Braking - A Weighty Issue

by Dr John >>

So what is it about the word 'brake' you don't understand? A phrase often used by instructors when trying to control 'boy racers' on track days? However, when instructing more experienced drivers, the phrase often changes to 'don't lift - keep the power on'. Why this apparent conflict? It comes down to understanding how to control where the weight of the car is heading when negotiating a corner.

Metaphors can work wonders when trying to understand complex issues, so here we go! Hold tight to your supermarket trolley.

We are heading down the aisle at high speed, fully laden. The end of the aisle approaches and we need to do a 90° turn to the right. If we do nothing, the weight of the trolley and contents will carry on in a straight line past the end of the aisle to disaster (Fig 1). Alternatively, we can stop pushing, hold back on the handle (brake) and ready ourselves for the turn. At the appropriate moment we turn the handle of the trolley, but much to our amazement we continue on in a straight line with the wheels crabbing (the equivalent of tyre squeal) and the trolley going sideways (Fig 2). Another disaster. But why? We did turn the 'steering wheel'.

It all comes down to vectors. The vector along the line of the aisle due to the weight and speed of the trolley caused it to carry on in a straight line, and the small force on the wheels caused by turning the handle did little to redirect the vector around the end of the aisle (Fig 2).

Let's try again. We are now approaching the end of the aisle; we hold back on the handle (brake) and, as we turn the handle, we start pushing along the line of the trolley in a direction towards the apex of the aisle. Wonder of wonders, we start turning but we chicken out, stop pushing and whoops we start moving sideways again away from the apex of the aisle as the weight of the trolley takes control (Fig 3). Finally, we crack it and realise that we need to slow, and as we turn, push towards the apex and keep pushing past the apex (Fig 4). *(For the purists amongst us, the figures show some licence in how the component vectors are shown to make the point.)*

With experience, we realise that the critical equation we must master is the degree of braking; when to release the brake, when to turn, how much to push and how to apply the push. Sounds fairly straightforward? Well it might be if we ignored the added complications of front engine, rear engine, front wheel drive, rear wheel drive, four wheel drive - not to mention tyre choice and road/track surface conditions due to weather etc.

We climb into our rear wheel drive GT40 on grippy tyres on a dry smooth track, and off we go. We approach the infamous right hand Quarry Corner on Castle Combe, brake late and move our foot off the brake and towards the accelerator - disaster - we are in the wall. Why? We are behaving like a 'hatchback boy racer' because we forgot to take into account that, at speed, it is going to take around 20 to 30 feet of track to move our foot between the brake and accelerator pedals. (I know you don't believe me, but try it!) We have to learn to brake early, release earlier than we are used to, and be on the accelerator at the turning point. (We will come on to trail braking in a moment!). This way we can redirect the weight that wants to go straight on towards the apex by applying power at or just before the turn point. But how much power? The tendency is to apply too much power too early and push the car wide

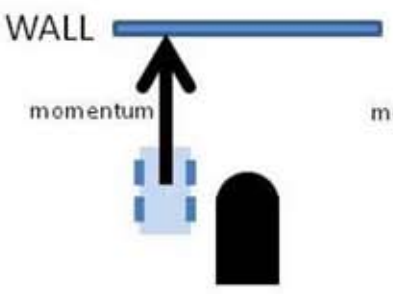

Fig 1 (no turn - no power)

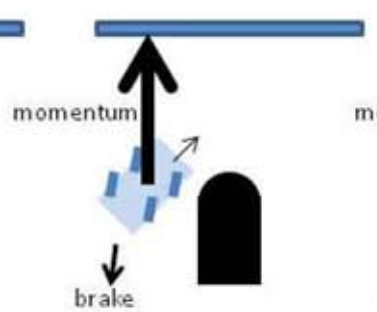

Fig 2 (turn - no power)

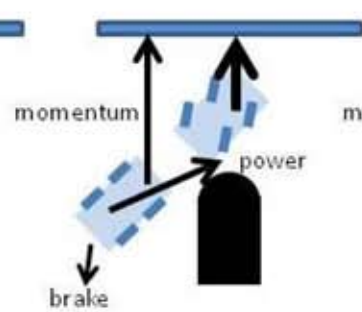

Fig 3 (turn – power - lift)

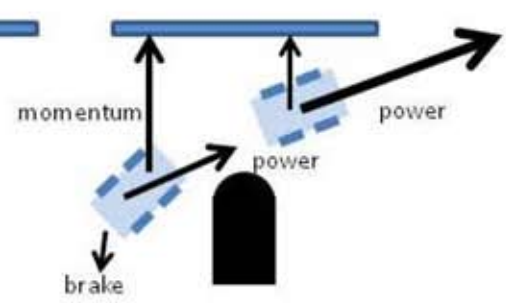

Fig 4 (turn – power – more power)

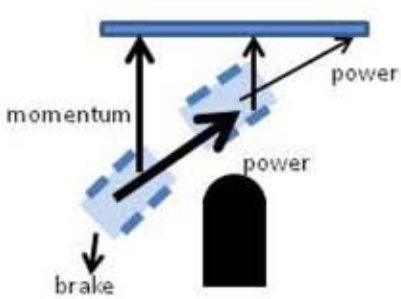

Fig 5 (turn – too much power - lift)

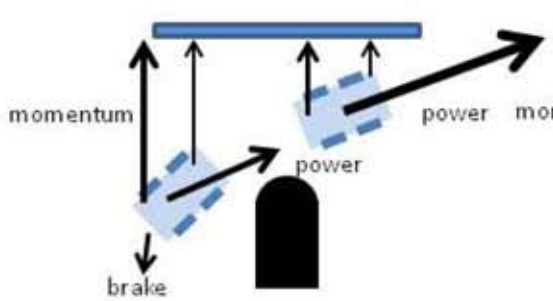

Fig 6 (turn – power – more power)

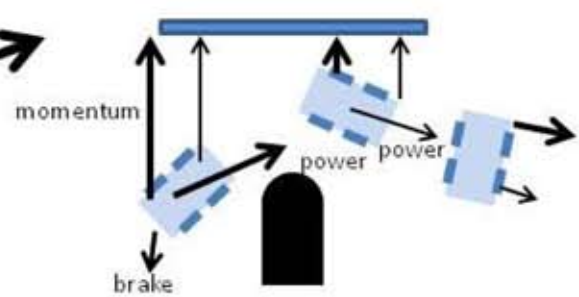

Fig 7 (oversteer – power – spin - lift)