for proper timing on all occasions, especially accelerating out of a corner for good balance of the car. Inputs must be decisive but smooth. This can be done with data (throttle position).

*Throttle steer* – Teach this more advanced technique of chassis balance and line control. Data can show this as a combination of steering angle (less) and throttle position (more). This will also show up on the friction circle.

*Braking* – The hardest skill to learn. Improve threshold and trail braking, proper pedal pressure in the brake zone, extending the brake zone and using the brakes to balance the car. Inputs must be decisive but smooth. Easy to see in the data, both on the speed trace and Long G.

### Skills and techniques

*Managing the contact patch* – This depends on the student's feel for the car. Focus them on it. This will show up as a rounder friction circle. Friction circle is a relatively advanced data channel, and so this is hard to teach.

*Smoothness and Balance, Consistency and Accuracy* – Emphasize the need for, and reinforce the achievement of these qualities in your student's driving. This is very easy to see in the data using the time delta and sector times.

*Different Lines and Off-line Corner Entries* - Explore them with your students. Develop their knowledge of different corner types. This is easy to see in the GPS position.

### Mental preparedness

*Self-Analysis and Receptiveness to Learning* – These are attributes that you can coach to, but the student has to decide for themselves if they want to make progress or just plateau. If students are receptive to data, they can coach themselves through data analysis. Ideally, they should get specialist advice so they are not misinterpreting data teaching themselves poorly.

### **Data for More Advanced Drivers**

Better Intermediate and advanced drivers need to know as much as they can absorb, and should be able to read (interpret) their own data. Advanced drivers probably should compare data with other advanced drivers. Seeing where someone else goes faster because of a different technique or driving line is eye opening.

Advanced students can add some more data channels:

- Lateral Gs - Is the driver over- or under-driving the tires?
- Longitudinal Gs - How well is the driver braking and accelerating?
- Friction circle - Assess how the driver blends inputs (trail braking mostly).
- Ultra-advanced data (OBD2 data logger).
- Steering angle - Less angle = lower lap time. Driver refines rotation of the car on the brakes, not turn the wheel
- Brake pressure - How much brake is the driver using and when?
- Throttle position - See exactly where the driver gets on and off the gas
- Wheel speed - Individual wheel speed sensors show how close the brakes come to locking up, or if they lock up in a corner.
- Anything else the OBD2 monitors.



## Appendix 5: Advanced Automobile Safety Features

The future is now, and it's not all suited to the track

### Anti-lock braking systems

From Wikipedia, the free encyclopedia ([https://en.wikipedia.org/wiki/Anti-lock\\_braking\\_system](https://en.wikipedia.org/wiki/Anti-lock_braking_system))



An anti-lock braking system (ABS) is a safety anti-skid braking system used on cars. ABS operates by preventing the wheels from locking up (STOPPING ROTATION) during braking, thereby maintaining traction and control contact with the road surface.

ABS is an automated system that uses the principles of threshold braking and cadence braking which were once practiced by skillful drivers with earlier non-ABS braking systems. ABS operates at a much faster rate and more effectively than most drivers could manage. Although ABS generally offers improved vehicle control and decreases stopping distances on dry and slippery surfaces, ABS may significantly increase braking distance on loose gravel or snow-covered surfaces, while still improving steering control. This replaces the need to manually pump the brakes while driving on a slippery or a low traction surface, allowing to steer even in most emergency braking conditions. Since ABS was introduced in production vehicles, such systems have become increasingly sophisticated and effective. Modern versions may only prevent wheel lock under braking, but may also alter the front-to-rear brake bias. This latter function, depending on its specific capabilities and implementation, is known variously as electronic brakeforce distribution, traction control systems, emergency brake assist, or electronic stability control (ESC).

### Operation

The anti-lock brake controller is also known as the CAB (Controller Anti-lock Brake). Typically, ABS includes a central electronic control unit (ECU), four wheel speed sensors, and at least two hydraulic valves within the brake hydraulics. The ECU constantly monitors the rotational speed of each wheel; if it detects the wheel rotating significantly slower than the speed of the vehicle, a condition indicative of impending wheel lock, it actuates the valves to reduce hydraulic pressure to the brake at the affected wheel, thus reducing the braking force on that wheel; the wheel then turns faster. Conversely, if the ECU detects a wheel turning significantly faster than the others, brake hydraulic pressure to the wheel is increased so the braking force is reapplied, slowing down the wheel. This process is repeated continuously and can be detected by the driver via brake pedal pulsation, this comes from the rapid opening and closing of the valves. This pulsing also tells the driver that the ABS has been triggered.

Some anti-lock systems can apply or release braking pressure 15 times per second. Because of this, the wheels of cars equipped with ABS are practically impossible to lock even during panic braking in extreme conditions.

The ECU is programmed to disregard differences in wheel rotational speed below a critical threshold, because when the car is turning, the two wheels towards the center of the curve turn slower than the outer two. For this same reason, a differential is used in virtually all roadgoing vehicles.

If a fault develops in any part of the ABS, a warning light will usually be illuminated on the vehicle instrument panel, and the ABS will be disabled until the fault is rectified.

ABS is offered or comes standard on most road vehicles produced today and is the foundation for electronic stability control systems and traction control systems, which are rapidly increasing in popularity.

### Use

There are many different variations and control algorithms for use in ABS. One of the simpler systems works as follows:

The controller monitors the speed sensors at all times. It is looking for decelerations in the wheel that are out of the ordinary. Right before a wheel locks up, it will experience a rapid deceleration. If left unchecked, the wheel would stop much more quickly than any car could. It might take a car five seconds to stop from 60 mph (96.6 km/h) under ideal conditions, but a wheel that locks up could stop spinning in less than a second.

The ABS controller 'knows' that such a rapid deceleration is impossible, so it reduces the pressure to that brake until it sees an acceleration, then it increases the pressure until it sees the deceleration again. It can do this very quickly, before the wheel can significantly change speed. The result is that the wheel slows down at the same rate as the car, with the brakes keeping the wheels very near the point at which they will start to lock up. This gives the system maximum braking power.

### Effectiveness

On high-traction surfaces such as asphalt or concrete, many (though not all) ABS-equipped cars are able to attain braking distances better (i.e. shorter) than those that would be possible without the benefit of ABS. In real world conditions, even an alert and experienced driver without ABS would find it difficult to match or improve on the performance of a typical driver with a modern ABS-equipped vehicle. The recommended technique for non-expert drivers in an ABS-equipped car, in a typical full-braking emergency, is to press the brake pedal as firmly as possible and, where appropriate, to steer around obstructions. In such situations, ABS will significantly reduce the chances of a skid and subsequent loss of control.

In gravel, sand and deep snow, ABS tends to increase braking distances. On these surfaces, locked wheels dig in and stop the vehicle more quickly. ABS prevents this from occurring. Some ABS calibrations reduce this problem by slowing the cycling time, thus letting the wheels repeatedly briefly lock and unlock. The primary benefit of ABS on such surfaces is to increase the ability of the driver to maintain control of the car rather than go into a skid, though loss of control remains more likely on soft surfaces such as gravel or on slippery surfaces. On a very slippery surface, it is possible to lock multiple wheels at once, and this can defeat ABS (which relies on comparing all four wheels, and detecting individual wheels skidding). Availability of ABS relieves most drivers from learning threshold braking. ABS is required on all new passenger cars sold in the EU since 2004. In the United States, the NHTSA has mandated ABS in conjunction with Electronic Stability Control as of September 1, 2013.

### **Electronic Stability Control**

From Wikipedia, the free encyclopedia

([https://en.wikipedia.org/wiki/Electronic\\_stability\\_control](https://en.wikipedia.org/wiki/Electronic_stability_control))



Electronic stability control (ESC), also referred to as electronic stability program (ESP) or dynamic stability control (DSC), is a computerized technology that improves a vehicle's stability by detecting and reducing loss of traction (skidding). When ESC detects loss of steering control, it automatically applies the brakes to help "steer" the vehicle where the driver intends to go. Braking is automatically applied to wheels individually, such as the outer front wheel to counter oversteer or the inner rear wheel to counter understeer.

Some ESC systems also reduce engine power until control is regained. ESC does not improve a vehicle's cornering performance; instead, it helps to minimize the loss of control.

Since November 1, 2011, EU Type Approval is only granted to models equipped with ESC. By November 1, 2014, ESC is required on all newly registered cars in the EU.

The NHTSA requires all new passenger vehicles sold in the US to be equipped with ESC as of the 2012 model year. A similar requirement has been proposed for new truck tractors and certain buses, but it has not yet been finalized.

#### Operation

During normal driving, ESC works in the background, continuously monitoring steering and vehicle direction. It compares the driver's intended direction (determined through the measured steering wheel angle) to the vehicle's actual direction (determined through measured lateral acceleration, vehicle rotation (yaw), and individual road wheel speeds).

ESC intervenes only when it detects a probable loss of steering control, i.e. when the vehicle is not going where the driver is steering. This may happen, for example, when skidding during emergency evasive swerves, understeer or oversteer during poorly judged turns on slippery roads, or hydroplaning. During high-performance driving, ESC can intervene when unwanted, because steering input may not always be indicative of the intended direction of travel (i.e. controlled drifting). ESC estimates the direction of the skid, and then applies the brakes to individual wheels asymmetrically in order to create torque about the vehicle's vertical axis, opposing the skid and bringing the vehicle back in line with the driver's commanded direction. Additionally, the system may reduce engine power or operate the transmission to slow the vehicle down.

ESC can work on any surface, from dry pavement to frozen lakes. It reacts to and corrects skidding much faster and more effectively than the typical human driver, often before the driver is even aware of any imminent loss of control. This has led to some concern that ESC could allow drivers to become overconfident in their vehicle's handling and/or their own driving skills. For this reason, ESC systems typically alert the driver when they intervene, so that the driver knows that the vehicle's handling limits have been reached. Most activate a dashboard indicator light and/or alert tone; some intentionally allow the vehicle's corrected course to deviate very slightly from the driver-commanded direction, even if it is possible to more precisely match it.

All ESC manufacturers emphasize that the system is not a performance enhancement nor a replacement for safe driving practices, but rather a safety technology to assist the driver in recovering from dangerous situations. ESC does not increase traction, so it does not enable faster cornering (although it can facilitate better-controlled cornering). More generally, ESC works within the limits of the vehicle's handling and available traction between the tires and road. A reckless maneuver can still exceed these limits, resulting in loss of control. For example, during hydroplaning, the wheels that ESC would use to correct a skid may lose contact with the road surface, reducing its effectiveness. Due to the fact that stability control can be incompatible with high-performance driving (i.e. when the driver intentionally loses traction as in drifting), many vehicles have an over-ride control which allows the system to be partially or fully shut off. In simple systems, a single button may disable all features, while more complicated setups may have a multi-position switch or may never be turned fully off.

#### Components and design

ESC incorporates yaw rate control into the anti-lock braking system (ABS). Yaw is a rotation around the vertical axis; i.e. spinning left or right. Anti-lock brakes enable ESC to brake individual wheels. Many ESC systems also incorporate a traction control system (TCS or ASR), which senses drive-wheel slip under acceleration and individually brakes the slipping wheel or wheels and/or reduces excess engine power until control is regained. However, ESC serves a different purpose from that of ABS or Traction Control.

The ESC system uses several sensors to determine what the driver wants (input). Other sensors indicate the actual state of the vehicle (response). The control algorithm compares driver input to vehicle response and decides, when necessary, to apply brakes and/or reduce throttle by the amounts calculated through the state space (set of

equations used to model the dynamics of the vehicle). The ESC controller can also receive data from and issue commands to other controllers on the vehicle such as an all-wheel drive system or an active suspension system to improve vehicle stability and controllability.

The sensors used for ESC have to send data at all times in order to detect possible defects as soon as possible. They have to be resistant to possible forms of interference (rain, holes in the road, etc.). The most important sensors are:

Steering wheel angle sensor: determines the driver's intended rotation; i.e. where the driver wants to steer.

Yaw rate sensor: measures the rotation rate of the car; i.e. how much the car is actually turning. The data from the yaw sensor is compared with the data from the steering wheel angle sensor to determine regulating action.

Lateral acceleration sensor: often an accelerometer Wheel speed sensor: measures the wheel speed.

Other sensors can include:

Longitudinal acceleration sensor: similar to the lateral acceleration sensor in design, but can offer additional information about road pitch and also provide another source of vehicle acceleration and speed.

Roll rate sensor: similar to the yaw rate sensor in design but improves the fidelity of the controller's vehicle model and correct for errors when estimating vehicle behavior from the other sensors alone.

ESC uses a hydraulic modulator to assure that each wheel receives the correct brake force. A similar modulator is used in ABS. ABS needs to reduce pressure during braking, only. ESC additionally needs to increase pressure in certain situations and an active vacuum brake booster unit may be utilized in addition to the hydraulic pump to meet these demanding pressure gradients.

The brain of the ESC system is the electronic control unit (ECU). The various control techniques are embedded in it. Often, the same ECU is used for diverse systems at the same time (ABS, Traction control system, climate control, etc.). The input signals are sent through the input-circuit to the digital controller. The desired vehicle state is determined based upon the steering wheel angle, its gradient and the wheel speed. Simultaneously, the yaw sensor measures the actual state. The controller computes the needed brake or acceleration force for each wheel and directs via the driver circuits the valves of the hydraulic modulator. Via a Controller Area Network interface, the ECU is connected with other systems (ABS, etc.) in order to avoid giving contradictory commands.

Many ESC systems have an "off" override switch so the driver can disable ESC, which may be desirable when badly stuck in mud or snow, or driving on a beach, or if using a smaller-sized spare tire which would interfere with the sensors. Some systems also offer an additional mode with raised thresholds so that a driver can utilize the limits of adhesion with less electronic intervention. However, ESC defaults to "On" when the ignition is restarted.

### Traction control system

From Wikipedia, the free encyclopedia ([https://en.wikipedia.org/wiki/Traction\\_control\\_system](https://en.wikipedia.org/wiki/Traction_control_system))



A traction control system (TCS) is typically (but not necessarily) a secondary function of the electronic stability control (ESC) on production motor vehicles, designed to prevent loss of traction of driven road wheels. TCS is activated when

throttle input and engine torque are mismatched to road surface conditions. The basic idea behind the need for a traction control system is the loss of road grip that compromises steering control and stability of vehicles because of the difference in traction of the drive wheels. Difference in slip may occur due to turning of a vehicle or varying road conditions for different wheels. When a car turns, its outer and inner wheels rotate at different speeds; this is conventionally controlled by using a differential. A further enhancement of the differential is to employ an active differential that can vary the amount of power being delivered to outer and inner wheels as needed. For example, if outward slip is sensed while turning, the active differential may deliver more power to the outer wheel to minimize the yaw (essentially the degree to which the front and rear wheels of a car are out of line.) Active differential, in turn, is controlled by an assembly of electromechanical sensors collaborating with a traction control unit.

Intervention consists of one or more of the following: Brake force applied to one or more wheels  
Reduction or suppression of spark sequence to one or more cylinders, Reduction of fuel supply to one or more cylinders, Closing the throttle if the vehicle is fitted with "drive by wire" throttle

In turbocharged vehicles, a boost control solenoid is actuated to reduce boost and therefore engine power.

Typically, traction control systems share the electrohydraulic brake actuator (which does not use the conventional master cylinder and servo) and wheel speed sensors with ABS.

#### Operation

When the traction control computer (often incorporated into another control unit, such as the ABS module) detects one or more driven wheels spinning significantly faster than another, it invokes the ABS electronic control unit to apply brake friction to wheels spinning with lessened traction. Braking action on slipping wheel(s) will cause power transfer to wheel axle(s) with traction due to the mechanical action within the differential. All-Wheel Drive (AWD) vehicles often have an electronically controlled coupling system in the transfer case or transaxle engaged (active part-time AWD), or locked-up tighter (in a true full-time set up driving all wheels with some power all the time) to supply non-slipping wheels with torque.

This often occurs in conjunction with the powertrain computer reducing available engine torque by electronically limiting throttle application and/or fuel delivery, retarding ignition spark, completely shutting down engine cylinders, and a number of other methods, depending on the vehicle and how much technology is used to control the engine and transmission. There are instances when traction control is undesirable, such as trying to get a vehicle unstuck in snow or mud. Allowing one wheel to spin can propel a vehicle forward enough to get it unstuck, whereas both wheels applying a limited amount of power will not produce the same effect. Many vehicles have a traction control shut-off switch for such circumstances.

#### Components of traction control

Generally, the main hardware for traction control and ABS are mostly the same. In many vehicles traction control is provided as an additional option to ABS. Each wheel is equipped with a sensor which senses changes in its speed due to loss of traction.

The sensed speed from the individual wheels is passed on to an electronic control unit (ECU). The ECU processes the information from the wheels and initiates braking to the affected wheels via a cable connected to an automatic traction control (ATC) valve. In all vehicles, traction control is automatically started when the sensors detect loss of traction at any of the wheels.

#### Use of traction control

In road cars: Traction control has traditionally been a safety feature in premium high- performance cars, which otherwise need sensitive throttle input to prevent spinning driven wheels when accelerating, especially in wet, icy or snowy conditions. In recent years, traction control systems have become widely available in non-performance cars, minivans, and light trucks and in some small hatchbacks.

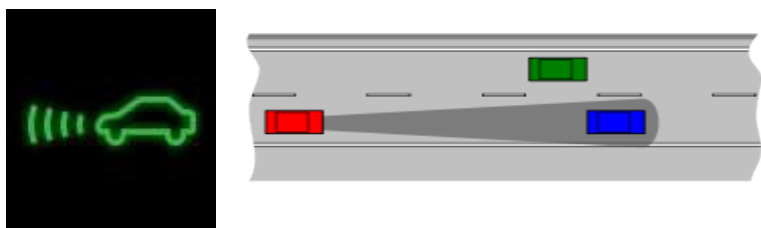
In race cars: Traction control is used as a performance enhancement, allowing maximum traction under acceleration without wheel spin. When accelerating out of a turn, it keeps the tires at optimal slip ratio.

Traction control is not just used for improving acceleration under slippery conditions. It can also help a driver to corner more safely. If too much throttle is applied during cornering, the drive wheels will lose traction and slide sideways. This occurs as understeer in front wheel drive vehicles and oversteer in rear wheel drive vehicles. Traction control can prevent this from happening by limiting power to the wheels. It cannot increase the limits of grip available and is used only to decrease the effect of driver error or compensate for a driver's inability to react quickly enough to wheel slip.

Automobile manufacturers state in vehicle manuals that traction control systems should not encourage dangerous driving or encourage driving in conditions beyond the driver's control.

### **Adaptive cruise control**

From Wikipedia, the free encyclopedia ([https://en.wikipedia.org/wiki/Adaptive\\_cruise\\_control](https://en.wikipedia.org/wiki/Adaptive_cruise_control))



Schematic of Intelligent Cruise Control. The red car automatically follows the blue car. Adaptive cruise control (ACC; also called traffic-aware cruise control) is an optional cruise control system for road vehicles that automatically adjusts the vehicle speed to maintain a safe distance from vehicles ahead.

Control is based on sensor information from on-board sensors. Such systems may use a radar or laser sensor or a camera setup allowing the vehicle to brake when it detects the car is approaching another vehicle ahead, then accelerate when traffic allows it to.

ACC technology is widely regarded as a key component of any future generations of intelligent cars. They impact driver safety and convenience as well as increasing capacity of roads by maintaining optimal separation between vehicles and reducing driver errors. Vehicles with autonomous cruise control are considered a Level 1 autonomous car, as defined by SAE International. When combined with another driver assist feature such lane centering then the vehicle is considered a Level 2 autonomous car.

Adaptive cruise Control does not provide full autonomy: the system only provides some help to the driver, but does not drive the car by itself.

Laser-based systems do not detect and track vehicles in adverse weather conditions nor do they reliably track dirty (and therefore non-reflective) vehicles. Laser-based sensors must be exposed, the sensor (a fairly large black box) is typically found in the lower grille, offset to one side.

Radar-based sensors can be hidden behind plastic fascia's; however, the fasciae may look different from a vehicle without the feature.

Single radar systems are the most common. Systems involving multiple sensors use either two similar hardware sensors or one central long-range radar coupled with two short-range radar sensors placed on the corners of the vehicle.

A more recent development is the binocular computer vision system. These systems have front-facing video cameras mounted on either side of the rearview mirror and use digital processing to extract depth information from the parallax between the two cameras' views.

### Assisting systems

Radar-based ACC often feature a pre-crash system, which warns the driver and/or provides brake support if there is a high risk of a collision. Also, in certain cars it is incorporated with a lane maintaining system which provides a power steering assist to reduce steering input burden on corners when the cruise control system is activated.

### Multi-sensor systems

Systems with multiple sensors can practice sensor fusion to integrate the data from to improve safety and/or driving experience. GPS data can inform the system of geographic features such as a freeway off-ramp. A camera system could notice driver behavior such as brake lights and/or a turn signal. This could allow a following car to interpret a turn signal by an exit as not requiring the following car to slow down, as the leading car will exit. Multi-sensor systems could also take note of traffic signs/signals and not, e.g., violate a red light while following a vehicle that crossed before the signal changed

### Predictive systems

Predict systems modify speed based on predictions of other vehicles' behavior. Such systems can make earlier, more moderate adjustments to the predicted behavior, improving safety and passenger comfort. One example is to predict the likelihood of a vehicle in a neighboring lane moving in front of the controlled vehicle. One system predicts a lane change up to five seconds before it occurs.

### Lane departure warning system

From Wikipedia, the free encyclopedia

([https://en.wikipedia.org/wiki/Lane\\_departure\\_warning\\_system](https://en.wikipedia.org/wiki/Lane_departure_warning_system))



In road-transport terminology, a lane departure warning system is a mechanism designed to warn the driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads. These systems are designed to minimize accidents by addressing the main causes of collisions: driver error, distractions and drowsiness.

There are three types of systems:

Systems which warn the driver (lane departure warning, LDW) if the vehicle is leaving its lane (visual, audible, and/or vibration warnings)

Systems which warn the driver and, if no action is taken, automatically take steps to ensure the vehicle stays in its lane (lane keeping system, LKS)

Systems which take over steering, keep the car centered in the lane, and ask the driver to take over in challenging situations.

Lane warning/keeping systems are based on:

Video sensors in the visual domain (mounted behind the windshield, typically integrated beside the rear mirror)

Laser sensors (mounted on the front of the vehicle)

Infrared sensors (mounted either behind the windshield or under the vehicle)

Lane keeping

Lane keeping assist is a feature that, in addition to the lane departure warning system, automatically takes steps to ensure the vehicle stays in its lane. Some vehicles combine adaptive cruise control with lane keeping systems to provide additional safety.

While the combination of these features creates a semi-autonomous vehicle, most require the driver to remain in control of the vehicle while it is in use. This is because of the limitations associated with the lane-keeping feature. The lane keeping assist system is being achieved in modern driverless vehicle systems using image processing techniques called Hough transform and canny edge detection techniques. These advanced image processing techniques derive lane data from forward facing cameras attached to the front of the vehicle. Real-time image processing using powerful computers are being used by many Vehicle OEMs to achieve fully autonomous vehicles in which Lane detection algorithm plays a key part. Advanced lane detection algorithms are also being developed using deep learning and neural network techniques. High accuracy has been achieved in developing self-driving features including lane keeping using a neural network-based training mechanism which uses a front facing camera in a car and runs it through a route and then uses the steering input and camera images of the road fed into the neural network and make it 'learn'. The neural network then will be able to change the steering angle based on the lane change on the road and keep the car in the middle of the lane.

An advanced Lane assist system has been combined with an Adaptive cruise control system marketed together as 'Autopilot'. It includes features like lane-keeping assist and also automatic lane changing without driver input. A similar technology to lane assist is used to do Auto-park feature as well.

A lane keeping assist mechanism can either reactively turn a vehicle back into the lane if it starts to leave or proactively keep the vehicle in the center of the lane. Vehicle companies often use the term "Lane Keep(ing) Assist" to refer to both reactive Lane Keep Assist (LKA) and proactive Lane Centering Assist (LCA) but the terms are beginning to be differentiated.

### Limitations

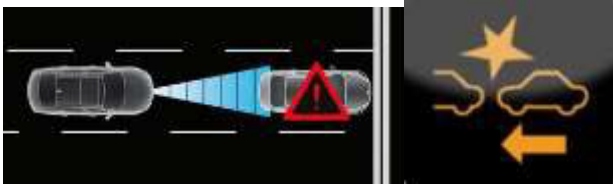
Lane Departure Warning Systems and Lane Keeping Systems rely on visible lane markings. They typically cannot decipher faded, missing, or incorrect lane markings. Markings covered in snow or old lane markings left visible can hinder the ability of the system.



## Collision avoidance system & Forward collision warning with auto-braking

From Wikipedia, the free encyclopedia

([https://en.wikipedia.org/wiki/Collision\\_avoidance\\_system](https://en.wikipedia.org/wiki/Collision_avoidance_system))



A collision avoidance system, also known as a pre-crash system, forward collision warning system, or collision mitigating system, is an automobile safety system designed to prevent or reduce the severity of a collision. It uses radar (all-weather) and sometimes laser (LIDAR) and camera (employing image recognition) to detect an imminent crash.

GPS sensors can detect fixed dangers such as approaching stop signs through a location database. Once an impending collision is detected, these systems provide a warning to the driver. When the collision becomes imminent, they take action autonomously without any driver input (by braking or steering or both). Collision avoidance by braking is appropriate at low vehicle speeds (e.g. below 50 km/h (31 mph)), while collision avoidance by steering may be more appropriate at higher vehicle speeds if lanes are clear. Cars with collision avoidance may also be equipped with adaptive cruise control, using the same forward- looking sensors.

In March 2016, the National Highway Traffic Safety Administration (NHTSA) and the Insurance Institute for Highway Safety announced the manufacturers of 99% of U.S. automobiles had agreed to include automatic emergency braking systems as standard on virtually all new cars sold in the U.S. by 2022. In Europe, there was a related agreement about Advanced Emergency Braking System (AEBS) or Autonomous Emergency Braking (AEB) in 2012.

AEB differs from Forward Collision Warning: FCW alert the driver with a warning but does not by itself brake the vehicle.

According to Euro NCAP, AEB has three characteristics:

Autonomous: the system acts independently of the driver to avoid or mitigate the accident.

Emergency: the system will intervene only in a critical situation. Braking: the system tries to avoid the accident by applying the brakes.

Features

Several features are commonly found across collision avoidance systems.

AEB systems shall detect possible collisions with the car in front. It performs it with sensors to detect and classify things in front of the vehicle, a system to interpret the data from the sensors, and a braking system which can work autonomously.

Some cars may implement lane departure warning systems.

Lane Assist

Lane assistance is designed to help the driver of the vehicle stay in the designated lane. Lane assist works through a camera mounted by the rearview mirror that detects lane markings ahead of the vehicle. With the lane markings taken into account along with the vehicle speed, and trajectory data, the vehicle makes a decision on when the lane

will be crossed based upon the data from the camera. An advanced form of lane assist is lane centering which actively steers and keeps the car centered in the lane.

### **Blind Spot Alert**

Side blind spot alert (SBSA) system is designed to assist the driver avoid dangerous situations or accidents with other road users during lane changes. The system designed will indicate to the driver if there is another vehicle traveling in the "blind spot." The vehicle is detected by ultrasonic sensors that scan the side, and rear areas of the vehicle.

### **Cornering Brake Control**

Cornering brake control (CBC) detects dangerous situation when applying the brakes while cornering turns in adverse conditions. CBC detects oversteer, understeer and drifting and redistributes brake pressure to wheels separately to regain control and prevent an accident.

### **Evasive Steering Assist**

Evasive steering assist detects slower or stopped vehicles ahead, and provides steering assistance if the collision cannot be avoided by braking alone.

### **Adaptive Headlights**

Adaptive headlights allow for better vision at night, the headlight beams adapt to the roadway, on bends in the road adaptive headlights can bend with the roadway whereas conventional headlight will face straight ahead.

### **Forward Collision Warning**

Forward collision warning (FCW) system is an advanced safety technology that monitors a vehicle's speed, the speed of the vehicle in front of it, and the distance between the vehicles. If vehicles get too close due to the speed of the rear vehicle, the FCW system will warn that driver of an impending crash. It's important to note that FCW systems do not take full control of the vehicle or keep the driver from operating it.

### **Reverse automatic braking**

Reverse automatic braking is a feature which allows autonomous braking of the vehicle, while working in reverse direction, to avoid a reverse collision.

## **Suggested reference materials**

Ross Bentley's Instructor Manifesto (free at <https://speedsecrets.com/hpde-instructor-manifesto-download/> ),  
Speed Secrets Weekly,  
Christopher Brown's Making Sense of Squiggly Lines, the Basic Analysis of Race Car Data Acquisition  
Facebook Group "HPDE Instructors"

## **Sources**

Metro New York Region Porsche Club of America Instructor Handbook; Niagara Region Porsche Club of America Instructor Development Manual; Porsche Club of America National Drivers' Education Instructor Training Program; E. Paul Dickinson; Motorsport Safety Foundation including Ross Bentley, Scott Elkins, Eric Meyer; Allegheny Region Porsche Club of America; Peter Argetsinger; Metro New York Region Porsche Club of America including Bill Rudtner, Mat Gluckson, Fred Pack, Shaibal Bandyopadhyay; Dave Scott, Niagara Region Porsche Club of America, including David Irish, Ken Buschner, Jim Tulloch, Dick Cott, Rich deAsis, et al; Wikipedia; Genesee Valley Chapter BMW Car Club of America, including Bill O'Neil, Dorothy Ochs, et al; Dion von Moltke of Blayze Coaching.