



Tech Basics: Cornering Horsepower

Getting your car to handle on a budget

By Godfrey Towns

When you can go hard in a straight line it's pretty helpful if you can go around the corners as well. And, if your car is - ahem! - a bit slow, there's nothing better than being able to waste them on the bendy bits! The answer is to have a car that handles.

In this particular feature we'll assume that you're driving a rear-wheel drive car - other drive configurations will be covered another time.

What Happens When You Corner



When you turn the steering wheel as you're bowling along, the front wheels also turn. Gee, that was hard to understand! Since the tyres are attached to those wheels, they also turn, forming an angle to the long axis of the car. Let's say that they turn by 3 degrees. You'd expect the front of the car to follow that exactly, wouldn't you - but it doesn't happen. Instead the front of the car might react as if the wheels have been turned by only two degrees.

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In other words, the front tyres have a sideways slip, even in normal turns at low speed.

At high speed this slip angle increases - you jab on a quarter turn of the wheel and the car behaves like you've only turned the wheel by an eighth of a turn. When this gets really bad - and it's starting to, isn't it? - the car is understeering. The front wants to keep on going straight ahead, and you wanna make it go around the corner.

Slip angles happen at the back, too - even though most times the wheels can't turn to steer the car. Instead what happens is that the rear wheels don't always follow along in the path of the front wheels. When they slip, they move towards the outside of the corner. When this slip angle becomes a lot, you say that the car is oversteering.

So, understeer is when the front ploughs straight on, and oversteer is when the tail hangs out. But remember, both are because the tyre is slipping at an angle to where it should be going.

What Affects Oversteer and Understeer

Okay, so it's the tyres slipping at an angle to the road that causes oversteer and understeer. But what makes the tyres slip? Generally, it's because they're overloaded - they've got too much weight placed on them, trying to push them sideways.

Imagine you're in a really softly-sprung car, one that has a lot more weight on the front tyres than the back. You corner hard, and the barge heels over. Straight away, there's more weight on the outside tyres than the inside, cos the car's leaning over on them. Then take the example of the front outside tyre. Not only has it got a heap of weight from the cornering on it, but because the car's front-heavy, it's got even more! The result is that the tyre is overloaded, its slip angle to the road increases, and the car understeers. A ha! You remember your right foot! You floor the throttle, and suddenly a gob of torque goes through the back tyres, increasing their load as well.

The outside rear tyre starts getting overloaded from power, and slips a heap. From understeer to oversteer in two seconds flat!

You can see then that weight and power are the two biggies affecting tyres' slip angles.

Stopping Understeer

Most rear wheel drive cars are set up to understeer. This is for a bloody good reason - it's a lot safer. You've had your license two days, and you take your mates for a ride in Dad's car. Up to a corner you come, only to find that you're going too fast. The car keeps going straight, tyres squealing and mates suddenly quiet, and in terror you lift your foot from the throttle - better to hit slower than faster.... The car's weight transfers forward, there's suddenly more weight acting downwards (not sideways) on both the front tyres, and the understeer magically stops. You and your mates live to tell the story.



But understeer that's so bad that it happens even when you **are** in control gets to be a pain in the butt. If the car has generally good levels of grip except for the annoying understeer, get a good wheel alignment with more camber dialled in.

This sits the front wheels in a little at the top, and so when you corner, the tyre on the outside stays more vertical, so developing better cornering grip. Another way of getting that camber is to have more castor, so that the wheels only get the camber angle when you're cornering. If the front of the car is rolling excessively, a stiffer front sway bar will reduce the weight transfer which is overloading the front outside tyre. So will stiffer front springs and shocks. Simplest first step of all is to increase the front tyre pressures by 5psi.

Stopping Oversteer

If the rear of the car slides first, what you do depends on whether you have a limited slip diff and how much power your car has. If you have an open diff (one wheel can spin) fit a stiffer **front** bar to stop oversteer. If you fit a stiffer rear bar the inside wheel will be picked up during cornering, meaning that you'll uselessly spin away any grunt when coming out of the corner. Again, stiffer springs and shocks can be used, as can zero-cost tyre pressure increases. If you have an LSD'd car, a stiffer rear bar can be used.

If it's power oversteer that you're experiencing - the car hangs out the tail when you boot it - bigger and stickier tyres are the best way of taming this.

Tyres



Contrary to popular opinion, it's possible to get a car **handling** very well on quite skinny tyres. That's because there's a huge difference between road holding and handling.

If you've a car that grips, grips, grips like shit to a blanket - and then when it lets go kills you - then I don't reckon you've a car that handles very well. On the other hand, if you've a car that you can make understeer, oversteer, or be neutral then you've got a car handling well.

Fitting big sticky tyres is the last step, not the first. When the car is handling (or you're driving it) in a way that inspires confidence and gives you excellent control, then's the time to up the grip levels. Generally, the car will then handle in exactly the same way, but at higher speeds and cornering loads. Lower profile tyres (the sidewall is shorter in height) will make a good difference to the speed of response of the car, and going wider so that the overall diameter of the tyre stays standard will give you more of that sideways grip.

What to do First

You'll find opinions as diverse as sexual techniques on the order that you do mods in. Here's my sequence:

1. Experiment with tyre pressures (costs nothing; can make a major difference)



2. Sway bars (cheapest suspension components; can make a radical change to handling balance)



3. Springs (lowered and stiffened a bit - but not necessarily the answer to everything that you might first think)
4. Shocks (stiff and good quality - and expect to pay a heap)
5. Wheels and Tyres (megabucks; generally won't change handling but will increase grip levels)



6. Bushes (unless the car is very old, factory bushes are generally fine).

Where to do it

I know, I know - here's the bit where you always read "It's always safest to experiment on the race track, etc, etc". And that's true. But race track handling is normally a different ball game to road handling, and how many times can you afford to hire a track?

The alternative is to find a nice corner, generally fairly tight so that you don't have to go too fast, with good run-off areas if the worse happens, and little or no traffic. You don't need to go ballistic - you're just trying to feel the behaviour of the car, not win a race. And make any suspension changes - even tyre pressures - one small step at a time.

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