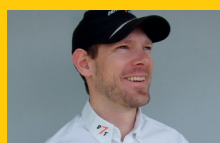




GRIP THE LIGHT FANTASTIC

In this month's coaching article, Porsche Driving Consultant, Neil Furber, discusses the famous 'limit'...

During the course of my *GT Porsche* driver coaching series, I've covered basic tips and new skills, driver-focused vehicle technology and comparisons between the dynamic behaviour of different models in the Porsche range. Although I've also talked about grip and a tyre's limits (along with understeer, oversteer and pivoting), I'm well aware that if you aren't already fluent in this topic, then further explanation may be required. With this in mind, now seems like a good time to delve into, what is for many, the most elusive and least understood part of amateur performance driving: the famous 'limit'.



DRIVING FORCE

Neil Furber is *GT Porsche's* resident driving expert. With a background as a mechanical engineer in Formula One, he brings a unique technical insight to driver coaching. Splitting his time between the French Alps and the UK, Neil coaches drivers through his brand, Drive 7Tenths (drive7tenths.com) and is also a Porsche Driving Consultant at Porsche Experience Centre Silverstone. Have a question about coaching? Email him at enquiries@drive7tenths.com.

WALKING THE TIGHTROPE

When it comes to driving sports cars safely, we must always consider the 'limit' of vision (how far we can see through a bend etc.). This article, however, is about the 'limit' of grip (what the tyres can cope with before skids and slides follow). It's this that triggers the strongest emotions — fear, anxiety, excitement. Unsurprisingly, I won't encourage deliberately exceeding the limit of grip on the public road. That's best saved for a closed circuit or specially prepared environment, such as one of the Porsche Experience Centres (find your nearest site at porsche.com). However, understanding where the limit of grip is and how to feel if you're getting close to it is an essential part of avoiding going too far.

You may have experienced minor skids or a loss of grip during poor weather or if you've 'over-egged' it at some point. This could be a spot of wheel-spin exiting a gravelly junction or ABS intervention (or lock-up, for readers with older cars!) during braking on an icy surface. You may have felt understeer (a straighter than desired trajectory) when passing polished asphalt on a damp bend, though many Porsche owners are more concerned about oversteer. This is the tail-out over-rotation leading to a spin, or the 'fishtail' effect often experienced if you overdo it with a powerful rear-wheel drive machine.

The truth is, despite some drive-specific tendencies, all cars can experience both understeer and oversteer during at-the-



limit cornering. It's the fine balance required to operate between the two that I refer to as 'walking the tightrope' of grip. It's here the satisfaction of flirting successfully with risk and reward can be found, but it's not easy, and there are many levels of difficulty depending on the amount of grip, speed and

specific car dynamics. Furthermore, it's the delicate interaction of your hands and feet, exact timing and finesse that will dictate whether or not you break traction during cornering, braking, acceleration (or a combination of all three) and exceed the limit of one or more tyres.

TYRES, TYRES, TYRES

Driving safely in a spirited manner or chasing the raw pace of competition at a track has many important factors, but there's one fundamental: tyres. Everything a car does dynamically is a result of the relationship between the tyres and the road surface. A tyre's grip can be considered as its ability to produce a force on a vehicle as a result of its interaction with the ground. This is generated at the contact patch (the portion of tread in contact with the road). The 'limit', or limit of grip, is the point at which the tyre(s) can no longer produce the forces required or requested by the driver. Reaching — or passing — the limit sounds like a black-and-white or 'light switch' phenomenon, yet it's actually a little more forgiving and readable than that. That is, if you know what it is you should be looking for!



NEXT
MONTH

Overtaking



TUNING IN

I'm sure you've heard certain drivers talk about 'feeling' from the seat of their pants. This is, in fact, a real thing and one of the ways to 'walk the tightrope'. A combination of cues can enable you to detect and control the understeer/oversteer balance, but the most significant is what your hands can feel through the steering wheel, what the eye can see and any rotation about a vertical axis (yaw) as detected by the inner ear (rather than bum-in-seat). In my experience, the inner ear bit — as well as any lateral feel through the seat — takes time to develop, but the steering feel and hand-eye coordination are much easier to recognise and work with. The latest generation of home driving simulators can be used to learn to read and manage all this without any physical movement, but more on that in a future article.

What is it we're looking for? Moreover, what can the hands feel? Once a new driver

has driven for some time and their steering accuracy is reasonable, they'll start to develop a sense of where their car will go during normal control. That is to say, during steering (cornering) below the limit of grip. Any deviation to this can be 'seen' and the car would feel odd if it were to steer more or less than expected. With further experience — and most effectively if your vision and steering accuracy is above average through driver coaching — your hand-eye coordination can improve still further, enabling you to make adjustments as necessary. At slow speeds in low grip conditions, such as manoeuvring around a snowy car park, you may automatically nudge the steering wheel one way or the other to regain control if the car starts to exhibit mild understeer or oversteer through a loss of grip, but recovery becomes harder to achieve as speeds increase and with a wider range of grip. The key to success is

using the eyes for effective 'target fixation', thereby providing the hands with timely and accurate information. Developing use of your eyes in this way is fairly easy, but teaching the hands exactly what to do requires practice during a wide range of actual skidding.

Luckily, the hands can feel whilst the eyes are working. In other words, they can provide information at the same time, helping to avoid the need for big armfuls of steering lock if you cause a skid. You may remember me talking about the speed of steering inputs and the notion that good driving is akin to reading a newspaper in a wing-backed chair (if not, order a copy of the October 2019 issue of *GT Porsche* at bit.ly/issuesgtp). Well, this is mostly to do with feel — when you turn the steering wheel of your Porsche during normal road-speed cornering, if you do so gently and focus on your actions, you'll be able to feel how the self-centring effect becomes stronger the more you steer. This is known as self-aligning torque. Put simply, the more stress you apply to a tyre in cornering, the more it tries to straighten. With a nicely tuned steering arrangement, this build-up of torque should be fairly linear to help you 'feel' how much stress the front tyres are under. If you steer too far, you'll feel a combination of vibration and a drop-off in torque. It's much like if the power steering assistance was suddenly ramped up to present you with very light steering. This is what happens when the front tyres reach the limit. If the rear tyres let go first, the drop-off is also felt, but without the vibration.

When a tyre lets go, the effect is a progressive development as one end of the contact patch starts to slip across the road surface (as opposed to gripping it). With further stress, this behaviour propagates until all of the contact patch is slipping. The more slowly you steer as you reach the limit, the more easily you can feel the progression, the drop-off (lightening) and any vibration from low to high frequency as the tyre tread blocks let go and oscillate across the road surface. Since reaching the limit of either front or rear tyres lead to this feeling of the steering becoming 'light', it's the eyes that permit you to differentiate between a car going straight on (understeer) or into a spin (oversteer).

The next stage to all of this is professional driver coaching. If this is of interest, please feel free to contact me for further discussion. For those of you more technically minded, I've expanded on the subject of slip angles and sideforce in an article on my website. Visit drive7tenths.com and search for 'tyres'.