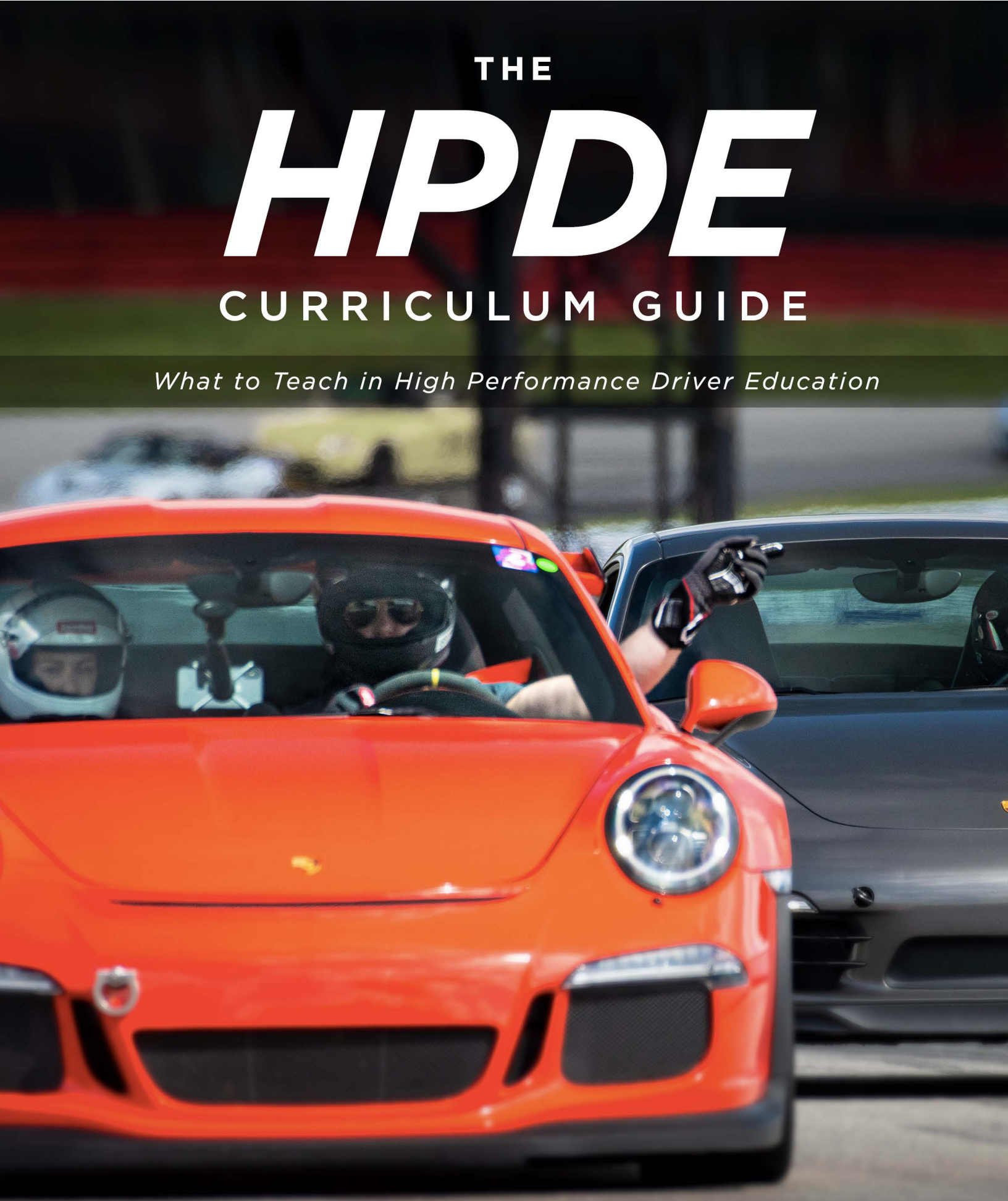
THE HPDE CURRICULUM GUIDE

What to Teach in High Performance Driver Education



PRESENTED BY THE INSTRUCTOR SUMMIT

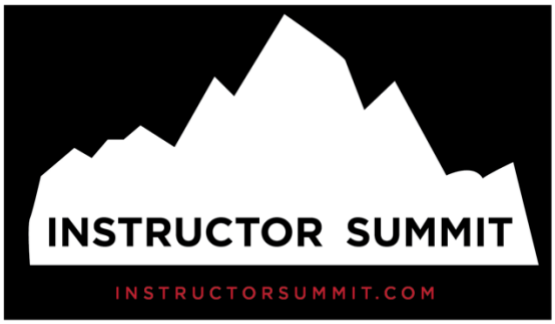
EDITED BY CHUCK TUCKER & CHUCK HAWKS

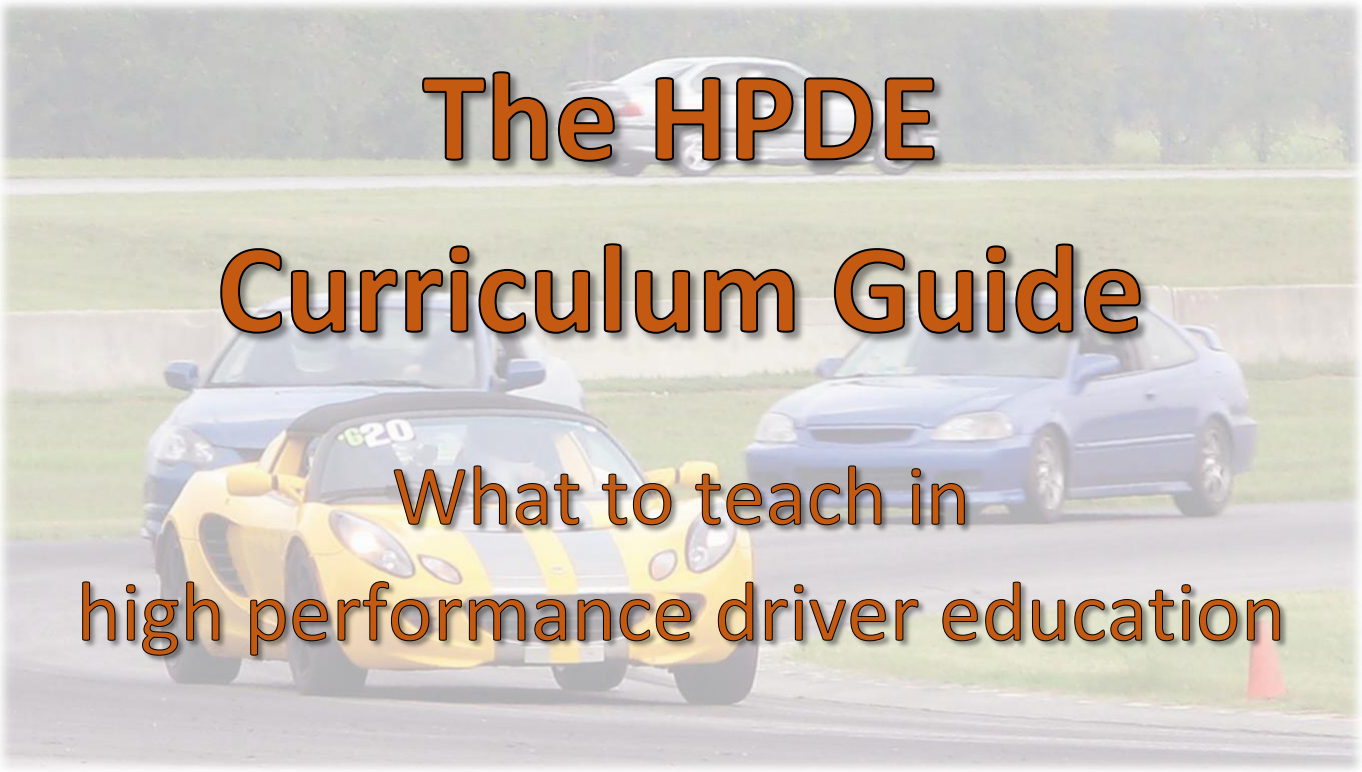
INSTRUCTOR SUMMIT

About the Instructor Summit

The Instructor Summit seeks to improve high performance driver education (HPDE) by supporting instructors who want to build their skills, and organizations that want to improve their programs.

The Instructor Summit brings people together from HPDE organizations everywhere to exchange ideas, learn from experts, and identify best practices. From live events to this guide, the Instructor Summit is your dedicated resource for all things instructing in HPDE. Go to InstructorSummit.com for more information, or search MotorsportReg.com for "Instructor Summit" to find events and register.





The HPDE Curriculum Guide

What to teach in high performance driver education

Edited by
Chuck Tucker and Chuck Hawks

with contributions from
Lee Cash, April Curtis, David DuBois, Alan Kendall,
Eric Meyer, Peter Puffer, John Santiago, and Pat Sullivan

Presented by the Instructor Summit

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Contents

Contributors

Chuck Tucker, editor

Chuck has been instructing since 2002 and holds PCA, NASA and MSF Level 2 instructor credentials. Several PCA and BMW clubs in the Midwest use classroom materials that he created. He has 30 years of classroom experience as a professor at the University of Illinois, where he won the campus award for teaching and led many curriculum improvement efforts. He coordinates support of HPDE classroom instructors for the Instructor Summit and edits the HPDEclassroom.com website.

Chuck Hawks, editor

Chuck has been involved in professional motorsport since 1979, retiring from pro-racer duties in 2007. Having held many forms of licenses and certifications, he has been actively involved for decades in training all types of drivers, from teens to racers to special forces. Chuck has served as an HPDE instructor and leader since the early 1990s and is sought out nationally as a curriculum developer and classroom presenter. He comes to this effort looking to make the sport safer while also increasing its business viability.

Lee Cash

Lee took a common path for his driving, starting with autocross, then HPDE, wheel to wheel racing, and finally instructing in HPDEs. While sitting in the right seat with a beginner student, he began to fully understand the advice his college-professor father had given him: “If you ever want to fully understand a subject, try teaching it to someone else.” Now retired from the semiconductor business, Lee keeps busy instructing with The Drivers Edge and learning how to help others safely enjoy high performance driving.

April Curtis

April started her high performance driving career as a student in 2001 and began instructing in 2003. She participated in her first club races in 2007, and has raced with BMW CCA, NASA, and SCCA. In 2014 April won the national championship in her class with BMW CCA. She regularly helps out with the track portion of the Bimmerworld Club Racing schools. April is currently co-chief instructor for Tarheel BMW CCA, and she also presents the classroom portion of Tarheel’s Instructor Training School. She flags at VIR for IMSA and other race series and drives pace/safety cars for racing events.

David DuBois

David has held pro SCCA and IMSA licenses while running in the Playboy and Fire Hawk endurance series. He has been teaching at HPDEs since 2007. David is currently a chief classroom instructor for the Empire State Region of the Ferrari Club of America and an in-car coach. David also coaches for the Summit Point’s Friday at the Track program, Hooked on Driving, the National Corvette Museum, and other clubs. He is an MSF Level 2 coach.

Alan Kendall

Alan is currently a chief instructor for Chin Track Days with responsibility of developing and delivering the classroom sessions. He also delivers MSF Level 2 instructor training for Chin. Alan has participated, instructed and managed HPDE events with many organizations and tracks since 1973. He held vintage and club racing licenses for 10 years, driving an ex IMSA Porsche 914-6. Alan's current track car is a 2012 Porsche Cayman R.

Eric Meyer

Eric began his open-track path in the spring of 2004. Spec Miata club racing, driving in Grand-Am and World-Challenge racing, and HPDE instructing preceded his favorite recognition: the Jim Cook Award presented by SCCA Pro Racing for series promotion and sportsmanship. Eric resides in Indianapolis and promotes HPDE student and instructor learning via the Instructor Summit, the Beginner Data group on Facebook, and as a chief instructor for the NASA Great Lakes region. He is currently a board member for the Motorsport Safety Foundation (MSF).

Peter Puffer

Peter is the chief driving instructor for Audi Club North America's Glacier Lakes Chapter and has been an HPDE in-car and classroom instructor for the last 20 years. He has developed HPDE curricula as well as the club's MSF Level 2 certified instructor training program. Peter enjoys participating as a team driver for WRL and Champ endurance races in a Spec Miata. As a psychologist, Peter has developed and offered specialized training relating to organizational and group dynamics.

John Santiago

John is a philosophy professor at the College of DuPage. An invited speaker at the 2020 Instructor Summit, he has written driving articles and been a guest speaker on driving podcasts. As the NASA Great Lakes HPDE-1 group leader since 2014, he has worked with their leadership team to develop the NASA Great Lakes curriculum. In his own driving he has competed in time trial, sprint, and endurance races.

Pat Sullivan

Pat got hooked on the HPDE hobby in 2010 and assumed right-seat instructor status by 2013, accumulating over 250 days of instructing for 11 different HPDE organizations at 13 tracks. Additionally, he enjoys senior instructor status with several organizations and has been actively involved in delivering instructor training programs since 2014. Currently he serves as the co-chief instructor for the National Corvette Museum's HPDE program. A lifelong motorsports enthusiast, Pat has over 34 years of licensed AMA motorcycle competition experience, covering several motorcycle disciplines.

Contributors

The contributors have instructed drivers, either on-track or in the classroom, for the following organizations. While we have borrowed many good ideas from these groups, no endorsement of this guide by them is implied or should be inferred.

10/10ths
Acura & NSX Clubs
Alfa Romeo Club
AMG Driving Academy
Asphalt Ventures
Audi Club of North America
Audi USA
AutoInterests
BMW Car Club of America
BMW NA & BMW Performance Center
Car Guys
Chin Track Days
Corvette Club of America
Ferrari Club of America
Ferrari NA
FiA
Ford Motor Co.
Hooked on Driving
Lexus Performance Driving Academy
Lotus of America
McLaren
Mercedes Club of America
Midwest Council
Motorsports Training Center of America
Mustang Club of America
MVP Track Time
NASA
National Corvette Museum
Northern Virginia Corvette Club
NSXPO
PBOC Motorsports Club
Performance Driving Experience
Petty Enterprises
Porsche Club of America
Red Bull Driver Development
rEvolution Performance
Ron Fellows Performance Driving School
SCCA
Shelby Club
Summit Point/BSR
Supercar Sensations
SVT/Cobra Club
Tarheel Sports Car Club
Teen Driving Solutions
The Drivers Edge
Toyota/Lexus
Track Club USA
Track Daze
Trackmasters
Turn One Motorsports
Viper Days
VIR Club
Wheel Source
Xtreme Xperience

Acknowledgements

Our first thanks go to Eric Meyer and Ross Bentley. The plan to write this guide was hatched at the 2020 Instructor Summit, which Eric was instrumental in organizing. The Summit brought together HPDE instructors and leaders from many different organizations to meet and share ideas. Ross provided a solid core for the program, keeping everyone energized and making obvious the power of likeminded people working together to improve the sport of high performance driver education. Thanks guys. Let's do it again soon!

Next, we want to acknowledge you! If you are reading this, you too are serious about providing the best experience possible at your events, you have an open mind about growth and how to attain it, and you are willing to look outside of your organization(s) to foster that growth. Without people like you, this sport would not be where it is today. It is your commitment that drives the passion felt by those who contributed to this document. Thank you!

Thanks to the Instructor Summit, we were able to gather an exceptional team of contributors. They bring a combined 180 years of HPDE instructing experience to the table, and well over two centuries of high performance driving and racing. Among their ranks are six classroom instructors, six chief or co-chief instructors, three featured guests on the Speed Secrets Podcast, and four authors of feature articles for *Speed Secrets Weekly*. Eight of them train other instructors. Page *v* lists more than 50 organizations for which the contributors have instructed, and this is an abridged list. If we counted each club chapter or region, the list would be much longer. Every one of the contributors is someone who shows up for their students. As you likely know, instructors who care about their students are the heart of HPDE, and every member of this team is one of those people. Working with this group has been pure fun.

While the contributors are all proud of their own HPDE organizations, they insisted that this guide work for *all* organizations, with early statements such as "I'll only join if the guide has some flexibility and doesn't try to force every organization into the same concrete box." We believe that has been achieved. Even though attendees were from a wide variety of HPDE organizations–from small independent groups to national non-profit car clubs to for-profit corporations–the 2020 Instructor Summit revealed a strong consensus around what good driving is and how to teach it. This guide's mission is to serve all types of organizations, helping the best ideas spread across the industry. The entire team has shared that mission from the beginning, always willing to learn from one another. You guys ROCK!

There were a number of people who helped us in the early stages, allowing our team to review their goals and driver evaluation tools. We are grateful to Jason Kennedy of AutoInterests; Dan Chadwick of drivingevals.com and the SLIP evaluation tool; Jay Andrew of NASA Great Lakes; and Mark Hicks of Chin Track Days. Thank you. Your generosity got us off to a good start.

In later stages of this project, we asked respected HPDE leaders to review drafts of the guide, confirm that our advice was solid, and point out any gaps we needed to fill. We deeply appreciate Mirko Freguia, Greg Haas, Jack Sugameli, and Bill Wade for the time and effort they

put into this task. Any shortcomings that remain are our responsibility, and we anticipate this guide will evolve over time as new needs arise and more best practices emerge.

Jeremy Bryner (Downforce Media) and Zachary Rackovan (ABI Photography) graciously provided professional photographs for this guide. We greatly appreciate their contributions and encourage you to find more of their excellent work at dfmphoto.com and abi-photo.com.

We are also grateful to Brian Kellett, a skilled HPDE instructor, for designing the cover.

Finally, we express our gratitude to the many drivers with whom we have worked over the years. Your willingness to learn and the joy on your face when you "got it" are what we love most about high performance driver education. You keep us inspired to do ever better. Thank you.

Chuck Tucker and
Chuck Hawks
January 2021


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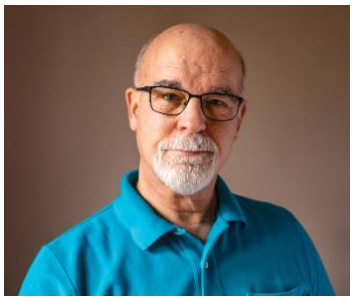

Chuck Tucker


GRID EXIT
GRID
ENTRANCE

How to Use This Guide

A. Should you read this?

If you are involved in the instructional side of high performance driver education (HPDE) and you want your events to be the best they can be for the drivers with whom you work, we wrote this guide for you!

We started this project because classroom instructors told us they could use some guidance about what to teach at HPDE events. But an HPDE curriculum involves much more than the classroom. Chief driving instructors, event organizers, and leaders of HPDE organizations have a major responsibility—to their organizations and to their drivers—to provide solid instruction in an environment that promotes safety. And the instructors who are on the track deliver most of that curriculum. If you serve in any of these roles, this guide is for you.

We assume that you want to do better for your drivers, who are also your customers. That could mean being a more skilled in-car instructor, giving more complete information in the classroom, or making sure the organization you lead is delivering first-rate instruction. In HPDE, much of the fun comes from getting better. As drivers we continually seek to improve our own skills, taking pleasure in carrying a bit more speed into a turn or moving our braking point a few feet closer to turn-in. As instructors we enjoy seeing our students drive better, and we take pride in helping them do that safely, efficiently, and effectively. Leaders of HPDE organizations don't always get to see the grin when a driver masters a new skill, but they do see satisfied drivers coming back to their events again and again. Wherever you fit in this picture, there is helpful information for you here.

One thing we are *not* trying to do is make all HPDE curricula the same. Each HPDE organization has its own style, business model, goals, instructional team, and customer base. We respect those differences, and we developed this guide to help each organization achieve the goals it wants to achieve. This guide collects best practices we have experienced with dozens of different HPDE organizations. **All the ideas here are sound, but not everything is right for every organization. From the beginning, this project was created with the expectation that you will choose for yourself what you will use from this guide.**

The HPDE industry is a competitive business space and an HPDE program/event is a business venture, even for a non-profit group. Every organization needs drivers to come to its events and return regularly, as well as generate referrals. This guide can help. You may be building a new HPDE program from scratch, stepping up the quality of your existing program, or looking to benchmark yourself against an industry standard. Whatever your goals, offering your drivers a learning experience based on best practices across the industry will help your events stay successful and popular.

B. A few key words

HPDE organizations use different names for the people who come to drive and learn with them: *student*, *client,* and *customer* are all common. In this guide we use ***driver***. While that may miss some of the relationship tone that is important to many organizations, it is simple and clear. It also respects the fact that we discuss all levels of driving, from beginners to very advanced drivers, and helping higher-level drivers improve is usually more a matter of coaching than teaching.

We will use ***instructor*** for the person who provides on-track instruction to drivers, traditionally from the passenger seat, though not limited to that. Some organizations prefer the term *coach* for this role. Of course, we haven't forgotten the group that started this–classroom instructors.

C. What's a curriculum?

This is a curriculum guide, but what does "curriculum" mean? For us, ***curriculum*** means *the skills and information an HPDE organization is committed to teaching all of its drivers, and the plan for accomplishing that*.

A complete curriculum has four components:

- **What** drivers will learn,
- **When** they will learn those things,
- **Who** will help them learn, and
- **How** you will know if drivers have learned what you wanted them to.

This guide offers a comprehensive list of ideas for the first component: the "what." We express each piece of that as a ***driver performance outcome***. Here is an example:

> **Initial** performance outcomes. Drivers will be able to:
>
> 168. Begin reducing brake pedal pressure before turn-in and smoothly release the brakes on all turns (F)

Notice that a performance outcome describes something the driver *does* that can be observed by an instructor. An outcome is a goal that drivers and their instructors work toward, and a way of marking achievement. The heart of this guide is a list of driver performance outcomes, grouped by topic, and we have even numbered them for easy reference. For each topic we have arranged the outcomes to match the progressive way that drivers develop skills. This provides a starting point for the "when."

The first step in setting up a curriculum is to choose what you'll teach, and it is best to do this explicitly. If you are intentional about what you teach, even to the point of writing it down (or putting a check mark next to items in this guide), you will be more effective with your drivers and far less likely to miss teaching them an important piece.

The next steps in a curriculum are to work out a logical sequence for drivers to learn each item, select the learning experiences that will achieve that, and decide whose responsibility it is to deliver each piece. For many outcomes this could be as simple as "introduce the skill in the

classroom, then work on the skill on track with the instructor," but there are other options. Some organizations use paddock driving exercises to teach certain skills, particularly with novice drivers. Other organizations use on-track drills as part of the regular track sessions. Some outcomes may be covered in pre-event emails or in the morning drivers meeting, and that's part of the curriculum too.

The last step is to assess what your drivers have learned. You don't know if your curriculum is effective until you've looked to see what your drivers are actually doing. Many organizations use driver evaluations, and the best evaluations are keyed to your curriculum. Note that the performance outcomes in this guide are written in a way that makes them easy to evaluate, which is one of the reasons for writing outcomes in terms of what drivers do.

Some organizations use evaluation forms and/or check rides to decide when a driver is ready to move to the next higher run group or drive solo. That's a great practice. It is also another key place to assess what drivers have learned, especially when the advancement criteria line up with your curriculum.

> "Wait! I'm proud of my HPDE organization. We do a good job, and we don't have any of this curriculum stuff."

If you are thinking that, you are not alone. Many HPDE organizations do not have a formal, written curriculum. But even if your curriculum isn't written down, you do have one. You have skills you teach on a regular basis, you have rules and procedures you expect your drivers to follow, you have a schedule for your events, you have on-track instructors and classroom instructors who work with your drivers, and you may do driver evaluations. That means you have a curriculum, even if it seems invisible. One thing we hope this guide helps you do is to make your curriculum visible and explicit. Then you can more easily measure your results and see how you might do even better.

D. Organizational goals and alignment

Before we jump into the details of building a curriculum, take a moment and answer this question for yourself and your HPDE organization: Why do you run HPDE events?

You may enjoy driving on the track with your friends and want to offer that fun experience to others. You may derive satisfaction from helping other drivers develop their skills, either for the track or for the street. You may want to build a pipeline that will channel drivers toward a racing series. You may want to make a living from running track events. All of these are valid goals for an HPDE organization, and you probably care about several of them.

Your curriculum should serve your organization's goals. If you can name those goals, and if your sense of those goals is shared with other leaders in your organization, that will help you enormously as you work on your curriculum.

Your curriculum will also be much more effective if all of its elements are ***aligned***. Here's a quick quiz to see how well your events are aligned now:

- Does the discussion in the classroom match what the on-track instructors are teaching?

- If you use drills in the paddock, at the skid pad, or on track, do they match the classroom material?
- Are the skills that drivers work on with their instructors the same skills that appear in their driver evaluations?
- Do the criteria for run-group promotion match up with the learning experiences and driver evaluations?
- Are your run-group promotion criteria clearly communicated and consistently applied?
- Are the messages at the drivers meeting consistent with what your instructors say in the car and the classroom?

The more you can say "yes" to these questions, the better your alignment, and the better your drivers' experience will be. The better their experience, the more they come back and the more they refer others to your program! We'll return to alignment in the closing chapter, but it's always a good thing to bear in mind.

E. Categories for driver performance outcomes

There are a *lot* of driver performance outcomes in this guide — more than 200 of them. Not every outcome is right for every organization, much less for every run group. It's helpful to think of the coming chapters as a "parts catalog" for building or enhancing your HPDE curriculum. If you were building a track car you would never buy every part in the catalog. Instead, you would think about what your car needed, look through the catalog, and pick the parts that were right for your car and budget. The same is true here. **Read through the "catalog," note which performance outcomes you already have in your curriculum, then select some you want to add**.

To help you make that selection we've categorized the driver performance outcomes in two ways: by *driver level* and by *skill category*. Here's more about each of those.

Driver levels are useful because most driving skills are acquired gradually, in stages. First-time drivers need to learn to brake much harder than they are used to braking on the street, certainly in threshold braking zones. Then they need to learn to squeeze the brakes on quickly and ease off of them gradually. Only when those skills (and others!) have been mastered can we talk about compressing the braking zone or trail braking. This means you don't just need to choose driver performance outcomes for your organization, you also need to choose performance outcomes for each run group.

To help with this, every driver performance outcome in this guide is assigned to the *initial*, *developing* or *accomplished* driver level. Here are our definitions for those levels:

Initial — Drivers at the initial level begin with little or no experience in high performance driving on racetracks. They may be unfamiliar with track-related terminology, concepts, and techniques, or with protocols regarding flags, passing, and safety. They need to learn to recognize their driving errors, and how to correct those errors, by working directly with an instructor (usually in their car) most, or all, of the time.

Initial performance outcomes describe what these drivers should achieve by the end of their time at this level. New drivers may take some time to reach these outcomes. We expect these drivers to rely on their instructors for guidance about what to do (the proper line, when to downshift, when to wave off a pass, etc.), and gradually take over those decisions as they become more capable.

Developing At this level drivers have some experience with high performance driving on racetracks. They still need instruction and coaching to build consistency and accuracy, though they may spend some (or all) of their track time driving solo, depending on the organization. They are familiar with track-related terminology, fundamental principles of driving on track, and protocols regarding flags, passing procedures and safety. They can recognize most of their errors and correct them. A driver who has mastered the developing outcomes is fully capable of driving solo and has a solid set of driving skills.

Accomplished Accomplished drivers have a high level of skill and experience with high performance driving. They may want additional coaching but they are able to demonstrate consistency and accuracy on their own. Accomplished drivers have a thorough understanding of terminology, principles, flags, passing procedures and safety. They are able to immediately recognize errors, as well as the effects of those errors. They have a high degree of comfort anywhere on the track, on- or off-line.

Our accomplished performance outcomes describe a high level of driving skill. The best drivers at this level are continually looking to learn more and improve their skills.

These levels do not correspond to run groups, and we intentionally avoided giving them typical run-group names. The nature, and even number, of run groups varies greatly from one HDPE organization to the next. One organization's intermediate group may be working on some initial outcomes, while another organization's intermediate drivers may be well into the developing outcomes. As you work with the driver performance outcomes, match them up to *your* run groups and the skills your drivers need to acquire to progress to your next group. How you match up our driver categories to your run groups is up to you, and overlap is OK; just remember that performance outcomes must be specific and objectively measurable.

Skill categories relate to the type of driver you want to produce, which in turn depends on your organization's priorities. While each HPDE organization has its own character, we all want our drivers to stay safe and have fun. The important difference between organizations, at least from a curriculum standpoint, is the extent to which they emphasize the development of driving skills. Some organizations place more weight on fun and camaraderie, while others put more effort into teaching driving skills. With that in mind, we have grouped our driver performance outcomes into the following skill categories:

(F) **Fundamentals and safety**. Driving skills in this category are essential to navigating the track safely and they are the foundation for further learning. Safety is a top priority at

any HPDE event, and the (F) outcomes include safety protocols (flags, passing, track entry/exit), and driving within one's personal limits. ***We believe that the (F) outcomes should be part of every HPDE curriculum.***

(C) **Core, non-competitive driving skills**. For most organizations the development of driving skills is central to the HPDE experience, but racing is not. The (C) outcomes focus on the skills needed to be a fast, safe driver in a non-competitive environment. Our (C) list is substantial, and most organizations will pick and choose from that list. Drivers who have mastered a well-selected set of the (C) outcomes can drive very quickly and safely on the track, because they know what they are doing. They can drive with other HPDE organizations with little or no difficulty.

(P) **Pre-competitive driving skills**. A few HPDE organizations seek to prepare their drivers for anything, including a transition to wheel-to-wheel competition. The (P) outcomes focus on getting the most of out a car, on deeper knowledge of cars and driving, and on pre-competitive skills such as driving side by side. Our (P) outcomes are quite advanced, and few, if any organizations regularly teach them all. A driver who has mastered many (P) outcomes is well prepared to compete in time trials or attend a school for wheel-to-wheel racing and can drive in the advanced group of any HPDE organization. For instructors in organizations that are explicitly non-competitive, the (P) outcomes can still be useful when working individually with advanced drivers as, regardless of application, they indicate a well-developed driver.

Each performance outcome is labelled with an (F), (C), or (P) to indicate its skill category.

Finally, **the performance outcomes are numbered consecutively**, from 1 (*Adopt and maintain a learning mindset rather than a go-fast mindset*) to 220 (*Drive side by side at a brisk pace*). This makes it easier to talk about the outcomes with others. Also, the Glossary at the end of this guide links outcome numbers to many of the terms. This can be useful when you want to find all the outcomes related to a specific term or skill, such as trail braking.

While the list of outcomes in this guide is thorough, it is not perfect. Your organization may teach performance outcomes that are not listed here. If so, please contact us through https://instructorsummit.com/curriculum-guide and let us know. We would love to include your best ideas in a future release of this guide.

F. Selecting your driver performance outcomes

How do you choose which driver performance outcomes you want in your curriculum?

There are two ways to go about this: you can browse the list and pick a few outcomes to add to your program, or you can work with the list systematically. In either case, you want to end up with a few performance outcomes that you can add to your curriculum. Of course, if you collect feedback and your drivers are asking for something specific, that should be a top priority for your "add to the curriculum" list!

Browsing is an easy way to start. We recommend you browse the performance outcomes anyway to get a sense of what's here. As you browse, you'll probably be noting which outcomes your organization is already teaching and which ones are less appropriate for your organization to tackle right now. In between those two extremes are the performance outcomes that are worth considering. Start with the "low-hanging fruit" to realize some early successes, then build up from there.

We also recommend paying careful attention to the (F) performance outcomes. These are all closely related to safety, so if there are any of these you are *not* doing, please consider adding them to your program immediately. We consider these as foundational to ***all*** HPDE programs.

The systematic approach can take more time, but it ensures that you don't miss anything, whether that's a safety-related outcome you need to add or a great opportunity for helping your drivers develop their skills. After browsing, you may want to take this approach.

In this approach, start by marking all of the driver performance outcomes that are part of your curriculum now. You'll want to do this by run group. We find it easiest to do one run group at a time. Remember, a performance outcome is part of your curriculum if you are committed to teaching it to ***all*** of your drivers and you have a plan in place to do so. As instructors there are plenty of things we teach to our most enthusiastic drivers that aren't part of the general curriculum. Because we don't expect *all* of our drivers to learn them before advancing to the next run group, these extracurricular topics are fine to teach but won't be listed in your general curricular goals, and thus may have been omitted from this guide or be presented differently here.

Next, check to see if there are any (F) outcomes you did *not* mark. If so, you should probably mark them as candidates to add to your curriculum, as these are the foundation of a safe event.

Now that you know which fundamental outcomes are present and which are needed, go back and choose some performance outcomes you are not currently doing that would be good candidates to add to your program. The performance outcomes are arranged by skill area and driver level, so it should be easy to see which ones would make good next steps for your drivers.

Collect your resultant candidates and think about each one. How big an impact would it make if all your drivers achieved this outcome? How easy would it be to implement that performance outcome in your curriculum? Adding a few slides to a classroom presentation is easy; getting your instructors to practice teaching a skill they haven't taught before will take more effort.

From your candidate list, pick a few performance outcomes to add to your curriculum. If you have candidates that are both high-impact and easy to implement, great! Build them into your curriculum as quickly as you can. If not, look for outcomes that have a good combination of impact and ease of implementation, and that align well with your organization's goals.

If you like to do this kind of work on a computer, you can download an **Excel spreadsheet** with all of the driver performance outcomes, their driver levels, and their skill categories from http://instructorsummit.com/curriculum-guide. Also, as the notice on the copyright page says, you can reproduce or adapt any of the driver performance outcomes from this guide in your

own organization's educational materials without prior permission by simply crediting this guide as the source.

We'll have more to say about implementing your chosen outcomes, and about what might come after that, at the end of this guide. But before you can implement a curriculum you have to decide what performance outcomes you want for your drivers. Let's dive into those.

Driver Performance Outcomes

1. Focus on Learning

Everyone who participates in high performance driver education must be aware of certain essential aspects of each event. This chapter covers those aspects, including: (i) participants' mindset oriented to learning rather than going fast; (ii) orientation to safety and risk management; (iii) establishing learning goals; (iv) recognizing errors; and (v) using available tools to improve performance.

A. Driver attitude and self-control

Goal: Maintain a learning mindset

Initial performance outcomes. Drivers will be able to:

1. Adopt and maintain a learning mindset rather than a "go-fast" mindset (F)
2. Follow the advice of their instructor and ask questions to get specific help (F)
3. Dial back their driving intensity immediately when requested by their instructor (F)

Developing performance outcomes. Drivers will be able to:

4. Recognize when they are becoming overly focused on speed or competing with other cars (i.e., experiencing "red mist") and reorient their driving toward learning and safety (C)

Accomplished performance outcome. Drivers will be able to:

5. Drive at a high level without placing themselves or others at risk (C)
6. Maintain a learning mindset, continuing to work toward improving their high performance driving skills (C)

B. Self-evaluation and self-coaching

Goal: Take a systematic approach to improve driving skills

Initial performance outcomes. Drivers will be able to:

7. Recognize and name large driving errors in real time (F)
8. Make instructor-guided corrections to respond to any error (F)
9. Discuss each upcoming on-track session with their in-car instructor and agree on one to three learning goals for the session (C)
10. Relate skills discussed in the classroom to their on-track experiences (C)

Developing performance outcomes. Drivers will be able to:

11. Recognize small driving errors and make corrections in real time (F)
12. Mentally note errors while on track, without dwelling on them or being distracted by them (C)
13. Use part of their track time to practice specific skills (C)
14. Keep notes about which skills they are executing well, which they are working on, and how the latter skills are changing through focused practice (C)
15. Recognize when they are unsure of a solution to a handling or performance issue and seek guidance from reliable sources (C)

Accomplished performance outcomes. Drivers will be able to:

16. Accurately identify the strengths and weaknesses in their own driving performance, and prioritize areas on which to work that will produce the greatest improvements in driving performance (C)
17. Identify most handling and performance issues in terms of their root cause, especially when the cause is driver-control based, and develop good strategies for addressing the issue (C)
18. Use a broad set of tools to measure and improve their performance, including instructors, video and data acquisition systems, coaches, etc. (P)

2. Safety and Emergency Procedures

When driving on track things happen quickly, and drivers must be prepared to deal with the unexpected. To keep themselves and others safe, drivers' responses to safety-related situations must become habitual. This chapter outlines safety procedures and driver responses. These include: (i) interactions with instructors; (ii) protocols for track entry and exit, cool-down, and passing; (iii) safety equipment; (iv) corner worker communication via flags; (v) recovery procedures in the event of spins, offs, mechanical problems; and (vi) emergency car exit.

A. General track safety

Goal: Habitually follow important safety procedures

Initial performance outcomes. Drivers will be able to:

19. Acknowledge that they must have an instructor working with them in their car or in a lead/follow format unless they have been explicitly authorized to drive solo (F)
20. Execute the correct response when given a hand signal or verbal instruction by their instructor (F)
21. Always check that their seat belt (or harness) and helmet are properly fastened and their head and neck support is attached, if applicable, before entering the track (F)
22. Leave any stability management system ON (F)
23. Enter the track using event rules for the grid, pit-out, blend line, etc. (F)
24. Use only the passing zones and passing protocols assigned for their run group (F)
25. Follow event rules for a cool-down lap once they have passed the checkered flag (e.g., reduced pace, no passing) (F)
26. Properly exit the track (e.g., pit signal, pit-in, traffic flow from pit lane to paddock) (F)
27. Recognize when they are fatigued, come off track immediately, and call it a day if necessary (F)
28. Recognize when they are dehydrated, come off track immediately, and do not go on track again until they are rehydrated and in good shape (F)
29. Obey traffic rules, speed limits, and parking restrictions in the paddock and pits (F)
30. Make an informed decision about obtaining track insurance, which may include determining whether their street insurance policies cover damage incurred at the track (F)

Developing performance outcomes. Drivers will be able to:

31. Explain the benefits of using a head and neck restraint and why head and neck restraints should be used in any car equipped with harnesses or a roll cage (C)

Accomplished performance outcomes. Drivers will be able to:

32. Demonstrate through their actions a complete understanding of track safety (F)

B. Flag awareness and response

Goal: Notice flags and respond accurately

Initial performance outcomes. Drivers will be able to:

33. State the meaning of all flags used at the event and describe what they should do in response to each flag (F)
34. Acknowledge all red, yellow, black, and checkered flags by waving inside the car (or by flashing the headlights, if in the organization's rules) (F)

Developing performance outcomes. Drivers will be able to:

35. Notice ALL flags displayed on track during a session, especially when driving in traffic, and respond properly to each flag (F)
36. Develop a plan for avoiding incidents, based on traffic and flags both locally and further down track (C)

Accomplished performance outcomes. Drivers will be able to:

37. Infer the situation on track from any flag or sequence of flags, and be prepared to execute a safe response (C)

C. Spins, off-track excursions, and mechanical failures

Goal: Correctly execute safety procedures

Initial performance outcomes. Drivers will be able to:

38. Put "both feet in" if the car is spinning beyond the point of recovery (F)
39. Stay in the car with safety gear on, should they need to stop on or near the track (F)
40. State the proper procedure to exit the vehicle in the event of a fire or rollover (F)
41. Drive off-line while returning to the pits if they might be dropping debris collected while off-track, or leaking fluids due to a mechanical problem (F)
42. Gradually work to collect a vehicle that is getting out of control, rather than abruptly trying to "save the car" (C)
43. Explain the recovery procedure to follow when putting two wheels off the track (C)
44. Execute the proper recovery procedure for two wheels off track during a planned exercise (C)

Developing performance outcomes. Driver will be able to

45. Identify mechanical failures (e.g., fluid loss, brake fade, engine issues) through symptoms such as smoke, smell, sound, and feel, and take appropriate, conservative action (C)

Accomplished performance outcomes. Drivers will be able to:

46. Demonstrate in the paddock how they would exit their car safely in the event of a fire (P)

3. Event and Organizational Protocols

Many different organizations run HPDE events. Although some organizations have similar protocols, not all HPDEs use the same rules or standards. This chapter covers event- and organization-specific items that drivers must be aware of, including: (i) the event schedule; (ii) meeting up with their instructor; (iii) rules of the track and the event; (iv) locations of important components of the event (classrooms, fuel, emergency services); and (v) the path for advancement to solo driving and/or higher run groups.

Goal: Function smoothly on and off the track

Initial, Developing and Accomplished performance outcomes. **All drivers** will be able to:

47. Follow the event's schedule and know where they can get a copy, if needed (F)
48. Identify their instructor and know where to meet them (F)
49. Follow track and event rules, and ensure their guests follow the rules, such as no fueling inside the garages, no smoking in the garages, and no consumption of alcohol or other substances that may impair a driver until all cars are off the track for the day (F)
50. Follow event requirements for class attendance (F)
51. Understand that declining an invitation to be examined by medical personnel may result in termination of their on-track privileges for the remainder of the event (F)
52. Identify who the key event staff/leaders are, their roles, and where/how to find them (C)
53. Point out the locations of classrooms, restrooms, fuel, air, fluid recycling, fire extinguishers, and emergency medical services (C)
54. Describe the path to advancement in the organization and develop related personal goals (C)
55. Explain any event requirements for getting their car re-inspected before taking the car back on track, after a mechanical failure or impact (F)
56. Acknowledge that they may be financially responsible for damage to the track facility that results from their actions, including fluid spills (F)

4. Vehicle Preparation and Knowledge

A very important part of being safe on track involves the condition of the car, as well as how the car is equipped. Some cars have ABS braking; others do not. Not all cars are equipped with a stability management system. Different tire brands/models can wear at significantly different rates, and tires can vary from all-season to R-compound to racing slicks. This chapter guides drivers to ensure the car they take on track is properly prepared and maintained during the event. Included in this chapter are: (i) readying the car for high performance driving (e.g., removing loose items, checking fluid levels and tire condition) and (ii) considerations for the use of electronic driver aids (e.g., stability management and ABS).

A. Vehicle preparation

Goal: Determine if their car is properly prepared for high performance driving

Initial performance outcomes. Drivers will be able to:

57. Clear car of any loose items prior to going on track (F)
58. Ensure the car has adequate fuel before each track session (F)
59. State the last time their oil and brake fluid were changed (F)
60. Check lug nut torque and tire pressures, and adjust them to their proper values if needed (C)
61. Check coolant level (C)
62. Monitor tire pressures using factory tire pressure readouts (if car is so equipped) (C)
63. State their cold tire pressure setting (or factory-recommended starting point) (P)

Developing performance outcomes. Drivers will be able to:

64. Visually identify brake pad thickness and state when the pads are too thin to use on the track (F)
65. Check brake fluid level in the master cylinder reservoir, describe the color of the fluid (if under-the-hood design allows), and assess whether fluid should be topped off or replaced (F)
66. Assess tire tread condition by observing wear patterns and/or chalking the tire's shoulder (C)
67. Check the oil level and state the type and weight of oil used for track duty (C)

Accomplished performance outcomes. Drivers will be able to:

68. Evaluate tire tread condition, explain wear patterns and their causes, and suggest adjustments to car setup or driving style (P)
69. Demonstrate how to take tire temperatures with a tire probe and explain when to take temperatures to obtain useful data (P)

70. Explain what a given set of tire temperatures indicates in terms of tire pressures and alignment settings (P)

B. Electronic driver aids

Goal: Determine the effects of electronic driver aids, especially ABS and stability management system

Initial performance outcomes. Drivers will be able to:

71. Describe which, if any, electronic driver aids their car has that should NOT be used on the track (e.g., lane-keep assist, autonomous emergency braking), and how to disable them (F)
72. Activate the ABS, if the car is so equipped, and recognize how ABS works and feels (C)
73. Point out where the indicators for their car's electronic driver aids are located on the dash and identify whether the systems are active or disengaged (C)

Developing performance outcomes. Drivers will be able to:

74. Use advanced settings of their stability management system only after discussion with an instructor (F)
75. Demonstrate how to access and toggle through their car's stability management options, if the car is so equipped (C)
76. Accurately predict the activation of ABS and/or stability management while driving (C)

Accomplished Performance Outcomes. Drivers will be able to:

77. Drive safely when using any available advanced settings of their stability management system, or if disabling stability management for improved performance results (P)

5. Vision and Situational Awareness

Vision is a skill on which all other driving skills depend. Drivers at all levels use their vision for more than simply the "line" in front of them. Drivers should have an awareness of traffic around them, know the locations of flag stations, and see all displayed flags. It is critical that drivers develop a visual rhythm that maintains full situational awareness of these things at all times. This chapter breaks down visual skills by considering: (i) visual reference points; (ii) other cars; and (iii) flags and safety.

A. Visual reference points

Goal: Drive a smooth, consistent line

Initial performance outcomes. Drivers will be able to:

78. Recognize visually where reference points and other relevant landmarks are, both on and near the track, and know what turn they are approaching (F)
79. Spend most of their time looking well ahead of the car, along the desired line (F)
80. Look "through" all turns, including turns with limited sight lines, mentally visualizing the path their car will take (C)
81. Use visual reference points for key actions (braking, turn-in, apex, and track-out) and as aiming points for the car's trajectory (F)

Developing performance outcomes. Drivers will be able to:

82. Before reaching each reference point (braking, turn-in, etc.), move visual focus to the next reference point and beyond, maintaining awareness of the first point using peripheral vision (C)
83. Find and use their own visual reference points, both on and off the track (C)

Accomplished performance outcomes. Drivers will be able to:

84. Adjust their choice of visual reference points and when they change focus from one to the next, in order to drive the track faster and safer (P)

B. Other cars

Goal: Handle traffic smoothly and safely

Initial performance outcomes. Drivers will be able to:

85. Set their mirrors to eliminate blind spots, relinquishing use of the passenger-side mirror to the instructor if requested (F)

86. Be aware of cars behind that are within 5 car lengths (F)
87. Check their mirrors every time they approach a passing zone, notice when someone is behind them, and give a point-by if appropriate (F)
88. Keep their visual focus well ahead of any cars that are close in front, while maintaining awareness of them (F)
89. Check gauges on straightaways to assess vehicle condition (F)

Developing performance outcomes. Drivers will be able to:

90. Maintain awareness of traffic behind and around their vehicle, using regular mirror scans and peripheral vision (F)
91. Anticipate when a pass might occur and coordinate it safely (C)

Accomplished performance outcomes. Drivers will be able to:

92. Use glances, peripheral vision, and mirrors to maintain awareness of other cars and situations on or near the track (C)
93. Maintain appropriate focus on reference points, scanning of mirrors, and awareness of flags and safety situations when driving close to other cars (P)

C. Flags and safety

Goal: See the flags, avoid trouble

Initial performance outcomes. Drivers will be able to:

94. Indicate the location of all manned flag stations on a track map (F)
95. Wave to the worker at every flag station on the warm-up and cool-down laps (F)
96. See most flags displayed on the track (F)
97. Focus vision on where they ultimately want to go, especially if they drop wheels off the track or experience major oversteer (F)

Developing performance outcomes. Drivers will be able to:

98. See ALL flags displayed on track during a session, especially when driving in traffic (F)
99. Scan run-off areas so they can be included in their avoidance/action plans (C)
100. Notice changes in track surface conditions due to vehicle fluids, weather, debris, wildlife, etc. and respond appropriately (C)

Accomplished performance outcomes. Drivers will be able to:

101. Check each flag station at the earliest place on track where the station is visible (C)
102. Check each flag station at the last opportunity before passing it (C)
103. Detect situations far ahead on the track (incidents, flags, traffic) when track layout makes that possible (C)

6. The Line

"The line" is where a driver places their car on the track. Driving a good line and using all the track where appropriate is an important skill. Drivers initially need to imitate a line taught by their instructors, learning to drive that line repeatably. Novices also need to recognize when they are not where they are supposed to be (e.g., they turned in early) and adjust their driving to negotiate the track safely. As drivers progress, they can begin to experiment with small changes in the line, observing the effects and using those observations to fine-tune their line.

This chapter differentiates between: (i) the line when the track surface is dry; (ii) the line when the track surface changes; and (iii) the preferred line, as determined by track conditions and organizational protocols.

A. The dry line

Goal: Drive a path that permits safety and a good preservation of momentum and speed

Initial performance outcomes. Drivers will be able to:

104. Drive the line as taught, starting to show consistency in turn-in, apex, and track-out points (F)
105. Recognize significantly early turn-in and adjust their driving, both in the moment to navigate the corner safely and in subsequent laps to improve performance (F)
106. Recognize when they are going to run out of pavement at corner exit, and put two wheels off or drive straight off the track in a safe, controlled manner (F)
107. Use all the track at turn-in, apex, and track-out, except at turns where their instructor has indicated otherwise (C)
108. Recognize overly late turn-in and adjust their driving, both in the moment to navigate the corner safely and in subsequent laps to improve performance (C)

Developing performance outcomes. Drivers will be able to:

109. Drive a good line, smoothly connecting all reference points, with minimal lap-to-lap variations of turn-in, apex and track-out points (C)
110. Identify turns that have the greatest effect on overall lap time and work to maximize performance in those turns (C)
111. Select a good line through a series of linked turns, balancing low duration of time spent in the turns with good exit speed (C)
112. Check their tachometer or speedometer at track-out to evaluate corner performance (C)
113. Determine for themselves which curbs can be used and which should be avoided (P)
114. Experiment with small adjustments in their line (e.g., turning slightly earlier or slightly later) and observe the effect on corner and/or section exit speed (P)

Accomplished performance outcomes. Drivers will be able to:

115. Drive an efficient line, smoothly connecting all reference points, with high accuracy and consistency relative to turn-in, apex and track-out points (C)
116. Choose lines that take advantage of, or compensate for, all features of the track surface, including slope, camber, crown, bumpiness, polishing, rubber, etc. (P)
117. Choose an effective line when driving side by side or otherwise forced off-line (P)

B. The rain line

Goal: Find an effective, safe line on a wet track

Initial performance outcomes. Drivers will be able to:

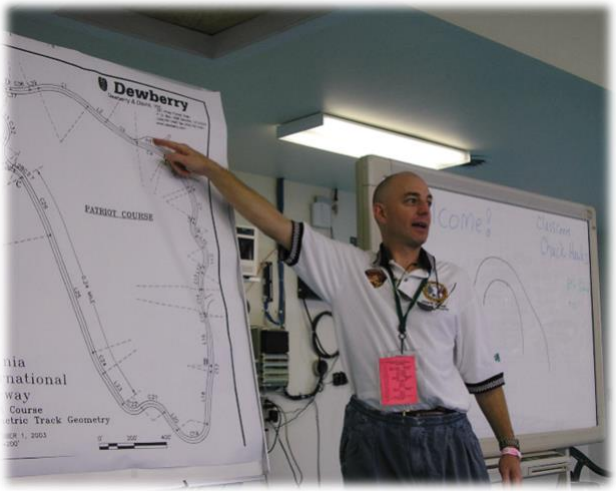
118. Drive a different line in the rain, as taught by their instructor (F)
119. Adjust their speed appropriately in wet conditions (F)
120. Avoid areas of the track that are slippery when wet (e.g., painted curbs, standing water, sealer patches) (F)
121. Drive carefully and straight through standing water where it is unavoidable (F)

Developing performance outcomes. Drivers will be able to:

122. Experiment with different lines when the track is wet and sense where the traction is better, especially in areas of transition between wet and dry (C)

Accomplished performance outcomes. Drivers will be able to:

123. Sense small variations in the available traction when the track is wet, and continually adjust their line to find the best traction, especially when the conditions are changing (P)



7. Track Maps and Track Assessment

Drivers can learn a great deal from tools such as track maps, videos of the track, data acquisition and analysis methods. These tools can be used with an instructor or for self-coaching, both in and out of the car. This chapter describes: (i) how track maps and personal notes can be used to record features of the track and landmarks, as well as where inputs (throttle, braking, steering) occur; (ii) using various types of data, from basic in-car gauges to data acquisition and analysis systems; (iii) assessing changes that can occur in track conditions and the driving techniques to adapt to those changes; (iv) keeping records of track surface features that increase risk (e.g., bumps, dips, holes, curbing anomalies).

A. Relating a map to the actual track

Goal: Point out features of the track on a map

Initial performance outcomes. Driver will be able to

124. Describe their on-track experiences in terms of location on the track (e.g., turn number, phase of the turn) when talking with their in-car or classroom instructor (F)
125. Refer to a track map to identify passing zones, turn numbers, flag stations, and physical features of the track (e.g., uphill, downhill, off-camber turns, pavement anomalies) (C)

Developing performance outcomes. Driver will be able to

126. Locate and print out track maps prior to the event (C)
127. Study the track map and any other available resources, such as videos, prior to the event to learn track layout and flow, flag stations, turn numbers, track entry and exit points, etc. (C)
128. Perform reconnaissance of a track to build knowledge of line-related track features, run-off areas, access roads, barriers, and corner-worker stations, recording the results on a track map (C)

Accomplished performance outcomes. Driver will be able to

129. Draw and explain large-scale sections of the track, including their line, visual reference points, and actions through those sections (C)

B. Record keeping

Goal: Save what you learned

Initial performance outcomes. Drivers will be able to:

130. Add all manned flag stations to their track map (F)
131. Add initial notes on their track map such as landmarks and driver actions around the track (braking/turn-in/apex/track-out points, gear shifts, full-throttle areas) (C)

Developing performance outcomes. Drivers will be able to:

132. Record on a track map information for gear selection; points for turn-in, apex, track-out, braking, transition to throttle, and full throttle; and priorities in each corner (C)
133. Record on a track map the line through all turns, especially linked turns and turns that do not use all of the track (C)
134. Document run-off areas, turns that require extra diligence, and landmarks needed to safely negotiate these turns (C)
135. Start a binder of track maps and notes for each track, for future use (C)

Accomplished performance outcomes. Drivers will be able to:

136. Record alternate visual reference points; details of track slope, camber, and roughness; and other fine details on a track map (C)
137. Record details such as degrees of steering angle, percentage of throttle and brake force applied in some/all turns on a track map (C)

C. Track assessment

Goal: Assess track conditions and adjust driving as conditions change

Initial performance outcomes. Drivers will be able to

138. Adjust speed, braking, corner entry, and exit in response to weather or surface changes (F)

Developing performance outcomes. Drivers will be able to

139. Identify high-risk areas of the track (e.g., bumps, dips, surface material changes) and adjust driving style to manage the overall risks (F)
140. Assess track characteristics by participating in a guided track walk (when available) or by discussing with instructor or other drivers prior to driving (C)

Accomplished performance outcomes. Drivers will be able to:

141. Safely use traction sampling to find the line best suited to their car (C)
142. Provide input during, or better yet lead, a track walk for other drivers (C)

8. Throttle and Acceleration

High performance driving on track involves speeds and car balance that differ from ordinary driving on the street. This chapter outlines the specifics applicable to throttle usage, where the intensity of acceleration can be high and the focus is on getting around the track quickly. In this chapter, throttle application will progress as follows: (i) balancing the car through turns; (ii) managing vehicle rotation and slip angles; and (iii) adjusting to reduced grip due to tire wear.

Goal: Speed, balance and control of the car

Initial performance outcomes. Drivers will be able to:

143. Use maintenance throttle mid-corner, especially in long corners, to balance the car (F)
144. Progressively add throttle from apex to track-out, coordinated with unwinding the steering wheel (F)
145. Maintain or continually increase throttle all the way down each straight, up to the next braking point (C)
146. Keep their right heel firmly on the floor when using the throttle (C)

Developing performance outcomes. Drivers will be able to:

147. Minimize time spent transitioning to throttle (i.e., engine braking or coasting) once they have completed braking for a turn (C)
148. Use small throttle adjustments in the corners to keep the car on the desired line (C)
149. Progress smoothly to maximum throttle as soon as possible in each turn (C)

Accomplished performance outcomes. Drivers will be able to:

150. Use the throttle to induce vehicle rotation for appropriate corners and situations (C)
151. Control slip angles during acceleration by precise application of the throttle (P)
152. Adjust throttle use to manage tire wear and reduction in grip (P)

9. Braking

Braking during high performance driving is far more intense than on the street, and braking affects the car's balance and grip as well as its speed. When driving on track, the focus in braking is to reduce braking distance and time, while preparing the car to enter the turn in a balanced state. This chapter will identify: (i) specifics of brake application on-track, including seat position; (ii) finding reference points to start braking; (iii) modulating braking inputs to adjust to changes in track slope and camber; (iv) achieving threshold braking; and (v) inducing car rotation for efficient positioning of the car on-track.

A. Initial brake application

Goal: Apply the brakes the right amount at the right place

Initial performance outcomes. Drivers will be able to:

153. Position the seat so they can press the brake pedal to the limit of travel without fully straightening their knee, extending their ankle, or moving in the seat (F)
154. Identify a reference point for beginning of braking at some turns and brake consistently at that point (F)
155. At the braking point, squeeze the brakes on quickly and smoothly (F)
156. Brake in a straight line in threshold braking zones, using a substantial portion of the car's braking ability (F)
157. Use threshold, medium, or brush braking at different corners, as appropriate or as taught by an instructor (C)
158. Begin to compress selected braking zones by moving the braking point closer to turn-in, using heavier braking pressure and shortening braking duration, with the help of an instructor (C)
159. Keep their right heel on the floor while braking (C)

Developing performance outcomes. Drivers will be able to:

160. Apply enough brake pedal pressure in threshold braking zones to reach the limit of the car's braking ability most of the time (F)
161. Transition quickly between throttle and brakes at the beginning of braking, with no coasting in between (C)
162. Determine which turns require threshold, medium, or brush braking and use the correct technique for each turn (C)
163. Compress threshold braking zones themselves, progressively moving the braking point closer to turn-in, until maximum braking potential is reached (C)
164. Choose braking points that account for major changes in slope and camber of the track (level, downhill, uphill, on/off camber) (P)

Accomplished performance outcomes. Drivers will be able to:

165. Reach the limit of the car's braking ability consistently in all threshold braking zones (P)
166. Consistently initiate braking as late as possible for all turns (P)
167. Use details of the slope and camber of the track at all braking zones to optimize braking performance (P)

B. Brake modulation and release

Goal: Enter the corner at the right speed

Initial performance outcomes. Drivers will be able to:

168. Begin reducing brake pedal pressure before turn-in and smoothly release the brakes on all turns (F)
169. Complete a smooth release of the brakes after turn-in (trail braking) for turns where appropriate, per their instructor (C)
170. Achieve a target speed at turn-in that is within their own and the car's capabilities (F)
171. Keep the car on-line during braking (rather than creeping toward the center of the track or turning in early) (F)

Developing performance outcomes. Drivers will be able to:

172. Release the brakes gradually, with some release beyond the turn-in point (trail braking) as needed to help the car turn in and utilize more of the car's grip (C)

Accomplished performance outcomes. Drivers will be able to:

173. Use trail braking in slower/tighter turns to adjust speed and promote car rotation on corner entry (C)
174. Adjust the timing and rate of release of brake pedal pressure in small increments to fine-tune entry speed and car rotation (C)
175. Use trailing-throttle oversteer to induce car rotation and avoid braking when possible (C)
176. Use left-foot braking to overlap throttle input and more effectively maintain the car's balance (C)

10. Steering

This chapter focuses on steering technique. We begin with seating position, because a driver's seating position for the street often needs to be changed for track driving to allow for proper hand position and controlled steering. The chapter then progresses through: (i) applying a single, smooth movement of the steering wheel in turns; (ii) properly placing the hands on the steering wheel; (iii) utilizing shuffle steering when fixed position cannot accommodate tighter turns; (iv) modulating the speed of steering inputs to improve on-track performance; and (v) combining steering inputs with throttle and brakes for optimum on-track performance.

Goal: Move the steering wheel at the right time and the right speed

Initial performance outcomes. Drivers will be able to:

177. Sit in their car with their back and shoulders firmly touching the seat back, and position their seat so they can move their arms freely with approximately a 90^{o} bend in their elbows when their hands are at the 9-and-3 position (F)
178. Drive from turn-in to apex using a single, smooth movement of the steering wheel (F)
179. Gradually unwind the steering wheel from apex to track-out (F)
180. Hold the steering wheel using the 9-and-3 position on all straights, and in all turns that can be taken without overly crossing their arms (C)
181. Use pre-positioning, shuffle steering, or some combination in tighter turns to prevent crossing their arms (C)

Developing performance outcomes. Drivers will be able to:

182. Make planned steering inputs more rapidly or more gradually (faster or slower hands) to improve grip and increase speed potential (C)

Accomplished performance outcomes. Drivers will be able to:

183. Manage steering in coordination with acceleration and braking to keep the slip angle near maximum grip (P)

11. Shifting

Shifting gears keeps the engine in an RPM range where it produces ample power and provides rapid acceleration. We want drivers to be in the right gear for their car and speed at every point on the track. We also want drivers to shift gears smoothly, both to maintain traction and to minimize wear and tear on the drivetrain. Very accomplished drivers will fine-tune their shifting techniques and the shift RPM for each gear to squeeze the maximum performance from their cars.

A good curriculum must support drivers using all types of transmissions, including manual transmissions with a clutch pedal, dual-clutch transmissions (shifted either manually or automatically), traditional automatic transmissions, and whatever is available in the future. Instructors with years of driving may place great value on executing a perfect heel-and-toe downshift, but many of today's students are driving cars without a clutch pedal. And we are starting to see fully electric cars, which may not need any shifting at all!

The following learning goals are applicable to cars with internal combustion engines. The goals depend on whether or not the driver initiates gearshifts (in a manual, dual-clutch or automatic transmission) and whether the car has a clutch pedal. In cars with modern dual-clutch transmissions, letting the car handle all the shifts is often a valid approach, especially for a novice driver.

Goal: Maximize power to the wheels

Initial performance outcomes

For all transmission types drivers will be able to:

184. Keep two hands on the steering wheel, only touching the shift lever or shift paddles when actively changing gears (F)

For all driver-shifted transmissions drivers will be able to:

185. Upshift only while accelerating, at a consistent RPM at or below redline (F)
186. Execute upshifts promptly and smoothly (F)
187. Downshift only while braking, and only when a lower gear is needed to exit the next corner (F)
188. Complete each downshift before turning the steering wheel (F)

Developing performance outcomes

For auto-shifted transmissions drivers will be able to:

189. Utilize the "sport" or "track" setting of the transmission, if the car is so equipped (C)

For all driver-shifted transmissions drivers will be able to:

190. Short shift in locations where they are coached to do so and explain why that can be advantageous (C)

For manual transmissions with a clutch pedal drivers will be able to:

191. Downshift using heel-and-toe technique, with only small variations in braking pressure and no sudden weight shift when the clutch is released (C)

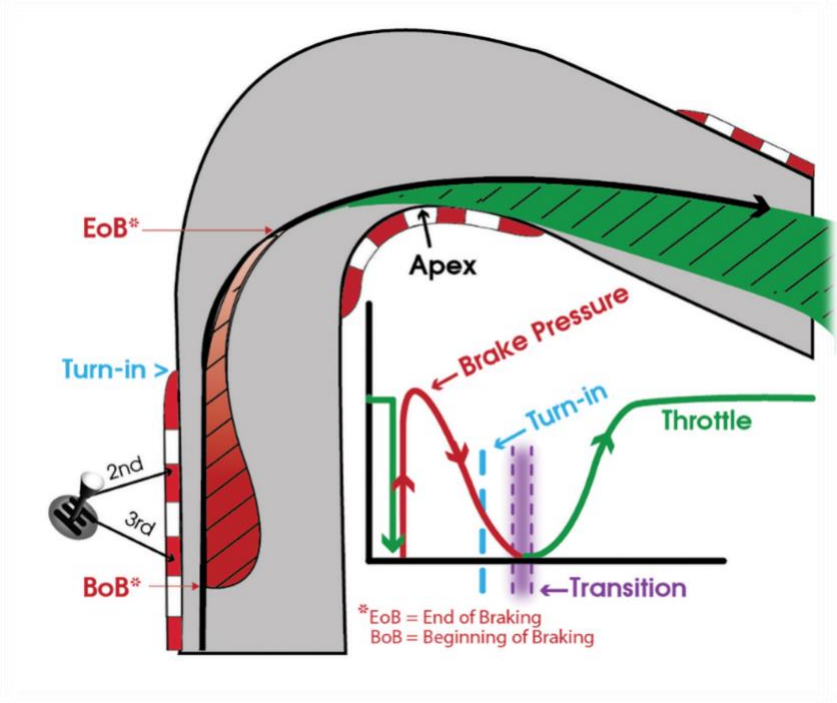
Accomplished performance outcomes

For all driver-shifted transmissions drivers will be able to:

192. Determine when a short shift would be advantageous by experimenting over multiple laps (P)
193. Upshift at the optimal RPM value for each gear (which is typically different for each gear) (P)

For manual transmissions with a clutch pedal drivers will be able to:

194. Downshift using heel-and-toe, with negligible brake pressure variation and no perceptible weight shift when the clutch is released (P)
195. Spend less than 0.5 seconds with the clutch disengaged on all shifts (P)



12. Weight Transfer and Car Control

General Comments

Skilled drivers control their cars by managing weight transfer. To acquire this skill, a driver must be able to sense what their car is doing (kinesthetics), understand the basics of weight transfer and how it affects the car (vehicle dynamics), and apply those skills to controlling their car (handling). Along with sensing what their car is doing, drivers must also be able to recognize what they are doing with the brake, throttle and steering, and how they are connected. The ability to drive a car close to its limits is a physical skill that is ultimately executed without conscious thought. This skill takes time to develop. Drivers learn more readily when they understand that their car's behavior is the result of requests they make using the controls, combined with the car's capabilities and the topography of the track surface.

Goal: Control the car while driving close to its limit

Initial performance outcomes. Drivers will be able to:

196. Recognize when the car is significantly understeering and regain control by smoothly reducing throttle and/or opening the steering wheel (F)
197. Recognize when the car is significantly oversteering and regain control by maintaining or smoothly adding throttle and/or counter-steering (F)
198. Explain which control inputs cause weight to transfer forward or rearward, and how that weight transfer affects the car's balance and response to steering inputs (C)
199. Sense side loads through the seat during cornering and know if the side load is steady or changing (C)

Developing performance outcomes. Drivers will be able to:

200. Use small changes in the throttle to adjust the balance and direction of the car in a turn (i.e., throttle steer) (C)
201. Recognize when the car is moderately understeering or oversteering and correct using throttle and/or steering inputs (C)
202. Recognize which tire noises indicate the tires are working properly and which noises indicate the tires are being over-driven (C)
203. Detect the change in steering effort as the front wheels approach their limit of traction in a turn (C)

Accomplished performance outcomes. Drivers will be able to:

204. Use weight transfer to predictably increase or decrease the car's rotation rate when that is desired (C)
205. Drive the car close to its limits almost all of the time, recognizing small amounts of over/understeer (which may occur almost continuously) and correcting with small control inputs (P)

13. Passing/Driving Near Other Cars

Driving on track near other cars, either when passing or remaining alongside other cars, is very different from driving on the street or highway. The available distance to pass another car on the track is limited, a very different situation from the endless interstate. This chapter addresses passing other cars on track, along with driving alongside other cars. Included in this chapter are: (i) permissible passing zones; (ii) proper signals to advise a faster car to pass; (iii) when and how to decline an offered passing signal; (iv) safely executing passes, with or without signals (if passing signals are not required by the organization); and (v) maintaining proper distance and pace when driving side by side.

A. Passing and being passed

Goal: Execute safe and timely passes

Initial performance outcomes. Drivers will be able to:

206. Describe designated passing zones and protocols (F)
207. Signal correctly to allow faster cars to pass on right or left (F)
208. Execute safe passes in designated zones when giving or receiving a point-by (F)
209. Demonstrate good judgment with regard to waving off an offered point-by (F)
210. Modulate the throttle as necessary to facilitate safe and efficient passes (F)
211. Communicate effectively with other drivers (e.g., tap the rearview mirror to signal "I see you," position their car to "present" for a pass, position their car to decline a pass) (C)

Developing performance outcomes. Drivers will be able to:

212. Maintain pace and composure while giving point-bys in designated passing zones (F)
213. Set up passing scenarios ahead of time for safe and effective presentation and execution (C)

Accomplished performance outcomes. Drivers will be able to:

214. Give or take passes anywhere (including corners) with or without a point-by as allowed by the event (P)
215. Anticipate passing situations and accomplish the pass with minimal speed adjustments and minimal time driving side by side (P)

B. Driving side by side

Goal: Drive safely while side by side (includes on-track exercises as run by an event)

Initial performance outcomes. Drivers will be able to:

216. Maintain car position and pace along straights when alongside another car (C)

Developing performance outcomes. Drivers will be able to:

217. Maintain car position through turns and on straights when alongside another car (C)
218. Stay within two car widths of a car alongside when driving side by side at a reduced/steady pace (P)

Accomplished Performance Outcomes. Drivers will be able to:

219. Maintain car position through turns and straights within one car width when alongside another car (P)
220. Drive side by side at a brisk pace (P)

Implementing Driver Performance Outcomes

You've chosen some performance outcomes that you want to add to your curriculum. Great! Now it's time to implement them. There is much that can be said about this, from techniques for in-car instruction to making continuous improvement part of the DNA of your HPDE organization. Here we'll outline the areas that usually need attention, provide some strategy tips, and point to resources that can help you.

A. On-track instruction

A great curriculum needs skilled instructors, either riding with student drivers or on the track doing lead/follow with them. Those instructors need to know how to drive at a high level, be able to instruct effectively, and be dedicated to helping their student drivers learn. A great HPDE organization has a great instructor corps, and the best organizations consistently work at developing new instructors and helping their experienced instructors sharpen their skills.

Here are a few ideas on how to keep your instructor corps sharp and ready to learn and teach new skills.

Have standards for your instructors

Don't let just anyone instruct your drivers. This sounds obvious, but the best HPDE organizations are careful about who instructs for them. At the same time, every organization needs a certain number of instructors at each event. How can you know if that stranger who just e-mailed you about instructing at your next event is someone you should accept?

The instructor training and certification programs that have emerged in the last decade are a great step toward solving this problem. Some of us were in the sport before these programs existed, and we saw how drivers' learning improved as these programs phased in. If you have a parent organization like BMW CCA or PCA that has a program for training and certifying instructors, take full advantage of it.

For any organization, the MSF CERTIFIED program[1] from the Motorsport Safety Foundation is an independent program for instructor training and certification that is being adopted by many HPDE organizations. Level 1 certification uses an online course and requires passing an online test on basic instructional knowledge. Level 2 certification involves in-car role-playing on track, with an experienced instructor playing the role of the student driver and the instructor candidate playing the role of the instructor.

If you don't have a parent organization with an instructor training program, or even if you do, consider getting your organization certified to deliver MSF Level 2 training, and perhaps even work toward making that certification a requirement for your instructors.

[1] https://www.motorsport-safety.org/hpde

While we may not yet be at a point where you can readily accept a new instructor solely on the basis of their certification(s), these programs lay an important foundation of instructional skills and offer value to all HPDE organizations.

Getting your drivers to evaluate their instructors is also a great way to keep the quality of instruction high. Instructors who consistently receive glowing evaluations can be recognized, and perhaps tapped for leadership roles. Instructors who receive problematic evaluations can be counseled or coached, and in the worst case not invited back to your events.

It's important to remember that an HPDE event is still a business venture and the drivers are your customers. Instructors are the front-line representatives of your brand. We all want our brand represented by instructors who are both highly effective and relatable, and who provide a lasting positive impression that generates return customers and referral business.

Develop a pipeline

As instructor training programs have become more common, HPDE organizations have started to think about what comes before those one-weekend training and certification events. Rather than plan an instructor training school and see who signs up, they provide ways for interested drivers to learn more about on-track instruction and start developing their instructing skills, well in advance of any formal instructor training school. A few organizations have structured programs where drivers apply to be "pre-instructors," and complete a series of experiences that prepare them for an MSF Level 2 or similar certification program.

Keep your instructors learning

Instructor training programs are good, but they are only a starting point. Delivering a great curriculum, and improving that curriculum from time to time, will be easiest if you set the expectation that your instructors continually learn and regularly polish their teaching skills.

There are many ways to do this. Some of the formal instructor programs require periodic re-certification. This is a great opportunity for instructors to be evaluated by a chief instructor or other trusted leader, to have their best skills affirmed, and to receive some coaching on how to improve where they need it.

Organizing a workshop for instructors, either at a track event or in the off season, is another good idea. If, for example, you offer Friday track time for instructors and advanced drivers before a Saturday/Sunday event, you could do a mini-workshop for your instructors on Friday. Choose a driver skill you would like to focus on and use a lunchtime meeting with instructors to set up the exercise. Pair up your instructors and use one afternoon track session for them to role-play as student and instructor (swapping roles halfway through), to practice teaching that skill. A follow-up discussion at the end of the day gives everyone the chance to discuss the experience and share lessons learned.

If you have a robust classroom program, encourage (or even require) your instructors to attend some classroom sessions. Instructors who know what goes on in the classroom provide a huge boost to the alignment of your program, and instructors who go to class with their students communicate a powerful message about the importance of learning.

Resources for on-track instructors

This guide had its beginnings at the 2020 Instructor Summit, a meeting of HPDE instructors from across the country, held that year in Indianapolis[2]. Much of the program was focused on in-car instruction, since that is the backbone of our sport. Future summits are planned, and we highly recommend them. The Instructor Summit is a place to build your knowledge about all things HPDE, see what industry-leading organizations are doing, and meet like-minded HPDE leaders from the U.S. and Canada. Keep an eye on InstructorSummit.com or search for "Instructor Summit" on MotorsportReg.com for future events.

The Motorsport Safety Foundation has a resource page for HPDE instruction, safety, and event management[3]. MSF also regularly offers webinars on topics of interest to the HPDE community, featuring national experts on everything from the initial student interview to lead/follow instruction. MotorsportReg.com and the HPDE Instructors group on Facebook are good places to learn about these webinars.

At the time of this writing, one of the best written resources for in-car instructors is Ross Bentley's *HPDE Instructor Manifesto*. It is available free at Ross's Speed Secrets website[4], and also on the MSF resource page. ***Every instructor should have this e-book and re-read it regularly***.

For those who use Facebook, the HPDE Instructors group has a large following and lively discussions about instruction.

B. Classroom instruction

Some of the performance outcomes you want to implement may require new content in your organization's classroom sessions. You may also find you need to add classroom sessions to your event, or perhaps just get your drivers to attend the sessions you already offer.

A good classroom instructor will enhance your drivers' experience, while a poor one can drain a lot of the fun out of that experience. Whether you bring in a star from outside or recruit from within your organization, you want someone who puts drivers and their learning first. A good classroom instructor must be a good driver, but that alone is not enough. Classroom instructors must be able to break driving skills down into digestible pieces, explain each piece clearly, and deliver these pieces at a rate their student drivers can absorb. And they must do this while providing information that is both relevant and timely for upcoming driving sessions. Within your organization, people with backgrounds in teaching, corporate training, or military training are good candidates. Regardless of background, you want classroom instructors who are articulate, have good interpersonal skills, and are good representatives for your organization.

[2] https://instructorsummit.com/2020-indy-summit
[3] https://www.motorsport-safety.org/resources
[4] https://hpde-instructor-tips.com

If you are an event organizer, you need to make sure there is a time and a place for the classroom part of the curriculum. If the track facility has a classroom, great. Ideally, it should be equipped with a large flat-screen display or a projector and screen (you or the classroom instructor may have to provide these), as well as a large-scale track map[5]. If you need to carve out some space for a classroom, do your best to find a place that is comfortable, convenient, and quiet.

Give some thought to the times of the classroom sessions in your event schedule. For example, some organizations prefer to have classroom soon after each on-track session, to catch drivers while their experience is fresh. This plan usually allows drivers plenty of time between the end of class and their next track time to relax for a few minutes and get ready for their next session. If this schedule is used, we still strongly encourage drivers to do a full de-brief with their on-track instructor before coming to class, since that time is very important for learning.

Finally, have a plan for what will be covered in each classroom session. You can either develop these lesson plans with your curriculum team, ask your classroom instructor(s) to do this, or use a coordinated combination. Then, share this plan with your on-track instructors. They can be much more effective, especially with beginners, if they know what their drivers just heard in the classroom. It is easy to prepare an outline of what is covered in each classroom session and hand that out to the on-track instructors. Appendix A has three examples.

Resources for classroom instructors

In the past there have been few, if any, resources specifically for classroom instructors, but some good options are starting to spring up.

The 2020 Instructor Summit had a session about classroom instruction[6], and future summits will likely do so as well. Again, watch InstructorSummit.com or search for "Instructor Summit" on MotorsportReg.com for future events.

The HPDEclassroom.com website was built specifically for classroom instructors. It offers ideas on how to teach specific driving skills (braking, cornering, passing, etc.), and many articles have slides or other materials you can download and use in your own classes. There are also articles on classroom teaching skills.

The site is a collaborative effort, so if you are a classroom instructor please consider contributing some of your own ideas to HPDEclassroom.com.

There is also an HPDE Classroom Instructors group on Facebook, which has information and discussion specifically about the classroom aspects of HPDE.

[5] If you'd like to make a track map on a whiteboard, see https://nasaspeed.news/toolshed-engineer/how-to-create-a-white-board-track-map/.

[6] Go to https://instructorsummit.com/2020-indy-summit, click *Edit … Find* in your browser, and search for "What the Best Classroom Instructors Do."

C. Organizational leadership

Even when you have a clear picture of a change that is truly needed, it can be challenging to get an HPDE organization to make that change. There is no magic formula, but here are some tips for helping your organization improve.

You do not have to be in charge to be a leader.

A leader is a person who sees where an organization needs to go and acts to help it get there. By that definition, anyone in an organization can provide leadership. It may seem easier for the event chair, chief instructor, or CEO to initiate changes in the curriculum than a single instructor, but that instructor can suggest new approaches and/or support good ideas coming from the top. Whatever your position in your HPDE organization, you can contribute to making it better. Often, it just takes someone with initiative to get the ball rolling.

If you are the only one who has to change, just do it.

Some curricular changes can be implemented by one or two people. This is often true for changes in classroom content. If you are a classroom instructor and you see opportunities to do better for your drivers, you probably don't need anyone's permission to do that. Go for it! If you are working with a fixed classroom curriculum, get with the curriculum designer to suggest those changes that will make your program better, safer, and fresher for your audience.

You might also choose a few driver performance outcomes to dial up your on-track instruction. That may not be curriculum change as we've defined it here, but if it helps the drivers you work with, that's a plus for our sport. And, it just might give you some ideas to share with your fellow instructors and your event leaders, perhaps ultimately leading to a full-scale curriculum change.

Changes work best when top-down meets bottom-up.

Top-down organizational changes are driven by the positional leaders: event chairs, CEOs, chief instructors, etc. Bottom-up changes are driven by the instructors who are on the front line. A change can be initiated from either place, but for a change to last over time it must have support from both the top and bottom. If you are a chief instructor, event chair, or CEO, you can ask your instructors to teach a new skill or fill out a new evaluation form. But for that change to persist you need to persuade those instructors that the new idea will be good for them, good for their drivers, and good for the organization as a whole. If you are an instructor and you've built consensus with your colleagues about doing something new, that's great! For that change to persist, you need to persuade your chief instructor, event chair, or CEO that the new idea is good for them and the organization, so they are encouraged to support it over the long term.

If it needs other people, get them involved early.

If you need others to buy into a change, get them involved early. If you want to do a complete review of your curriculum, gather your board or HPDE committee, or a group of instructors–whoever the right people are in your organization–and perform the review together as a team.

If those folks have a hand in coming up with the list of changes you'd like to make in your program, they will be much more likely to support them.

Pitch new ideas as experiments.

When proposing something new ("Hey, let's teach our intermediate drivers to trail brake!"), there will always be some people who like the idea and some who don't. It can be difficult to resolve those differences of opinion by discussion. Instead, when an idea has reasonable but not full support, suggest testing it for an event or two to see how it works. That is an easier sell, and it provides evidence for making a long-term decision. Remind those involved that a single test of something new is not a good indication of its value. There will undoubtedly be some "teething issues" when multiple people participate in something new. Give a new idea several iterations before deciding on its true efficacy. Measure each attempt objectively, and identify what works and what needs changing before moving forward.

When you test out your new idea, pay attention to how things go and record lessons learned. For instance, if drivers struggle with learning the new skill on track, do they need a better explanation in the classroom, do instructors need more guidance or practice teaching the skill, or do you need to build drivers up to the new skill more gradually? Is it a combination of these or other effects? Again, your first attempt at implementing something new may not be perfect, so plan to learn from each iteration and get better as you go. Consider putting specific questions about the new changes on the event evaluations.

Driver feedback is your best friend.

Even if you don't ask specific questions relative to the new changes on evaluations, qualitative feedback can still be gained. After all, you can build a beautiful curriculum plan, but that curriculum is only good if it works for your drivers. Ask your drivers for feedback, even if only verbally, and pay attention to what they say. Often, a simple show of hands in the instructor and drivers' meetings can give valuable feedback and provide evidence to your leadership that a curriculum change is making a positive (or negative) difference. Ask repeat drivers to comment on changes in the comment section of evaluations when practical. While novice and even intermediate drivers will not necessarily know what is missing from your curriculum, they will know what is and is not working for them. Encourage all those who get an evaluation to use the comment sections. Getting a five-star (or one-star) review is fine but a rating doesn't tell you why that person gave the score they did. Ask participants to tell you why they scored the event and its components as they did. It's much easier to act accurately on evaluation data when you know the reasons you're doing so. If you keep track of driver feedback across events, you'll be able to see how improvements to your curriculum are reflected in driver comments, as well as repeat attendance to your events over time. That's exactly what a good curriculum should give your organization: happy, skilled drivers who are eager to attend your next event. Just as you can't hit a target you can't see; you can't determine success if you're not measuring it. We cannot overemphasize the value of feedback when measuring progress and making it stick.

What Else Do You Need?

There are many things that go into running a great HPDE event. Some we have only discussed briefly, others we may not have mentioned at all. For a start, this includes

- Event management and safety
- Coaching with data and video
- In-car instruction
- Lead/follow instruction
- Classroom instruction
- Pre- and post-event communication
- Marketing and business development
- Driver evaluations
- Making parts of the classroom virtual (i.e., using online materials to replace some of the classroom content, or using online quizzes to check drivers' learning)

We built this guide around the curriculum, expressed as driver performance outcomes, because what you teach lies at the center of your HPDE program. It makes good sense to get that center like you want it, and then work outward in any of the directions above to build and improve your organization.

If you've found this guide useful, think about the topics listed above and let us know what would be most helpful to you in the future, either as updates to this guide or as a new resource. You can do this at http://instructorsummit.com/curriculum-guide. The Instructor Summit has connections throughout the sport and can bring together people to share their expertise and spread best practices across the industry. We would like to improve the sport for everyone, and your input on that would be valuable.

Appendix A: Example Handouts for On-Track Instructors

The following pages provide three examples of handouts that can be used to keep on-track instructors informed about what is covered in the classroom. Handouts like this also provide a convenient reference for drivers. These handouts are only examples; classroom content will vary according to the run group, the organization's goals for that group, the day's driving schedule, and the number and length of classroom sessions.

Example Handout 1

Example 1 is for a novice group in a two-day HPDE event with traditional in-car instruction. Each page summarizes the content of one classroom session and offers suggested learning goals for the next on-track session(s). Instructors receive a full set of handouts on the first morning, and drivers receive one sheet at each classroom session.

Drivers and instructors are also encouraged to choose two or three learning goals for each track session. (This is consistent with driver performance outcome number **9**). While the handouts suggest some goals based on the classroom content, each driver and their instructor are told to choose learning goals that are appropriate for the driver.

Novice Group
Day 1, Classroom Session 1

Goals for the weekend:

- Be safe
- Learn something
- Have fun

Familiarization laps: like a regular session (helmets on, instructor in car) except touring speeds and no passing.

Car control basics: hands at 9 & 3 (preferred), eyes well ahead of the car, smooth inputs, 3rd gear (or Drive).

Drive the turns outside-inside-outside, using the full width of the track. Your instructor will tell you which turns are different.

You have primary responsibility for your own safety. Obey flags and track workers. Listen to your instructor. Drive within your abilities.

Some flags give commands you must obey:

- Yellow: no passing; reduce speed
- Red: stop on track
- Black: exit the track; get info in pits
- Checker: exit track; session over

Terms and concepts:

- Line
- Braking point
- Turn-in point
- Apex
- Track-out or exit

Day 1, Track Session 1: Familiarization Laps
Suggested Session Goals

First-Time Track Drivers

1. Experience a track session
2. Drive with your helmet on
3. See the track: straights & turns, flag stations, curbs, brake markers

Experienced Drivers

1. Drive a great line
2. Point out every flag station to your instructor
3. Find 3 new reference points

Novice Group
Day 1, Classroom Session 2

A good mindset lets you learn faster

- Give yourself time to learn
- Focus on technique; speed will come
- Drive within your abilities
- Take care of your body and your car

What to do in each part of the track:

- Straights: accelerate, pass/be passed
- Braking zones: brake firmly, keep the car straight, look into the turn
- Turns: turn wheel smoothly, use full width of the track, initially use a little gas to balance the car. As you exit, unwind the wheel and begin to accelerate

Use reference points to drive a consistent line: curbs, distance markers, object in the distance, etc. You'll gradually build a rich set of these

Passing:

- Only pass between turns 10 and 1, turns 4 and 5, or turns 7 and 8
- Only pass when the car in front signals with an arm out the window
- Give a passing signal whenever there is a car behind you that wasn't there before
- Show you want to pass by "presenting" yourself: get within 2-3 car lengths, and a half-width to the side (if available)

Terms and concepts:

- Early (turn-in, apex, track-out)
- Late (turn-in, apex, track-out)
- "Drive off straight" (better than a spin)
- "Both feet in" (In a spin, both feet in)

Day 1, Track Session 2
Suggested Session Goals

1. Get the feel of driving faster
2. Give and take some passes.
3. Wiggle your fingers on the front straight

Novice Group
Day 1, Classroom Session 3

Doing better at passing:

- Check your mirrors at the start of each passing zone
- Check your mirrors when you aren't busy; know who is behind you
- Lead car: give prompt, clear signals
- Second car (of 3 or more): present yourself and be ready to pass or signal the car behind you to pass

Creating your own track map:

1. Start with corner numbers
2. Add flag stations
3. Add more reference points and notes throughout the weekend

Day 1, Track Session 3
Suggested Session Goals

1. Give and take passes promptly; keep the traffic moving (a group goal)
2. Find turn-in reference points for Turn 10 and two other turns
3. Use more of the track's width

Talk with your instructor about riding with them in an Intermediate Group session today

Novice Group
Day 1, Classroom Session 4

Shifting gears:

- Never in a turn
- Upshift: on the straights, as your car approaches max RPM
- Downshift: while braking and going straight, when you need a lower gear to exit the next turn

Fine-tuning your line:

- A (somewhat) late apex line is faster (allows you to accelerate sooner) and safer (if you miss the apex, wait to accelerate).
- Early turn-in:
  - Feels like you "run out of track" at the exit. You can't unwind the wheel after the apex.
  - Recognize early (eyes up!); reduce speed gradually, or just don't accelerate until the exit.
- Overly late turn-in:
  - You can't get to the apex; you don't need all the track at the exit.
  - Turn in a little earlier next time. May need to brake sooner/harder.
- On the correct line:
  - Turn-in to apex: steering input and throttle nearly constant.
  - Apex to exit: can gradually accelerate and unwind the wheel.
  - You use all the track at the exit.

Tips for this afternoon and tonight:

- Get an instructor ride this afternoon
- Take a few "mental laps" before bedtime
- Consider the Sunday am track walk

Day 1, Track Sessions 4 and 5
Suggested Session Goals

Session 4

1. Recognize early turn-in and correct the issue
2. Gradually accelerate and unwind the wheel as you exit each turn
3. Add three new reference points to your track map

Session 5: Write your own goals

1.
2.
3.

Novice Group
Day 2, Classroom Session 1

You cannot start where you left off yesterday. Work back into it gradually.

Improve your anticipation time by looking farther ahead:

- For each turn scan 1 to 2 points ahead: braking point, turn-in, apex, exit, down track
- Use visual reference points well down the track
- Keep your visual focus well ahead of the car; see nearby objects with peripheral vision

The domino effect: a turn that was working is not working today

- You may be approaching faster, by doing the previous turn better
- Solution: move your braking point back, get the entry speed you want

If you turn in too early, or too fast:

- Keep looking ahead. You'll detect the error sooner, and the car goes where you are looking
- Small error: delay acceleration
- Medium error: slow down gently, keep the car on track if you can
- Big error: drive off straight (or put two wheels off); much better than a spin

Better braking:

- Initially: build pressure quickly, transfer weight forward, slow the car, . . .
- Then: reduce pressure gradually to balance weight front & rear, improve grip in the turn
- Light "brush braking" will be gradual on/gradual off (e.g., Turn 3 to 4)

Day 2, Track Session 1
Suggested Session Goals

1. Gradually work back up to yesterday's rhythm and pace
2. Combine hard initial braking with a gradual release
3. Add three new reference points or driver notes to your track map

Novice Group
Day 2, Classroom Session 2

Before each session, write three goals. These could be:

- Things you'll do (how you'll brake, where you'll turn, . . .)
- Things you'll see (visual reference points, traffic, flags, . . .)
- Things you'll feel (weight transfer, grip, G forces, . . .)
- Ways you'll get yourself ready (mental imagery, physical rehearsal, . . .)
- Ways you'll consolidate your learning (track maps, notes, discussions, . . .)

After the session, look at your goals and make notes on how you did, what you learned.

Skills to work toward in future events:

- Brake and turn close to the car's limits
- Use the throttle to position the car
- Heel & toe downshift
- Drive the line very consistently
- Find and adjust your own line
- Look 8 to 10 seconds ahead
- Think at least 30 seconds ahead
- Provide smooth inputs, even with the car close to its limits (but corrections are always quick)
- Drive comfortably in traffic
- Execute passes quickly and smoothly

Use street driving to practice:

- Good seat and hand position
- Looking far ahead
- Smooth braking and acceleration
- Feeling what the car is doing

In your street driving, set a good example for others–especially your children

Day 2, Track Sessions 2 and 3
Session Goals

Session 2

1.
2.
3.

Session 3

1.
2.
3.

Example Handout 2

Example 2 is also for the novice run group in a two-day event. This organization uses a set of on-track drills, most of which are done during the first two laps of each session. Each drill is explained during the preceding classroom session, and drivers receive a feedback sheet that their in-car instructor fills out immediately after the session. The next classroom session begins with a download and discussion about the drill, then moves on to new material, and then to the next drill. This sample document is a quick-reference outline for in-car instructors, providing them with an overview of the whole weekend. This document is also used during new instructor training and for onboarding out-of-region instructors.

Example Handout 2 Page 1/2

Novice Group Classroom Overview

NOVICE GROUP – DAY 1 CURRICULUM

Morning Meeting (on-grid demos)

- Pre-session check list: seating position, setting mirrors, general safety check
- Grid/pit entry/pit-out procedures (emphasis on the blend line)

Classroom Session #1

- Ground rules: "*We are a learning organization*"
- Flags, passing protocols, and passing zones

DRILLS (Day 1, Track Session #2 – *two laps*) One or more of the following:

- Point-By Drill
- Hands Drill
- Black-Flag Drill (track exit and re-entry protocol)
- Emergency Vehicle Drill

Classroom Session #2

- Basics of "the school" driving line (i.e., the dry line)
- Understanding rhythm of corner anatomy:
  - Braking point, turn-in, apex, exit
  - Chassis balance through a corner
- Effects of early apex / benefits of late apex
- Types of corners (increasing radius, decreasing radius, sweepers)

DRILL (Day 1, Track Session #3 – *two laps*):

- Early/Late Apex Drill (one lap for each)

Classroom Session #3

- Picking reference points
- Keeping eyes up / ahead of car / eye movement / scanning
- Trouble scenarios (excessive speed related)
- Trouble scenarios (mechanical related)

DRILL (Day 1, Track Session #4 –*two laps*) One of the following:

- Vision Drill (student verbally calls out "eyes on…")
- Old School: Tape/line on windshield

Novice Group Classroom Overview, continued

NOVICE GROUP – DAY 2 CURRICULUM

Classroom Session #1

- Core concepts of performance driving:
  - Smoothness
  - Rule of One (give the car one input at a time)
  - Mind ahead of car
  - Car communication
  - Consistency
- Braking: focus on EoB (not "braking marker" bragging rights)
- Optimizing corner entry speed (incremental goal approach)

DRILLS (Day 2, Track Session #2 – *two laps*): One or more of the following:

- Braking Drill: Inch-by-Inch
- Braking Drill: Turn-In Entry Speed
- Braking Drill: The Book of EoB (sensory session)

Classroom Session #2

- Tire contact patch
- Basics of weight transfer/traction circle
- Addressing understeer & oversteer

DRILLS (Day 2, Track Session #3 – *full session*):

- Sensory Session Drill (call out "set" or "ready")
- Weight Transfer Drill (mid-track entry, throttle modulation, 75% pace)

Classroom Session #3

- Optimizing track time: Seat-time use
- Car modifications (needs-driven approach)
  - Brakes & tires
  - Suspension
  - Power

DRILL (Day 2, Track Session #4):

- New Track Drill (v.1 or v.2 when feasible)
- Note: No student evaluation document for this session. Download reserved for discussion of student's overall progress

Example Handout 3

Example 3 gives classroom content for all four run groups at a one-day event using lead/follow instruction. The novice and intermediate groups do paddock exercises after the first classroom session, then have a second classroom session before their first time on track. The two advanced/solo run groups have one classroom session each. This example also gives the time allotted for each classroom session, showing that the classroom instructor plans for the time required for drivers to get into the classroom at the beginning and get out before the next group arrives.

NOVICE CLASSROOM – (4 Sessions)

Session 1 (08:30) 50 min in/out = 40 min content

- Event flow & using lead-follow
- Gridding in "the box," track entry, pit-out & blend line
- Corner stations & flags
- Seating & hand positions
- Braking – this is NOT street braking!
    - Tee up paddock exercises (paddock instructor will be in class to assist)

Session 2 (09:20) 40 min in/out = 30 min content

- First Track Session Goals
    - Lead-follow ("Tracks in the snow")
    - No helmets, low speed, NO PASSING
    - LOOK FOR MANNED CORNER STATIONS! (Wave/ack them on out & in laps)
    - LEARN THE LINE (including where braking occurs – look for brake lights on & off points)
    - Maintain 3-car-length gap (NO TOLERANCE FOR 'RUBBER BANDING')
    - Post-session debrief with instructor after EVERY session
- Instructor Hand Signals
    - Tap on roof = "Catch up!" and/or "Get on MY line" (wandering student)
    - Point-bys and "pitting now" = normal signals
        - Any student passing should be immediately passed back by instructor with proper point-by
    - Hand down, fingers splayed = "Back Off" and/or "Whoa, hold on there cowboy – Pay attention!"
- Reminders:
    - Grid location
    - Seating & hands
    - Start using what you learned in paddock exercises even @ lower speeds

NOVICE CLASSROOM, continued

Session 3 (13:15) 50 min in/out = 40 min content

- Helmets ON, speeds up next time out
- Focus on accuracy and smoothness
- Lead-follow review and expansion – Picking up the pace
    - Look THRU the instructor's car to line up landmarks/reference points
    - What do you see as a reference when you arrive where instructor braked, turned-in, apexed, etc.?
    - Brake release technique
- What to do if you leave the pavement
    - EASE off throttle (avoid brakes if possible AND you weren't already on them)
    - If you need to use the brakes, apply SMOOTHLY. (DO NOT STOMP!)
    - LOOK WHERE YOU WANT TO GO (track/pavement)
    - Get wheel STRAIGHT when car is pointed in a safe direction
    - Slowly EASE back onto pavement with minimal throttle and rejoin your instructor
    - Follow instructor to pits
- What to do if you lose control (including exiting the pavement)
    - When in a spin, both feet in
    - When in a slide, let 'em ride (i.e., don't change anything – let the car settle)
    - When in doubt, both feet out
- Let's take a verbal lap (talk way around the track/line)

Session 4 (15:45) 25 min in/out = 15 min content

- Passing
    - Zones
    - Hand signals (in-class practice)
- Q&A
    - What's going well so far?
    - What's "not there yet?"

INTERMEDIATE CLASSROOM – (3 Sessions)

Session 1 (08:00) 30 min in/out = 20 min content

- Event flow & using lead-follow
- Gridding in "the box," track entry, pit out & blend line
- Corner stations & flags
- Braking exercise in paddock (Paddock instructor will be in class to assist with tee-up)

Session 2 (12:50) 25 min in/out = 15 min content

- What to do if you leave the pavement
  - EASE off throttle (avoid brakes if possible AND you weren't already on them)
  - If you need to use the brakes, apply SMOOTHLY
  - LOOK WHERE YOU WANT TO GO (track/pavement)
  - Get wheel STRAIGHT when car is pointed in a safe direction
  - Slowly EASE back onto pavement with minimal throttle and rejoin your instructor
  - Follow instructor to pits
- What to do if you lose control (including exiting the pavement)
  - When in a spin, both feet In
  - When in a slide, let 'em ride (i.e., don't change anything – let the car settle)
  - When in doubt, both feet out

Session 3 (14:55) 50 min in/out = 40 min content

- Lead-follow review and expansion – Picking up the pace
  - Instructor "rotate" passing hand signal: Big circles while pointing up (Intermediate multi-car student group only) to move 1st follower to back, 2nd car becomes 1st behind instructor.
  - Look THRU the instructor's car to line up landmarks/reference points
  - What do you see when you arrive where instructor was at last transition (brakes, turn-in, apex, etc.)?
  - Brake release technique (smooth and controlled)
  - Consistency counts! Hit your marks
- Verbal lap (talk way around the track/line)

ADVANCED/SOLO 1 CLASSROOM – (1 Session)

Session 1 (11:00) 50 min in/out = 40 min content

- Self coaching – How to best do it
- Sensory data and listening to the car
- 2 Sessions remain today – Use them wisely!
    - Session 1: Focus on what you FEEL throughout each lap
    - Session 2: Focus on what you HEAR throughout each lap
- Verbal lap (talk way around the track/line)
- General Q&A – If there's time (highly doubtful … verbal laps here generally take 30 min or more)

ADVANCED/SOLO 2 CLASSROOM – (1 Session)

Session 1 (14:05) 50 min in/out = 40 min content

- Self coaching – How to best do it.
- What are your GOALS for the event?
    - 3 Sessions in the books, Are you ACHIEVING them?
    - How do you know? (Data vs. video vs. in-car gauges vs. feel) What's empirical and objective vs. not?
    - How are you going to use the last remaining session?
- Verbal lap (talk way around the track/line)
- General Q&A – If there's time (highly doubtful … verbal laps here generally take 30 min or more)

Glossary of Common Terms

Here we provide brief definitions of many important terms and concepts, arranged alphabetically. This can serve as a checklist for classroom planning. Some words may be unfamiliar to beginners, while others have special meaning in the context of HPDEs. Your drivers will learn more quickly if everyone uses a common set of terms in the classroom and on the track.

Words in *italics* are defined elsewhere in this glossary.

In lieu of a formal index, the numbers in **blue** give the driver performance outcomes where each term is used. We think this provides a friendly and useful form of index, especially in electronic versions, where clicking on any blue number will jump you to the associated outcome.

9-and-3: Refers to the optimal position of the driver's hands on the steering wheel – at the nine o'clock and three o'clock positions when the vehicle is going straight. Most instructors advocate keeping the hands fixed on the wheel in these places during turns, if this can be done without overly crossing the arms. Otherwise, *shuffle steering* or *pre-positioning/pre-setting* may be used in addition to the 9-and-3 technique. **177, 180**

ABS: Anti-lock Braking System. Installed on most modern cars, ABS automatically modulates *brake pressure* at the limit of *traction* to maximize brake system efficacy, while providing the driver better directional control than if the tires were allowed to remain in lockup/skid. ABS also prevents flat-spotting the tires. **72, 76**

accelerator: The *throttle* pedal or gas pedal.

alternate visual reference: A *visual reference point* that can be used when primary visual references are obscured (e.g., by nearby cars), or otherwise impractical. **136**

apex: The point in a turn where the vehicle most closely approaches the inside of the track. See also *early* and *late*. **80, 104, 107, 109, 131, 178, 179**

autonomous emergency braking (AEB): An electronic system that applies heavy braking automatically when the vehicle detects that a forward collision is imminent, based on sensors (RADAR, SONAR, etc.) that measure forward closing rate with objects and other vehicles. ***This system may be inappropriate for use on the track and its use/status should be evaluated carefully***. **71**

balance: (1) The distribution of lateral *grip* between the front and rear of a car, and thus the resultant handling qualities of the car. Balance ranges from *understeer* (not enough front grip) to *oversteer* (not enough rear grip). A vehicle that is neither understeering nor oversteering is "neutral" or "balanced." (2) The weight distribution of the vehicle

across the *chassis* and *contact patches*. An instructor may advise the driver to "balance the car" using one or more inputs (throttle, brake, steering) to cause *weight transfer*. **143, 176, 198, 200**

beginning of braking (BoB): The point in the *braking zone* where the brakes are first applied. Same as *braking point*. See also *end of braking*. **154, 161**

black flag station: Either (1) the designated corner station(s) that will display a black flag to individual drivers, instructing them to come to the pits, or (2) a location, usually in pit lane, where drivers report for further information when they have been shown an individual black flag on track.

black flag all: When all manned corner stations are displaying a black flag, indicating that all cars are to exit the track and/or report to the pits.

bleeding the brakes: The process of removing any air from the brake system by forcing fresh *brake fluid* from the brake *master cylinder* through the lines that lead to each brake caliper. May also refer to a complete replacement of the brake fluid. Often considered regular maintenance in track applications.

blend line: A line painted on the track surface at pit exit to separate cars entering the track from cars already circulating on the track. A blend line serves to keep entering cars from moving too quickly into the path of faster cars. May also be used at *pit-in* for cars exiting the track. Cars entering or exiting the track should avoid crossing the blend line from its beginning to its end. **23**

blip: Quickly pressing and releasing the *throttle* pedal. This is performed when doing a *heel-and-toe downshift*.

BoB: See *beginning of braking*.

both feet in: The action of simultaneously pressing the clutch pedal (if present) and brake pedal fully. If the vehicle has no clutch pedal, the driver may place both feet on the brake pedal to maximize pressure. Used in a spinning vehicle to provide a predictable trajectory that other cars can avoid (by locking the wheels) and to prevent damage to the engine (by pushing the clutch in). As the saying goes, "In a spin, both feet in." **38**

brake fade: A loss of stopping power due to overheating of the brake system. There are two versions: (1) pad fade, where the brake pads get too hot, causing poor grip between the pads and rotors. The brake pedal usually remains firm but braking performance is significantly reduced or eliminated. (2) fluid fade, where the *brake fluid* becomes too hot and boils. This produces a soft or "spongy" pedal feel and results in significantly lower brake performance. If heat continues to accumulate, the brake pedal may go to the floor and produce little, if any, braking force. **45**

brake fluid: Fluid used in vehicle brake systems; is pressurized to activate the brakes. Brake fluid is susceptible to heat and moisture, both of which can degrade the quality of the fluid and thus the brake system's effectiveness. **59, 65**

brake pressure: The force with which the driver presses the brake pedal. Learning to gauge brake pressure, and how it varies from beginning to end of braking, is an important skill for developing drivers. Accomplished drivers often collect brake pressure data along with other variables to assess and improve their performance. **158, 160, 168, 174, 191, 194**

braking point: The point approaching a turn where the brakes are first applied. Same as *beginning of braking*. May also refer to a *visual reference point* used to begin braking. **154, 155, 158, 163, 164**

braking zone: An area on track where brakes are applied before a turn. Some braking zones have distance markers next to the track to serve as *visual reference points* for the *beginning of braking*. **156, 158, 160, 163, 167**

breathe: To very slightly reduce throttle application or brake pressure. Example: "Breathe off of the throttle just before the kink to transfer weight to the steering tires."

brush braking: A technique of applying and releasing the brakes gradually with minimal *brake pressure*. May be used to transfer weight to the front of the vehicle and promote steering response as much as, or in place of, reducing velocity. **157, 162**

camber (of the track): The side-to-side tilt of the pavement, usually in reference to a turn. A portion of the track is *on-camber* if the surface is lower near the inside of the turn and higher near the outside. This is favorable to lateral grip. If a portion of the track is higher near the inside of the turn and lower near the outside, it is *off-camber*, and is unfavorable to lateral grip. On-camber turns can be taken faster than off-camber turns of the same radius. Compare to *slope*. **115, 125, 136, 164, 167**

camber (of the suspension): The side-to-side tilt of a wheel and tire relative to the pavement. The camber of each wheel is important part of the vehicle's alignment. With *negative camber* the top of the tire is closer to the vehicle centerline than the bottom. Some negative camber is considered a benefit for driving on road courses and is used to achieve a larger contact patch on the outside wheels when turning. With *positive camber* the top of the tire is farther away from the center of the vehicle than the bottom. Positive camber is not normally used for road courses, where the car turns both directions.

carousel: A turn, or series of turns in the same direction, with a large radius and well over 90 degrees of direction change.

chassis: The main load-bearing structure of the vehicle (unibody or frame), which supports the suspension, drivetrain, and other components.

check ride: An on-track examination performed to assess the skills and abilities of a driver, usually before promotion to the next *run group* or authorization to drive *solo*.

checkered flag: Black and white checkerboard flag displayed to indicate the end of a session on track and summon all cars to the pits. There should be no passing beyond the location where this flag is displayed. **25, 34**

coasting: Strictly speaking, coasting means driving when the transmission is in neutral or the clutch pedal is depressed, and the wheels are free to rotate. A vehicle can lose speed while coasting due to friction of the tires on the pavement, in moving parts of the car, and from aerodynamic drag. In contrast, releasing the throttle while the transmission is still engaged produces *engine braking*. **147, 161**

cold tire pressure: Air pressure in a tire measured when the tire is at ambient temperature, before it has been worked or driven. Vehicle manufacturers specify proper cold pressures for OEM and equivalent tires, printed on a sticker placed on the door frame. Cold pressures are easier to measure consistently than *hot tire pressures*. Cold tire pressures serve as a baseline and are used together with *hot tire pressures* to make adjustments for optimizing tire performance and/or driving style. Note that there may not be enough time between track sessions for the tires to fully cool and return to the cold tire pressure. **63**

collect (a car): Regain control after a significant loss of *traction*. "Save it." **42**

compress a braking zone: To move the driver's selected *braking point* or *BoB* closer to the *turn-in* point, with the ultimate goal of beginning to brake as late as possible. This usually requires braking harder over a shorter distance. **158, 163**

constant radius: Describes a turn whose curvature is steady throughout, as compared to a turn that becomes more or less sharp the further one travels through it. See *decreasing radius* and *increasing radius.*

contact patch: The area where a tire touches the pavement at any given instant. All forces between the vehicle and track surface are transmitted through the contact patches. The size and shape of the contact patch, together with the downward force on the tire, determine the amount of *grip* a tire has at any given moment.

cool-down lap: The remainder of the drive back to the pits after passing the location where a *checkered flag* has been displayed. Generally driven at a relaxed pace and used to cool down brakes, engine, etc. There should be no passing during the cool-down lap. **25, 95**

corner entry: The portion of a turn from *turn-in* to *mid-corner*, where the vehicle is reducing speed and increasing lateral G forces. **138, 141**

corner exit: The portion of a turn from *mid-corner* to *track-out*, where the driver is increasing speed and progressively *unwinding* the steering wheel. **106, 187**

crown (of the track): A side-to-side shape of the track surface where the center is higher than either edge. Road surfaces are normally crowned to allow rainwater to run off to the sides. When the track has significant crown, the track will go from *on-camber* to *off-camber* (or vice-versa) as the vehicle crosses the crown. The highest point will not necessarily be halfway between the track edges.

curb: An edging to the track surface, usually made of concrete and raised relative to the pavement surface. Curbs are normally painted to make them more visible, though painted curbs may have reduced *grip*, especially if the track is wet. Track edgings that are intentionally rough to discourage cars from driving over them are called *gators* or

rumble strips. Curbs, gators, and rumble strips are typically found near the *turn-in*, *apex* and *track-out* regions of turns. **113, 120**

decreasing radius: Describes a turn that tightens, gets sharper, or closes towards the end, as compared to a turn that does not change curvature or one that opens up the further one travels through it. Compare to *constant radius* and *increasing radius*

diamond line: A V-shaped path that turns more sharply near the middle of the corner than elsewhere. The diamond line is often used for corners with a large radius, such as a *carousel*, that benefit from using more than one *apex* point. See also *double apex* and *square a corner*. Often referred to as "diamonding it off."

double apex: A *line* through a turn, or series of turns in the same direction, where the car touches the inside of the track in two places rather than one. Sometimes used in *carousels* and/or with a *diamond line*.

downshift: To change from the current gear to a lower gear. Downshifts on the track are usually performed while braking for a turn. See also *heel-and-toe*. **187, 188, 191, 194**

early (turn-in, apex, track-out): Describes a *line* that is closer to the beginning of a turn than some reference line; the opposite of *late*. Generally, an earlier *turn-in* produces an earlier *apex* and an earlier *track-out*. Turning in and apexing too early requires the driver to increase steering input near the apex to keep the vehicle on track. At best this reduces the driver's speed exiting the corner; at worst it requires the driver to put *two or four wheels off* the track, or else spin the car. While a very early turn-in can be a mistake for a beginning driver, skilled drivers may use a slightly earlier line to carry more speed into a turn. There also may be turns that are best driven using an early line. **105, 171**

electronic driver aids: Systems installed on a vehicle by the manufacturer to automatically aid a driver in the interest of safety. *ABS* and *stability management systems* are common in most street vehicles. Newer vehicles may have *lane-keep assist*, blind-spot monitoring, *autonomous emergency braking*, and more. These latter systems are less compatible with driving on racetracks and it is often desirable to disable them, if possible, for driving on the track. Some systems may not offer the option to disable, while others may never be invoked, such as adaptive cruise control. ***Student drivers should not change the status of any of these systems unless they have consulted with and gained agreement from their instructor.*** **71**

electronic stability control: See *stability management system*.

end of braking (EoB): The point where a driver has fully released the brakes. For beginners this is usually near the *turn-in* point. When a driver is *trail braking*, the end of braking will come well after turn-in.

engine braking: Using the engine to reduce vehicle speed by partially or fully releasing the throttle while the drive line is engaged. Engine braking provides a greater rate of deceleration than actual *coasting,* and this rate can be adjusted using gear selection,

engine compression ratio, and other variables. Sometimes imprecisely referred to as coasting. Also called "compression braking" due to engine compression ratio. **147**

entry: See *corner entry*.

entry speed: The vehicle speed at a select area of the track, usually at *turn-in.* **174**

EoB: See *end of braking*.

ESC: Electronic stability control. See *stability management system*.

exit speed: The vehicle speed at a select area of the track, usually at *track-out* or some other point where the steering wheel is (nearly) straight. Often checked by *glancing* at the *tachometer* or speedometer at some *reference point*, such as the end of the exit *curb*. **111, 114**

fade: See *brake fade*.

fast hands: Moving the steering wheel more rapidly, especially when entering a turn. The opposite of *slow hands*. Skilled drivers learn to vary the rate at which they dial in steering angle, especially during corner entry, to get the most out of their cars.

feather: To hold a pedal at an intermediate position and make small, precise adjustments. Commonly associated with release of the clutch to avoid a stall. One can also feather the throttle or the brakes.

flag station: A location, visible from the track, where flags are displayed to provide information to drivers on track. Flag stations are often associated with specific corners or placed where the track ahead is not visible to drivers. They also provide protection for the flaggers. **94, 95, 101, 102, 125, 127, 130**

flat: At full throttle; flat out. Same as wide open throttle*; see WOT*.

four wheels off: An event where all four of a car's tires leave the designated track and/or pavement. Usually involves utilizing a *run-off area* or invading the nearby agriculture.

gator: A portion of pavement that is intentionally rough; see *rumble strip*.

glance: A direct but brief look at something, using the central *visual focus*. Glances are used to check *flag stations*, conditions far down the track, or otherwise gain situational awareness. **92**

grid: Either the area where cars are staged just before going on track, or the act of moving cars into the grid formation in preparation for going onto the track. See also *pre-grid*.

grip: The maximum force parallel to the road surface that a tire can provide at a given time. May also refer to the combined maximum force for all tires on a vehicle, or to the frictional properties of the track surface. Same as *traction*. Lateral grip is required for cornering and to steer the car. Longitudinal grip is required for acceleration and braking. **122, 123, 141, 152, 172, 182, 183, 203**

HANS device: A well-known brand of *head and neck restraint system,* currently owned by Simpson Performance Products. The name stands for "head and neck support" and is pronounced "häns."

harness: A driver restraint system that includes a lap belt, two shoulder belts, and usually one or more "sub" belts holding the lap belt down (5-point or 6-point harnesses). Harnesses hold the driver tightly in the seat, in contrast to the three-point belts that are standard in passenger cars. Many organizations require a *head and neck restraint system* to be worn if also using a harness. **21, 31**

head and neck restraint system: A support system for the head and neck used by drivers and passengers to mitigate injury in the case of an impact. These systems greatly reduce the chances of a fatal basilar skull fracture. The *HANS* and Hutchens devices are examples. Some track events and most race-sanctioning organizations require this device. **31**

headed for the wall – hands off all: When contact with a wall, guardrail, or other obstruction is imminent, drivers should remove their hands from the steering wheel just prior to impact. This reduces the chance of injury to hands and wrists should the front wheels impact the obstruction and abruptly turn the steering wheel. See also *both feet in*.

heel-and-toe: A technique of *downshifting* in a manual transmission vehicle with a clutch pedal. Most drivers use the ball of their right foot on the brake pedal and the right edge of that foot to *blip* (quickly depress and release) the throttle just before the clutch is released. The left foot operates the clutch pedal. When done correctly, the driver matches engine RPM relative to vehicle speed in the new gear as the clutch pedal is released, minimizing changes in the vehicle's weight distribution. **191, 194**

hot tire pressure: Air pressure in a tire measured immediately after it has been driven or worked, and thus has an increased temperature and pressure. Hot tire pressures are more indicative than *cold tire pressures* of the tire's condition from being driven on track. Experienced drivers usually seek specific hot pressures for each tire when choosing cold tire pressure and/or suspension settings. Driving a *cool-down lap* before measuring tire pressures will make hot tire pressures less accurate.

increasing radius: Describes a turn that opens up or becomes less tightly curved towards the end, as compared to a turn whose curvature does not change or one that becomes tighter the further one travels through it. Compare to *constant radius* and *decreasing radius*

kerb: British spelling of *curb*; used widely in Europe.

lane-keep assist: A system on some newer cars that uses cameras to identify and track lane markings on the pavement. When the system detects a possible lane departure with no turn signal active, it will notify the driver, adjust steering angle automatically, or both in order to keep the vehicle in its current lane. This system is considered incompatible with driving on a racetrack and should be disabled, if possible. **71**

late (turn-in, apex, track-out): Describes a *line* that is closer to the end of a turn than some reference line; the opposite of *early*. Generally, a later *turn-in* produces a later *apex* and

a later *track-out*. A line that apexes slightly later than the geometric center of the turn is often optimal, as it allows the driver to begin accelerating and unwinding the steering at or near the apex. This can increase corner *exit speed*. A turn-in and apex that are too late require the driver to sacrifice too much *entry* and *mid-corner* speed, so that acceleration begins from a slower speed. A driver who turns in extremely late may not be able to get the vehicle to the apex and/or will not need the full width of the track at track-out. Beginning students are often taught a line that is somewhat later than optimal, so that variations from lap to lap will not result in a dangerously early line. As drivers progress and become more consistent, they can experiment with slightly earlier lines and seek the best trade-off between carrying speed into the corner and accelerating out sooner. **108, 114**

learning goals: Incremental improvements sought in driver skill or understanding, often during a single track session. Can also relate to a day or an entire track event. **9**

learning mindset: Mental focus on mastery of driving skills and safety, rather than focusing exclusively on lap times or comparison to other cars/drivers. Individuals with a learning mindset seek to build their own skills, are continually looking for new ideas and new approaches to high performance driving, and use data such as lap times as one of several indicators of their progress. **1, 6**

lift: Releasing the throttle partially or fully. Used to slightly reduce speed or, while turning, to adjust the *balance* and turning rate of the car. See also *throttle steering, rotation*, and *trailing-throttle oversteer*.

line: Either the desired path around the track, or the path actually taken by a driver. May also refer to the portion of the track where most cars drive, which may be *polished* and collect more rubber. While beginners may view the optimal line as fixed, accomplished drivers can regularly make small adjustments to their line to seek the best *grip* and/or use all the capabilities of their car. HPDE drivers and instructors often prefer lines that are fast while providing ample margin for error. **79, 104, 107, 109, 111, 114, 115, 117, 118, 122, 123**

linked turns: Two or more consecutive turns, close enough together that the optimal line through one turn is affected by the other turn(s). Examples are a left turn followed immediately by a right turn, or two closely spaced turns in the same direction. **111, 133**

lug nut torque: Torque ("twisting force") used when tightening a wheel's lug nuts or lug bolts. Measured with a torque wrench and specified in foot-pounds or Newton-meters. **60**

maintenance throttle: Applying just enough throttle in a turn to maintain a constant speed. This keeps the *chassis balanced* and provides more cornering *grip* than *coasting*, *engine braking,* or strong acceleration. Often used in the central portion of long corners. **143**

marbles: Rubber debris left in turns because of heavy tire stress. As tires are worked hard in cornering, hot pieces of rubber roll off the tread and are slung away. Marbles usually accumulate *off-line* and reduce *grip* potential. Marbles can also stick to hot tires,

creating vibration and reducing performance. HPDE drivers should avoid driving through marbles when possible.

master cylinder: A mechanical component of an automotive braking system that, when actuated by the brake pedal, forces *brake fluid* under pressure to the brakes at each wheel. Normally found under the hood, just beneath the brake fluid reservoir. **65**

medium braking: A technique in which *brake pressure* is substantial but below (or only briefly at) the limit of *threshold braking*. Used for corners where threshold braking slows the vehicle too much, but *brush braking* does not slow the vehicle enough. **157, 162**

mid-corner: The central portion of a turn, usually approaching and around the *apex*, where the vehicle has finished slowing and is not yet strongly accelerating. Often the place in a turn where the *chassis* is most *balanced* and steering angle is the most stable. **143**

mirror scan: The act of *glancing* at a vehicle's mirrors to increase situational awareness and/or determine if other cars are nearby.

modulate: To vary *braking pressure* or *throttle* application by small amounts over time, increasing, decreasing, or both. Used to control the vehicle by adjusting weight distribution among the *contact patches*. See also *breathe* and *feather*. **210**

negative camber: A suspension setting where the top of the tire is closer to the centerline of the vehicle than the bottom. See *camber (of the suspension)*.

off: A departure of the vehicle from the designated track boundaries, usually no longer on the pavement. "I had an off in turn 7." See *two wheels off* and *four wheels off*.

off-camber: A portion of the track where the surface is higher near the inside of a turn and lower near the outside. See *camber (of the track)*. **125**

off-line: On a path different from the desired path, or different from the path that gives the best speed around the track. A driver may have to drive off-line to pass another vehicle or to avoid an obstacle. **41, 117**

on-camber: A portion of the track where the surface is lower near the inside of a turn and higher near the outside. See *camber (of the track)*.

open the wheel: Reduce steering input; partially straighten the steering wheel. Same as *unwinding* the steering wheel.

oversteer: A state of *chassis balance* where the rear tires have less *grip* than the front tires. Also known as "loose." Small, controlled amounts of oversteer may be intentionally induced by *throttle steering*, to take the vehicle more toward the inside of a turn. Large or uncontrolled amounts of oversteer correspond to "losing the back end," and can result in a spin. Compare to *understeer*. **97, 175, 197, 201**

paddock: The area where drivers park their cars while not on track. Usually near the *grid* and pit areas. **26, 29, 46**

parade laps: Laps driven at a significantly reduced speed, often led by a pace car and generally not requiring helmets or other special safety gear. Seat belts or *harnesses* (if applicable) should always be worn on track. Also called "touring laps."

passing signal: See *point-by*.

passing zone: An area on track where vehicles are allowed to pass one another, usually with a *point-by*, per the rules of the event. Different *run groups* may be restricted to specific passing zones based on their experience. **24, 87, 125, 206, 212**

peripheral vision: The portion of the human visual system that allows us to see things we are not looking at directly, i.e., away from the area of *visual focus*. Peripheral vision can detect shape, movement, and some color, but not fine detail. **82, 90, 92**

pit signal: Universal signal to inform other drivers and flaggers that one is going into the pits. This is indicated by holding a fist as high as possible out the driver's side window. **26**

pit-in: The area where drivers leave the active racetrack and enter the pits. Also, the action of entering the pits or an instruction to do so. See also *blend line*. **26**

pit-out: The area where drivers exit the pits and enter the active racetrack. Also, the action of entering the track from the pits. See also *blend line*. **23**

point-by: A signal given by one driver to another driver behind them indicating "It is OK to pass me now." Usually, the signaling driver puts their arm outside the window and points to the side of their vehicle where the trailing vehicle should pass. Some organizations use turn signals for point-bys. Also known as a *passing signal*. **87, 208, 209, 212, 214**

polished: Used to describe any portion of the track that has a smoother surface texture than the surrounding pavement. Polishing occurs due to frequent use, so the most desired *lines* are usually polished. Polished areas have less *grip* when wet compared to un-polished areas, which have a rougher surface texture that better allows water dispersion. **115**

positive camber: A suspension setting where the top of the tire is further away from the centerline of the vehicle than the bottom. See *camber (of the suspension)*.

pre-grid: See *grid*. Can also be an area to line up vehicles before they enter the grid.

pre-positioning/pre-setting: A steering technique where the driver judges ahead of time the amount of steering needed at an upcoming turn. Before turn-in, the driver places their hands on the wheel such that returning the wheel back to a *9-and-3* hand position produces the maximum steering angle needed for the turn. This places the driver's hands at 9-and-3 mid-turn in preparation for any needed adjustment, but both hands grip the wheel during corner *entry* and *exit*. Compare to *shuffle steering*. **181**

present (for a pass): Moving one's vehicle into a position close behind another vehicle and offset to the side on which a pass is anticipated. This makes the presenting vehicle visible in two mirrors of the forward vehicle and communicates that the presenting vehicle is ready for a *point-by*. **211, 213**

rain line: An optimal or desired path around the track when the surface is wet. A rain line is generally chosen to avoid areas with standing water collection and/or lack of *traction* from *polished* areas, and to make use of un-polished areas with better *grip*. **118, 119, 120, 121, 122, 123**

red mist: A mental state in which a driver loses situational awareness by overly focusing on their position relative to nearby vehicle(s) on track. Red mist can cause drivers to make significant mistakes, such as underestimating their speed or overestimating their vehicle's braking or cornering ability, possibly resulting in an *off*. **4**

redline: The maximum RPM at which the engine can be run safely, indicated by red markings on the *tachometer*. Most vehicles have rev limiters that prevent the driver from accelerating past the redline, also known as over-revving. **185**

reference point: See *visual reference point*. **80, 82, 83, 84, 93, 109, 129, 136, 154**

ride-along: Riding with another driver on track. Sometimes students will go on a ride-along with their instructor to learn. Other times, this may be more leisure oriented, e.g., *parade laps*.

roll (onto/out of the throttle): To change *throttle* position substantially in a smooth, progressive manner. Rolling onto the throttle is the opposite of suddenly "flooring it."

rotation: Movement of a vehicle around a vertical axis, where the rear of the vehicle moves away from the direction of steering. Intentional rotation is a small, controlled amount of *oversteer*, induced through *trail braking* or *lifting* off the *throttle* (*trailing throttle oversteer*) to reduce the radius of the vehicle's path. Unintentional rotation can lead to a spin or other loss of control. **150, 173, 174, 175, 204**

rumble strip: A portion of the track that is intentionally rough, meant to discourage driving in that area. Due to the oscillation or pattern of a rumble strip, *traction* is also generally reduced when on top of it. Note that there may be additional pavement beyond a rumble strip that is considered "off track" or out of bounds, depending on the organization, track and configuration. Also called a *gator*.

run group: A group of drivers assigned to drive on track together. Drivers are usually grouped by skill and/or vehicle type, e.g., the novice run group, the instructor run group. **24**

run-off area: Any area adjacent to the track that can be driven on in an emergency. Typically used to prevent loss of control, deal with brake failure, or avoid hitting other cars. Run-off areas may have gravel or sand to slow a vehicle's speed, or may be pavement, grass or dirt. Some run-off areas may not be large enough to prevent contact with guardrails or other obstructions. **99, 128, 134**

set: See *take a set*.

short shift: To change into the next higher gear before reaching either the RPM to shift for optimal power or the *redline*. Typically used just before a corner where the next higher gear would be required before the end of that turn. Short shifting may allow more speed to be carried through the corner, since shifting in the corner can upset the

balance of the car. It can also be used to allow greater *throttle* application without inducing sudden *weight transfer* or spinning the drive tires, as might occur in a lower gear. **190, 192**

shuffle steering: A steering technique where the driver's hands alternately grip and slide over the steering wheel. For example, to initiate a right-hand turn the right hand grips the steering wheel and moves down from the 3 o'clock to 6 o'clock position, while the left hand slides down to 6 o'clock from the 9 o'clock position. The left hand then grips and continues moving the wheel, rising from 6 to 9 o'clock, while the right hand slides back to the 3 o'clock position. At that point the driver could stop rotating the steering wheel, gripping with both hands, or repeat the technique to continue rotating the steering wheel. The process is reversed as the vehicle exits the turn. Shuffle steering allows the driver to have a *9-and-3* hand position *mid-corner* such that more steering is always available, even for unexpected events. The technique can also be used on the upper half of the steering wheel using the 9, 3, and 12 o'clock positions. A disadvantage is that the driver only has one hand gripping the wheel at any time during the shuffle, especially during corner *entry*. Compare to *pre-positioning*/*pre-setting* and *9-and-3*. **181**

slip angle: The difference in angle (measured in degrees) between the direction a tire is pointed and the direction the tire is actually traveling on the pavement. Tires require some slip angle to develop side force, and do not necessarily have to slide over the pavement to achieve this. Side force increases with slip angle up to some maximum, then decreases for larger slip angles. **151, 183**

slope: Change in track elevation in the direction of travel, i.e., the uphill or downhill orientation of the track. Contrast with *camber*, which is the side-to-side variation in track height. **115, 136, 164, 167**

slow hands: Moving the steering wheel more gradually, especially when entering a turn. The opposite of *fast hands*. Skilled drivers learn to vary the rate at which they dial in steering angle, especially during corner entry, to get the most out of their car's *traction*.

solo: The act of driving alone on track, without an instructor. **19**

square a corner: To use a very *late turn-in* and potentially late *apex* for a turn, with the vehicle's path being more squared (closer to 90^{o} angle) than rounded relative to the arc of the turn. This can be used to *double apex* longer-duration turns, maximize the length of a straight, or exploit the acceleration capability of certain vehicles. See also *diamond line*.

stability management system: Often called electronic stability control (ESC) or a variant thereof, these systems intervene in certain circumstances (e.g., substantial *oversteer*) to help the driver maintain control of the vehicle. The system generally employs components of the anti-lock braking system and is required on all passenger vehicles in the USA starting with model year 2012. Systems on SUVs usually also incorporate rollover mitigation. Highly skilled drivers may prefer to disable stability management for driving on track. Some vehicles may not allow stability management to be disabled,

while others offer intermediate settings that will only intervene in more severe situations. For less experienced drivers, leaving the system fully active is highly recommended. Stability management systems can be also used as a coaching tool, alerting drivers when they have asked the vehicle to do something beyond its *traction* and stability limits. ***Student drivers should avoid disabling or changing the settings of their stability management system unless they have consulted with and gained agreement from their instructor.*** **22, 74, 75, 76, 77**

tachometer: A gauge that displays engine speed in revolutions per minute (RPM). Used by drivers to determine when to *upshift*.

take a set: The moment during corner *entry* where weight has fully transferred to the outside wheels and will only shift again when the driver makes further adjustments. **112**

target speed: An aspired speed for a select area of the track, usually measured on a straight or at turn entry/exit. **170**

threshold braking: A braking technique that uses the maximum *traction* of the tires to slow the vehicle. Typically used when a fast straight is followed by a slow corner. The goal in threshold braking is to apply as much *brake pressure* as possible without locking up the tires. In cars without *ABS,* this requires considerable skill and practice. Since ABS employs threshold braking, the driver of a vehicle so equipped can flirt with ABS activation to know when they are at the threshold/limit. **156, 157, 160, 162, 163, 165**

throttle: The pedal on the far right that makes the vehicle go faster. Usually tall and skinny in shape. "Gas pedal," "*accelerator*," "happy pedal." **131, 132, 137, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152**

throttle steering: *Modulating* the *throttle* while turning to adjust the rate at which the vehicle turns without necessarily moving the steering wheel. See also *trailing-throttle oversteer*. **200**

track insurance: A short-term insurance policy, separate from normal automobile insurance, covering vehicle damage that occurs on track at an HPDE event. Some policies may also cover damage to the facility and/or personal injury. **30**

track map: A two-dimensional diagram of the track or its path. Often used to teach the *line* around the track, or to record information from past sessions for analysis and improvement. **94, 125, 126, 127, 128, 129, 130, 131, 132, 133, 135, 136, 137**

track-out: The point on a track where a driver has completed a turn, often resulting in a steering wheel that is straight. This usually occurs at the outer boundary of the track. **80, 107, 109, 112, 131, 132, 144, 179**

traction: See *grip*. **122, 123, 141, 152, 172, 182, 183, 203**

trail braking: Overlapping a gradual release of the brake pedal with progressively increased steering in the *entry* phase of a turn. When well executed, trail braking takes full advantage of the car's *grip* in combined turning and deceleration. Highly skilled drivers

use trail braking to induce a small amount of controlled *oversteer*, *rotating* the vehicle toward the *apex* as they turn in and ultimately using less steering angle. **169, 172, 173**

trailing-throttle oversteer (TTO): Releasing and/or *modulating* the *throttle* to move weight forward in the *chassis*, such that the vehicle *rotates* on its axis toward the inside of the turn without increasing steering input. Can refer to intentional *throttle steering* or to unintentional *oversteer*. Brakes are not used in TTO.

turn-in: The point at which a driver begins moving the steering wheel to navigate a corner. May also refer to a desired point for initiating a turn, described relative to a *visual reference point*. **80, 82, 104, 105, 107, 108, 109, 131, 132, 158, 163, 168, 170, 172, 178**

two wheels off: An event where two of a car's tires leave the designated track and/or pavement. Considered less serious than *four wheels off*. **43, 44, 106**

understeer: A state of *chassis balance* where the front tires are *gripping* less than the rear tires. Also called "push" or "tight." Small, controlled amounts of understeer may be induced by *throttle steering* or intentionally applying too much steering angle. Large or uncontrolled amounts feel like the front tires are "washing out," or "plowing" and may result in leaving the track. **196, 201, 205**

unwind: To progressively release steering angle that was applied previously, typically while *exiting* a turn. Also called straightening the wheel or *opening the wheel*. Unwinding the steering wheel allows the driver to add more *throttle*. **144, 179**

upshift: To change from the current gear to a higher gear. **185, 186, 193, 195**

visual focus: The place one is looking directly, using the center of one's visual field. The central portion of our vision is how we see detail, and drivers learn when and where to direct their visual focus to gather the information they need. **82, 84, 88, 93, 97**

visual reference point: Any fixed mark or object on or near the track, or landmark in the distance, used by a driver to execute a desired *line* repeatably. Common visual reference points include distance marker signs, *curbs*, patches and seams in the track, trees, buildings, and tire walls. Cones are poor visual reference points because they are easily moved by other cars. Also known as a *reference point*. **80, 82, 83, 84, 93, 109, 129, 136, 154**

weight transfer: A change in the way that downward load is distributed among the vehicle's *contact patches*. Weight transfer is induced by accelerating, decelerating, or turning. Applying the brakes creates weight transfer from the rear tires to the front tires, while turning the car at speed creates weight transfer from the inside tires to the outside tires. **198, 204**

WOT: Wide open *throttle*, where the throttle pedal is pressed to its maximum limit. Also called *flat* or "flat out."

NOTES:

THE HPDE CURRICULUM GUIDE

This guide is the definitive source for creating or improving an HPDE program. Using this guide, your program will deliver the highest quality instruction through industry best practices that generate repeat and referral business, while focusing on safety and fun. Developed by some of the best instructors in the industry and tapping nearly two centuries of cumulative experience, the guide brings you wisdom from chief instructors, classroom instructors, and in-car instructors from across the USA, and shares the best ideas from dozens of industry-leading HPDE organizations.

The information in this guide can be used to start a curriculum from scratch or enhance an existing program. Choose from over 200 driver performance outcomes, organized by skill category and driver competency level, to tailor a curriculum that meets your organization's goals. If you help deliver any part of an HPDE program and you want your students to have the best learning experience possible, there is plenty in this guide for you!

Tighten your harness and get ready for some podium-topping information that will have you excited to help your student drivers increase their skills quickly, safely, and enjoyably!

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