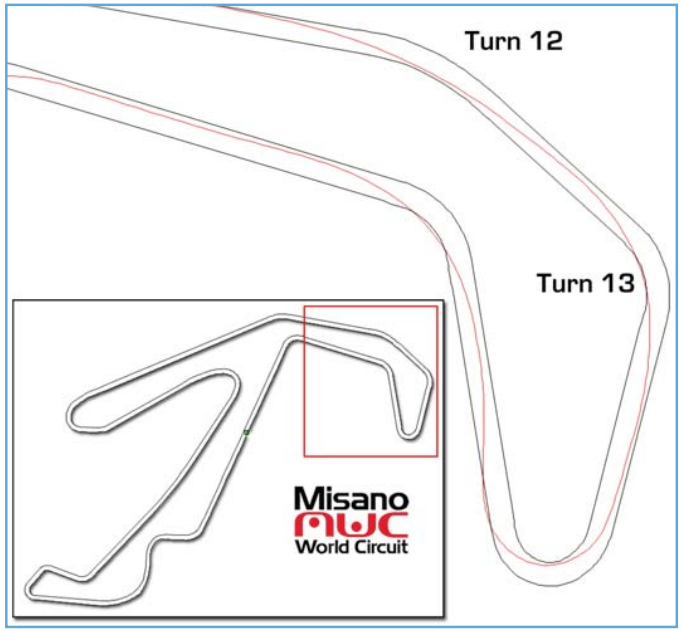
Advanced Circuit Driving Techniques Article 1: Compound Corners

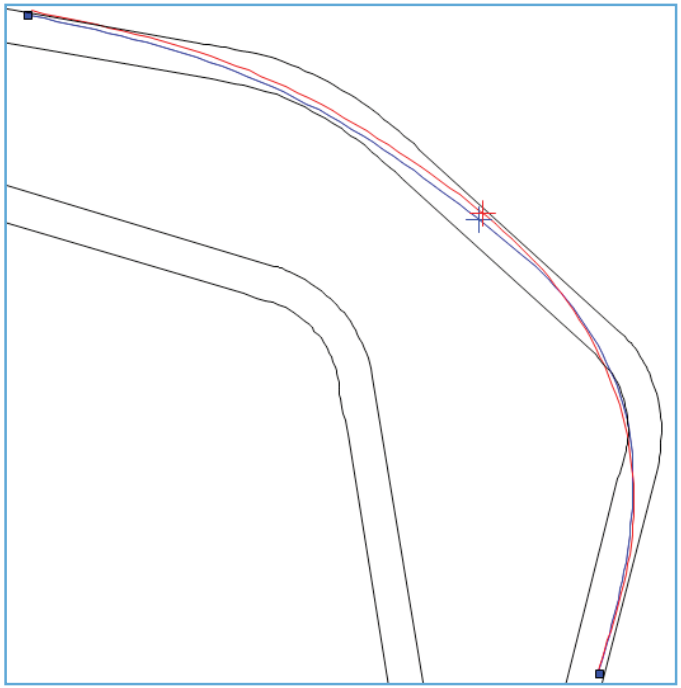
Definition – Compound corner: a series of corners, close enough such that the car is always turning and never travelling in a straight line.

The following data was taken from a Funcup race at Misano in 2009.

Nigel driving in the Funcup Misano 2009



Misano World Circuit



Two different lines

Nigel Greensall – "It is a common mistake to treat compound corners as two separate items, whereas they should be tackled as one section, with sacrifices being made in the first corner to gain maximum exit speed. It often seems counter-intuitive not to maximise the speed through the first corner, but the end result is often a faster lap.

There are many examples, but let's take Misano Circuit which is shown above, Turns 12 and 13 which consists of a shallow right hand corner followed by a sharper right hand corner.

On first inspection you may naturally assume that you have to clip apexes of both Turns 12 and 13 to get the best lap-time.

However, there are many other ways to take these corners and I have found that the quickest for me is to almost ignore Turn 12 by missing the apex completely, and set yourself up for a nice wide entry into Turn 13, which seems a little odd at first.

To see this line in action, have a look at the image above, which shows my preferred line in red, and my team mate's line in blue.

The red line misses the apex of Turn 12 by almost 2m, but maintains the same apex speed of 105mph as the blue line which clips the apex.

Different line, identical Apex speeds

Much wider entry into Turn 13

Analysing Apex speeds at Turn 13

Interestingly, through Turn 12 you are not quite on the limit of grip (a peak of 0.85G), so you can experiment with your lines through here without losing any speed.

This wider line is also slightly shorter, which also gives a small advantage.

The screenshot above shows the apex point of Turn 12, where both approaches have the same speed, 105mph.

It is after this point where the reason for this wider line becomes clearer.

If you treat Turn 12 as a conventional corner and clip the apex, you cannot get far enough across to use the whole width of the track into Turn 13.

By running wide in Turn 12, you can get much further over to the left for the entry into Turn 13 allowing more speed to be carried around the corner.

Using more screenshots from the in-car video, you can see just how much closer to the edge of the track (just before Turn 13) I could go, whilst carrying 7mph more speed.

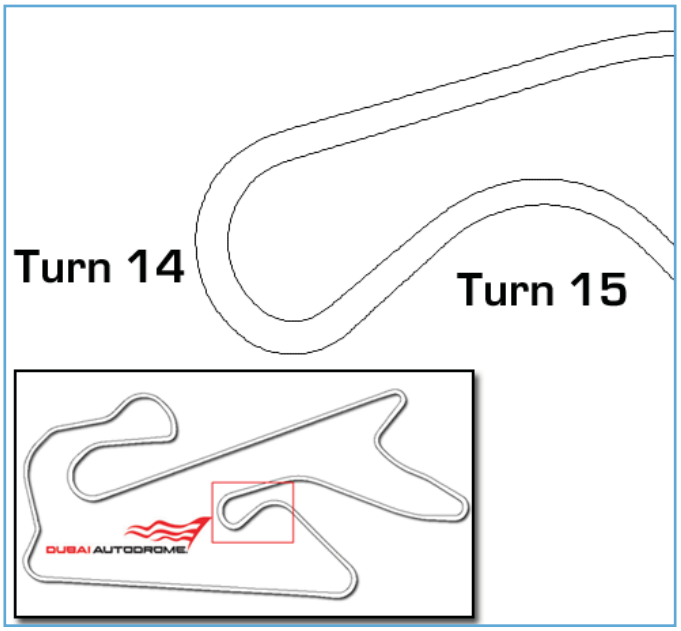
If we look at the Apex speeds of the second turn using **CIRCUIT TOOLS** software, the gain in speed is even greater.

In this screenshot you can see that the wider line allows me to carry 11mph more at the Apex, the upper graph is the speed, and the lower graph is the Delta-T or time difference between the two laps.

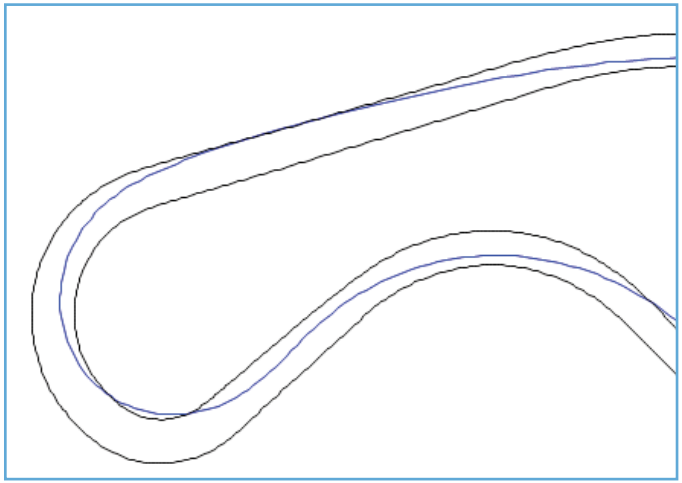
The analysis software showed a total gain of 0.67s in this section, which was very simple to achieve, just by taking a slightly wider line through Turn 12, which is very easy to do!"

We now zip 2700 miles across to the Dubai Autodrome in an Aston Martin GT4...

Nigel driving in the Dubai 24 Hour race in 2010



Dubai Autodrome



Conventional line

Nigel Greensall – "Here's a great example of compound corner, Turn 14 (Parabolica) and Turn 15 on the Dubai Autodrome GP layout.

This is another example of where you need to think of them as a whole rather than as two separate corners.

Turn 14, the Parabolica, is slightly banked, and being a desert circuit sand tends to drift across and collect on the outsides of the track.

There is only a very short straight before Turn 15 and this is the reason why you can take an unusual line through and compromise the Turn 14 slightly to gain an overall advantage.

If you attack Turn 14 as a conventional corner, you may start off wide and sweep in for a late apex to maximize your exit speed. This is in fact the line that the race school teaches you.

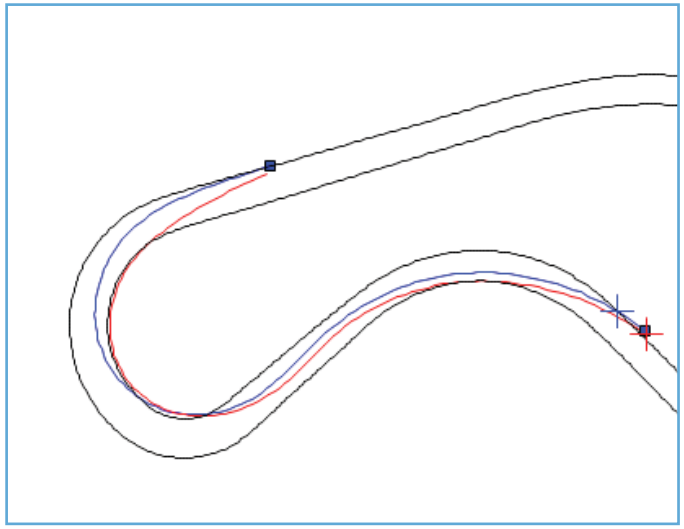
This would probably work fine if there wasn't another corner straight afterwards.

This second corner means that the exit speed of Turn 14 is not so important, because you can't carry this extra speed down a long straight.

If there wasn't a corner straight afterwards, then you may take the conventional line to gain the maximum corner exit speed which would be carried all the way down the straight.

Because there is no long straight after Turn 14, what becomes important is getting to Turn 15 as soon as you can, so in this case it is better to take the shortest route possible and take a very tight line around the Turn 14.

This has the added advantage at this track of missing out on the sandy outer edges of the track.



Two different lines

This seems as though you would lose a lot of speed going round Turn 14, and indeed the wider line has an apex speed of 89km/h (55mph) compared with 79km/h (49mph) for the tighter line. Yet this line is **0.45s** quicker, which is very counter-intuitive!

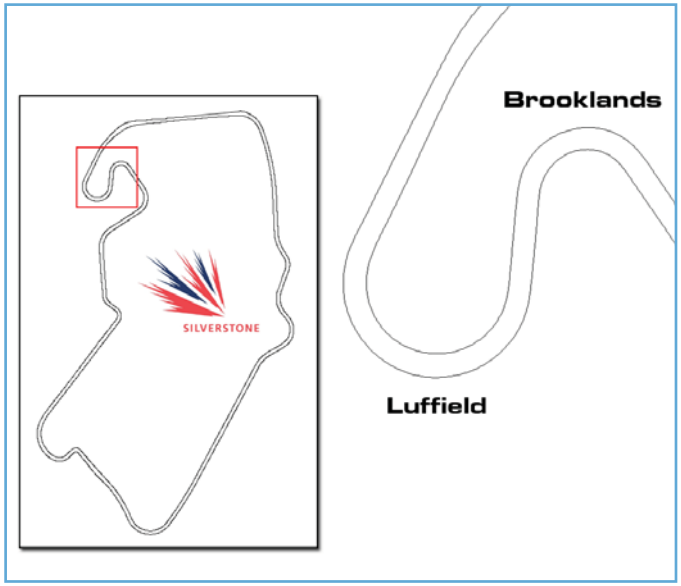
However, the reason this works is the really interesting part; the tighter line is **13.9m (45feet)** shorter than the blue line, so even though the blue line had a higher average speed, the significantly shorter distance has a pronounced effect and in this example gives a 0.45s advantage between the entry to Turn 14 and the exit of Turn 15 and the exit speeds are almost identical.

Incidentally, the blue trace was my team mate's fastest lap, who is an instructor at the circuit who was quite surprised when I showed him the data!

Time gained using the shorter path

Above is the data shown in the analysis software, the lower graph is the Delta-T or continuous time difference between the two laps (using position **not** distance as this wouldn't be accurate for such a situation) and the upper trace is the velocity. You can also see in the video that I am much further over towards the kerbing at this point, and also travelling 6 mph slower.

However, at the turn in point for Turn 15 I have travelled 13.9m (45 feet) less distance than the blue path, which has given me a big advantage."

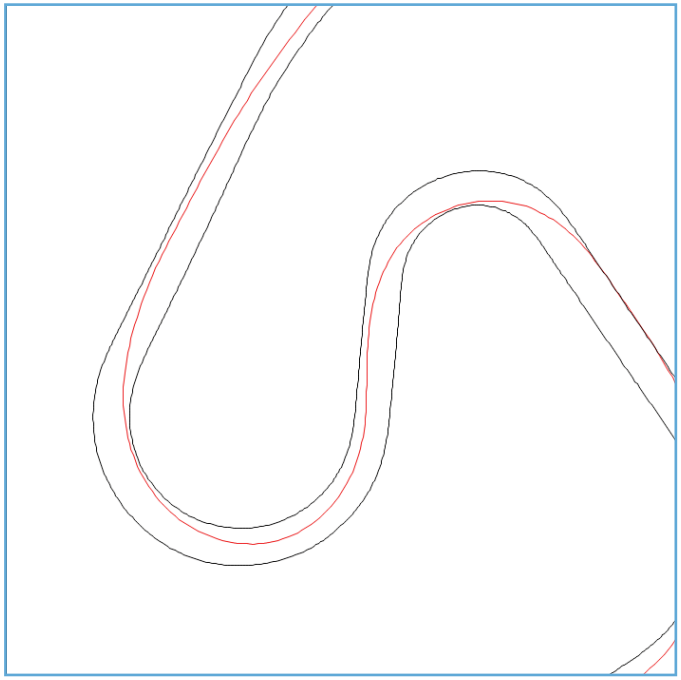


Back to home turf now, as we go to the fabulous Silverstone Grand Prix Circuit...

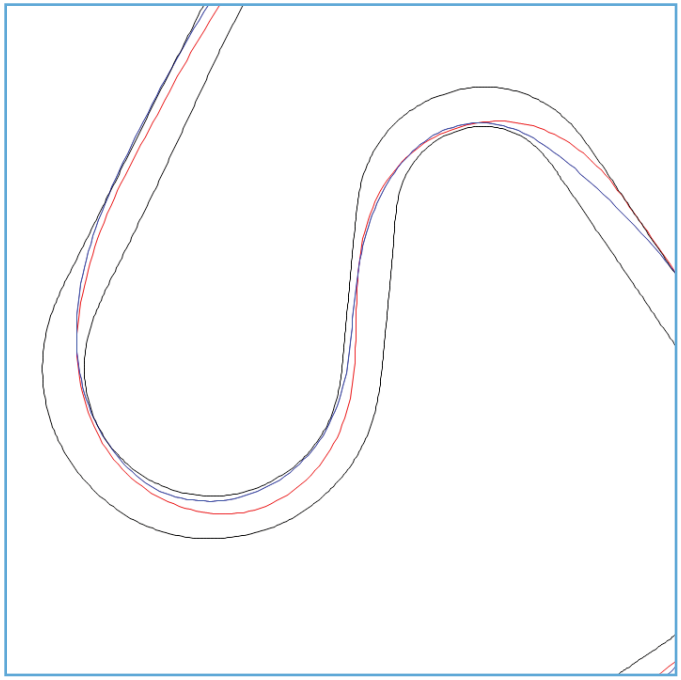
The Luffield complex at Silverstone is another great example of a compound corner where there are a number of different lines which can be taken. This time we will examine the line through this complex from Britain's top GT driver, and Goldtrack Trackday owner Calum Lockie.

Many people take a similar line (in red) through this complex, which consists of a wide entry into Brooklands, and a late apex through Luffield.

However, if we compare this with the line (in blue) Calum takes, we can see that he uses a completely different approach.



Conventional line through the Luffield complex



Calum's line in blue through Luffield

Calum's way of tackling these corners is to turn in much earlier to Brooklands, but at a shallower angle, and then he turns sharply on the apex. From here he dives across the track, taking the shortest line into Luffield. He then lets the car drift out slightly, and then turns sharply again on a grippier piece of tarmac.

Taking Calum's commentary from the Video:

Brooklands- "With this line into Brooklands you can brake ever so late, as long as you get the lock on early enough to get it turned in. It's a weird feeling to tighten the lock so much in a corner." Luffield - "There is patch of tarmac which has more grip than the rest, so you can turn the car towards the apex and get really early on the power."

By analyzing the data, we can work out one of the reasons why this approach is quicker than the more obvious line. From the braking point into Brooklands to the exit of Luffield, Calum's line is 11.72m (38 feet) shorter. Therefore the small amount of speed he loses on the apex of Brooklands is more than made up for in the reduction in distance. To put some numbers behind this, the average speed through this complex is around 87km/h, and an extra 11.72m takes an additional 0.5s to traverse.