POLE POSITION

Porsche Driving Consultant, Neil Furber, discusses how handling differs between rear-engined and mid-engined sports cars

When talking about the handling abilities of a classic 911, it doesn't take long for somebody to chip in with the word 'pendulum' or, as is often the case, 'widowmaker'. As for mid-engined Porsche products, all but the most die-hard of 911 fans tend to have nothing but praise for the way these cars cling to the road. Let's consider what differentiates the two distinctive layouts from one another.

DRIVING FORCE

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

SKATEBOARDS AND MASS DISTRIBUTION

The early 911's skinny tyres and engine positioned behind the rear axle make for a near-unique spirited driving experience. Of course, it's perfectly possible to get in a pickle with the latest range of high-powered Porsches, but doing so tends to be through driver error at high speed, as opposed to as a consequence of chassis layout. The most modern kit features a suite of electronics to try and help protect the driver from themselves, but none of these aids are infallible and, contrary to popular belief, good driving technique is more effective than electronic aids.

Over the years, the 911 has seen huge amounts of development. The most recent levels of refinement and handling are, frankly, superb. Losing the tail during everyday driving is certainly far less of a concern than when in charge of an early example of the model. This is, in part, thanks to significant development in tyre compound technology and increased size, but there's also been continual tweaking of architecture and tuning.

Perhaps unexpectedly, during poor weather conditions, I'd prefer to drive a 911 over a Cayman. The rear-biased weight distribution champions rear grip and, when we talk inertia, the 911 is initially more forgiving if you steer gently. Talking of which, you may have heard the term 'moment of inertia', otherwise referred to as 'rotational inertia'. This is the measure of resistance to an increase or decrease in rotation. It's the main property behind why rear-engined and mid-engined cars behave differently during corner turn-in. Consider a skateboard as a simplified chassis. If we pop a strimmer engine on the rear end (behind the wheels), a tin of paint in the middle to represent the driver and a large pack of batteries over the front wheels to simulate the fuel tank, we have a very crude representation of the 911. If we move the engine forward of the rear wheels - far enough forward for it to touch the paint tin - we now have an equally crude Boxster. In these examples, the total mass of each model is the same, but the individual masses that make up the vehicle are distributed differently along its length. The more concentrated the individual masses, the less rotational inertia there is. Plus, the vehicle will rotate more easily when turning-in to the corner.

The mid-engined car has its major masses nearer the centre and can rotate very quickly when steering. The rear-engined car has these masses distributed over a greater length and reacts more slowly when steering. It's just like if you spin on an office chair. Tucking your legs in will make you rotate faster. Kick them out and you'll find yourself slowing down.

MYTHBUSTING

Many of us have heard horror stories about the way an early 911 handles. You'd be forgiven for thinking the rear-engined layout is much easier to spin and that this behavior can occur with the minimum of effort. The truth is a little more complex. The mid-engined setup will steer, pivot or spin much more easily due to the reduced rotational inertia, and yet, if (excess) oversteer is detected and corrected quickly, it's also much easier to bring the car back under control. As for the aforementioned 'pendulum' analogy, I prefer to think more in terms of a sledgehammer! To swing one of these tools over your shoulder will require a huge amount of effort, but once it's on its way, you'll struggle to stop it mid-swing. The 911's rear tyres are able to do just that, providing you stay within their limits!

Consider the front tyres as destabilising and the rear tyres as stabilising. When you turn the steering wheel a fixed amount for a corner, the front tyres steer, deform and generate lateral force. The bodyshell rotates (yaw) a little and, therefore, the rear tyres are subjected to induced angle, generating their own lateral forces. The front tyres started a spin close to the centre of rotation, the rear tyres provided counterbalancing. They support.

The rear-engined format will generate greater rotational momentum during cornering, but it's less keen to develop when compared to a mid-engined layout. That's why the Boxster feels so agile by comparison. Thankfully, when driven in a stable fashion, the 911's wide rear tyres have the extra weight needed to provide the grip to help resist a spin. That's thanks to the rear-biased weight distribution. Progressive acceleration upon corner exit will continue to load the rear to really stick down. This is one of the 911's true strengths. All is fine and dandy unless you push too far...

NEXT MONTH

Automotive safety systems and how they interact with the driver

LIFE CHANGES AT THE LIMIT

Despite common opinion suggesting the 911 engine is the 'wrong' place, in terms of performance, the placement is actually a good choice. During high-speed cornering, for example, a front-engined car will tend to understeer (run straighter than desired), whereas a rear-engined car will tend to oversteer (spin). Although the latter is the very behavior that worries many road drivers, it's generally preferred by racing drivers. And let's not forget a rear-engined car's massive gains in traction, which help get power down. Mid-engined cars are fairly neutral in this respect, but are still easy enough to spin.

Once we start flirting with the limit during circuit driving, we're looking to get similar behavior from both mid and rear-engined layouts. If we're no longer worried about oversteer and spinning, but are instead looking to promote rotation when required, things become more interesting. The mid-engined layout makes for nimble cornering with quick changes in direction and easy pivoting, but at the expense of rear traction for acceleration. The rear-engined layout makes the turn-in a slower process, but can more than make up for the delay at the corner's exit.

I've mentioned trail braking before. Mid-engined cars don't support as much trail braking as rear-engined cars due to the tail breaking away much more easily. As you'd expect, however, a quick countersteer can sort this out. For fast lap times in a 911, trail braking is essential, but challenging. The potential to build rotational momentum is much greater, meaning that when you do reach the ultimate rear tyre limits, that sledgehammer we talked about follows through. You'll need some fancy wheel work if you're to gather things up!

Naturally, we arrive at finesse. This is where the dab of opposite lock and hammer swinging become less severe. Most of the time, I'll say never lift or go for the brake in a corner, but at expert level, a well-timed, correctly dosed lift can have great effect. Even so, a simple 'off switch' approach near the limit is likely to send you sideways and beyond. Then we're back to inertia and your handiwork at the wheel.

Personally, I prefer the general driving dynamics and agility of the Boxster's layout, but I love the complexity of dancing on the limit in a 911 at the track. I'm keen to hear your thoughts. Email or Tweet us using the contact info on Dan's editor letter page at the start of this issue of *GT Porsche*. We look forward to hearing from you.