

Advanced Circuit Driving Techniques

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Brain Power is the new
horsepower

This guide is made up of articles written by pro racing drivers and instructors who use video and data to illustrate various circuit driving techniques, with tips on how to get the most out of yourself as well as your car.

Some may surprise you...

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1. Compound Corners [page 3](#)

Compound Corners are common to almost every race circuit. Pro racing driver and instructor Nigel Greensall looks at examples from Silverstone, Misano, and Dubai circuits to give tips on how to negotiate them.

2. Slow Corners and Hairpins [page 9](#)

More time is spent in slow corners than in fast corners, so you can often gain the most lap-time by concentrating on these areas. Nigel Greensall uses video screen-shots, circuit maps and videos to discuss his approach.

3. How I found 4s a lap in 24 hours [page 16](#)

RACELOGIC MD Julian Thomas puts the **VIDEO VBOX** to the test and goes from novice to front runner in 24 hours.

4. How to cut a second on Eau Rouge, Spa [page 21](#)

Comparison video + data shows several techniques you can use to cut time on this famous section, and indeed any other fast corner.

5. Long Corners [page 34](#)

One racing driver reveals his secrets on how he tackles long corners, showing how he gained half a second on 'Sunset Bend' at Sebring over other drivers using the traditional racing line.

6. Vision and Cornering [page 42](#)

ARDS grade A Racing Instructor, Ben Elliot, discusses the importance of where a driver is looking on the track, and why aligning head and eye movement while driving is so important.

7. Pro vs. Pro: Finding lap time gains in the most unlikely places [page 46](#)

Nigel Greensall on why a corner sometimes isn't a corner – showing how he gained 0.3s over a Porsche Supercup Champion in just one chicane at Daytona.

8. Predictive Lap Timing [page 52](#)

Learn how predictive lap-timing is used in racing for instant driver feedback, as used in **VIDEO VBOX** with the 'LineSnap' Predictive Lap Timing.

9. Finding time in the wet [page 56](#)

Nigel Greensall and Julian Thomas explain how driving quickly on a wet track sometimes requires a very different technique compared with driving in the dry and how a predictive lap-timer can help you go faster in difficult conditions.

10. Landmark Decisions [page 63](#)

The importance of recognising and using reference points of a race circuit, which can help with relaxation and understanding of where time can be gained. Nigel Greensall explains with examples from his own coaching and racing.

11. Getting on the Gas [page 68](#)

In this article, Ben Clucas – Grade A ARDS Instructor, former Australian Formula 3 champion, and racing driver with over a decade of experience in a wide variety of cars – takes us through the importance of correctly timing your throttle application.

12. Spa Masterclass [page 73](#)

In this article we follow Nigel Greensall as he sets a record-breaking lap in qualifying at the Spa Six Hours. If you have followed our series of driver training articles you will recognise a combination of some of the techniques we have previously described, and with this edition you can also download the video and data for your own reference.

13. Making mistakes gives you speed [page 82](#)

Finding time when the only data you have to compare against is your own sounds counter-intuitive. Julian Thomas presents several instances where mistakes made in qualifying allowed him to discover several areas of improvement that he could put into practice when racing.

14. Mastering Corner Entry [page 88](#)

In a series of videos, Julian Thomas examines the various elements of approaching and entering a corner.

15. The science of rapid race car optimisation using tyre temperature [page 90](#)

Understand how to maximise the contact patch of a tyre by quickly removing the guess work surrounding vehicle set up.

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Article 15: The science of rapid race car optimisation using tyre temperature

Understand how to maximise the contact patch of a tyre by quickly removing the guess work surrounding vehicle set up.

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Article 15: The science of rapid race car optimisation using tyre temperature

Maximising the contact patch is the best way to get the most out of your tyre and ultimately improve lap-times. There are many variables which affect how your rubber is interacting with the track surface, such as camber, caster, toe-in, brake bias and tyre pressure. There are so many ways of changing the handing characteristics of a race car, so how can you go about this in a scientific way?

One answer is to use the wealth of information that the latest generation of tyre temperature sensors can give you. They read 16 independent values across the width of a tyre, allowing you to see exactly how hard your tyre is being worked, across its whole surface.



Optimising Camber

Under load, you want as much of the rubber contacting the track as possible. This normally means running negative camber so that when the car rolls during cornering, the tyre is as flat as possible in respect to the surface of the track. Therefore, during steady state cornering, the temperature across the tyre should be as uniform as possible.

Note that when you take a manual reading in the pits, you can only get an average overview of the temperature profile, so you can easily misinterpret the data, as tyres rapidly lose surface temperature in a straight line. Also, any negative camber will keep the inside of the tyre warmer than the outside, skewing the data.

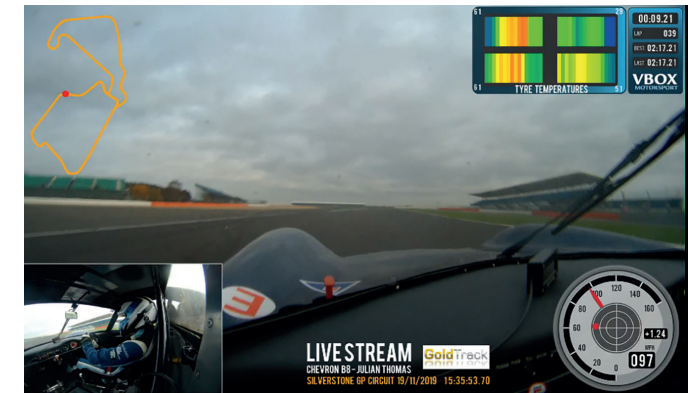
In this example, I was driving a Chevron B8, and it had significant understeer on the exits of most corners. Taking a manual reading across the tyres throughout the season didn't indicate any particular camber problems.

We then fitted some tyre temperature sensors, and quickly saw that the front tyres were getting hot on the inside of the tyre, but only during the exit phase of the corner. You can see this in the tyre temperature graphic in the top right hand corner. The front left tyre is showing a marked temperature difference across the tyre of 23°C



Front left tyre showing steep temperature gradient of 23°C

By reducing the front camber, the temperature gradient became a lot less pronounced, and the grip at the front of the car was significantly more consistent and the understeer was significantly reduced. This gave us a benefit of 1.2s a lap around the Silverstone GP circuit:



After camber-change, front left showing temp gradient of only 9°C

As you can see in the second screenshot, there is still a small temperature difference of 9°C, so this tells us that the camber can still be reduced very slightly to get the temperature even across the tyre.

Normally, you wouldn't be able to adjust the camber to such a fine degree and feel any difference in the handling or spot a definitive improvement in lap-time, as you would have to make a much bigger change. However, by using the instantaneous temperature gradient during cornering, you can fine tune the camber with confidence, knowing that you are getting as close as possible to the optimum value, which wouldn't normally be possible using traditional methods.

The benefit of this camber reduction wasn't only in helping the understeer, but it also gave better grip under braking as more of the tyre was in contact with the track, and less tyre wear on the inside of the tyre.

Optimising brake bias

To get the most out of your braking system, it is vital to fine tune the brake bias so you have an even distribution of load between the front and rear tyres. This is a tricky process to carry out and requires a degree of experience and understanding on the behalf of the driver. Even with the very best drivers, this is very much a trial and error process.

The more force you put through a tyre, the hotter it becomes. Therefore, you can see how hard the front tyres are working in relation to the rear by looking at their temperature during the braking phase.

Here is a good example where I was driving a Cobra Daytona at Spa, and braking down from 155 mph to 55mph at the end of the Kemmel Straight:



Too much rear bias leads to cold front tyres during turn in

You can see from this snapshot that the rear tyres have warmed up more than the front during the braking phase. This indicates that the bias is set slightly too much to the rear. By moving the brake bias forward, the braking performance could be improved.

Not only that, but by putting more energy into the front tyres, they would warmer before the crucial corner entry phase. In fact, with too much rear bias, the front tyres were cooling down on the long Kemmel straight and not coming up to temperature until the exit of the corner. Without this data, you wouldn't think that you can reduce corner entry understeer by moving the brake bias forward..!

On a different car, we have also seen too much rear bias overheating the rear tyres on the entry into a fast corner, which then leads to oversteer later on in the corner as the rear tyres have become too hot:



Too much rear bias overheats the rear tyres, causing late corner oversteer

Optimising tyre pressures

The best tyre pressure is one that enables an even contact patch for the rubber on the track surface. Too much pressure makes the tyre balloon and too little makes it collapse in the middle.

By using tyre temperatures, you can see this happening in real-time. If the centre of the tyre is colder than the rest, then the pressure is too low, and if the centre of the tyre is hotter, then the pressure is too high.

In the following example, the front right tyre is showing signs that it is over-inflated, you can see the hottest part of the tyre is in the middle:



Front right tyre hotter in the middle

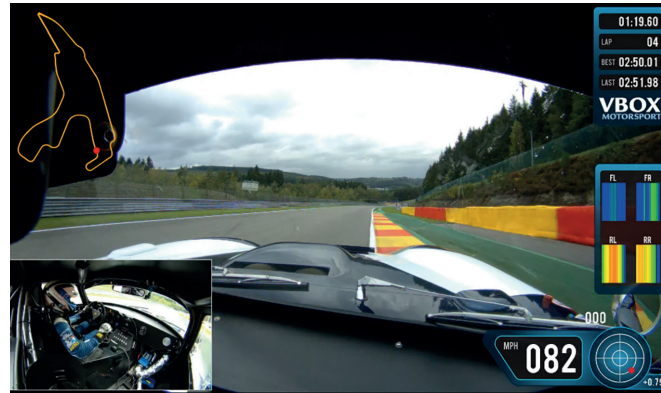
This allows you to finely tune the pressure of each tyre to maintain the best possible contact patch. This then works the tyre more evenly, and the long term tyre wear will be reduced.

Here is another example, where the front right tyre is under-inflated and there is an obvious cold patch in the middle:

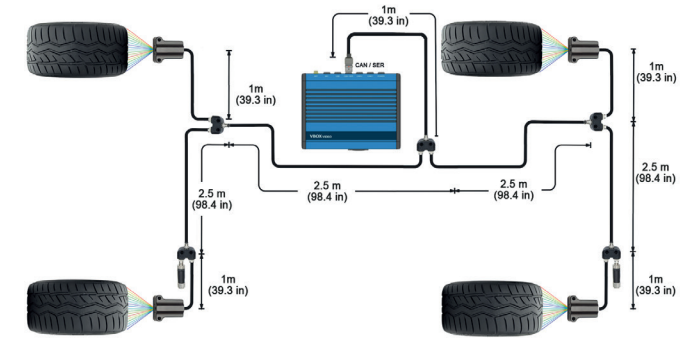


Front right tyre colder in the middle

Another example where the left rear is over-inflated:



Left rear tyre hotter in the middle



Conclusion

As you can see from some real world examples, real science can be applied to the process of optimising camber, brake bias and tyre pressures. Previously this would involve a lot more testing and is very dependent on the feedback from the driver, which can be difficult to determine in a short test session.

Live Streaming

If you want to speed the setup process up even further, then you can Live Stream this video back to the pits, so the engineers can see what is happening to each tyre, and be ready to make adjustments the moment the car comes back into the pits. In this way, the car's setup can be perfected with objective measurements in a very quick time frame.

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All the video and data in these articles were recorded using a **VBOX MOTORSPORT VIDEO DATA-LOGGER** as pictured above. The screenshots have been taken from **CIRCUIT TOOLS**, intuitive analysis software that comes included with every **VBOX MOTORSPORT** product.

VBOX VIDEO HD2 and the **VIDEO VBOX** range incorporate a GPS engine and synchronised video recorder with customisable graphic overlay, designed and manufactured in the UK by **RACELOGIC**.

Anyone can work through the examples in these chapters using **CIRCUIT TOOLS** and the files available that accompany them. Download the software from the **VBOX MOTORSPORT** website.

Lots more information about **RACELOGIC'S** motorsport products and where to buy them is available from vboxmotorsport.co.uk

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