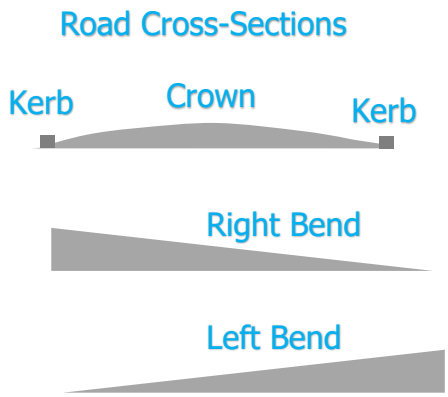
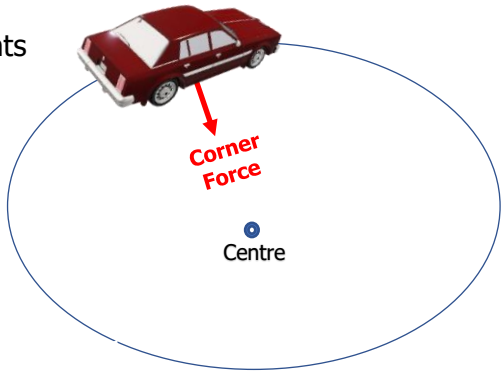
What is 'Superelevation'?



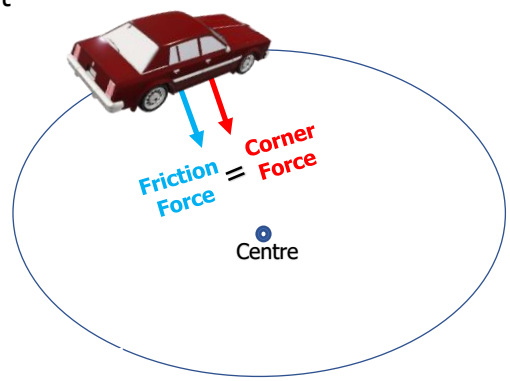
Most roads are 'Crown Cambered' that is, they are higher in the centre than at the edges to allow water to drain towards the kerbs.

However, Motorway bends are 'Superelevated', which means they slope gently from one side of the Motorway to the other across both carriageways. In a right bend, the slope is relatively high on the left sloping down to the to right and in a left bend it is relatively high on the right sloping down to the left; as viewed in the direction of travel.

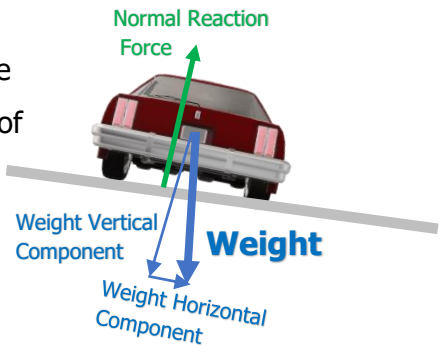
What advantage does this give?



In a bend, a car is acted on by the Corner Force, which points towards the centre of the bend. Corner Force destabilises the car and, wherever possible, needs to be kept to a minimum. We do this by applying SYSTEM on approach to a bend. I.E. we maximise the bend radius by keeping as far left as possible in a right bend and as far right as possible on our own side of the road, in a left bend: in each case, only if it is safe to do so. We approach the bend at an appropriate speed as determined by the Limit Point and the Safe Stopping Rule.

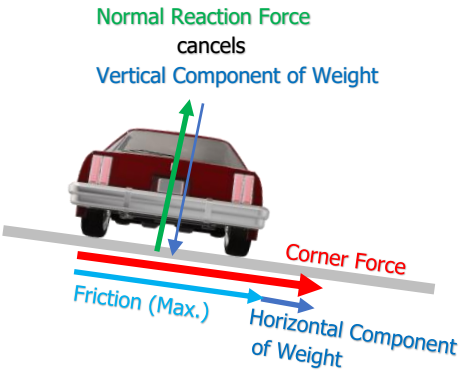


Corner Force is a demand that must be met and the force that primarily meets this demand is the Friction Force (I.E. also referred to as 'Grip') between the tyres and the road surface. If there is enough Friction to meet the Corner Force demand, the car remains stable in the bend; but if the Corner Force demand exceeds the maximum amount of Friction available, the car will Understeer in the bend and run wide: which has serious safety implications!

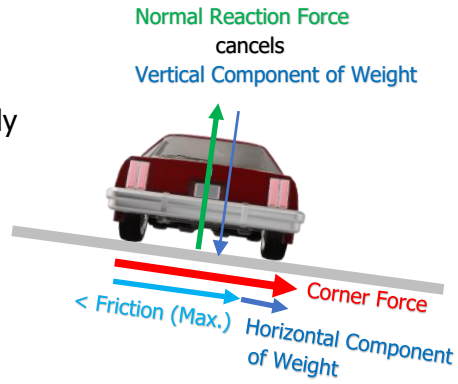


Banking a bend in the way described above, results in some of the car's Weight acting down the slope, in the direction of the centre of the bend. Consequently, this component of the car's weight adds to the Friction Force and helps it to meet the Corner Force demand.

Note: The Normal Reaction Force and the Vertical Weight Component are Newton's 3rd Law equal and opposite Forces, which cancel each other out.



In the case of a racing car on a banked circuit, the additional Horizontal Weight Component acting down the slope effectively ***increases*** the amount of Corner Force demand the car can cope with, before Understeer starts: which means that the racing car can go through the bend faster, than it would be able to on a flat track with the same bend radius. I.E. greater speed results in greater Corner Force.



In the case of an ordinary motorists, the additional Horizontal Weight Component acting down the slope effectively ***reduces*** the amount of Friction Force needed to meet the Corner Force demand: which leaves more Friction in reserve to deal with any unexpected increase in Corner Force.

Having Friction in reserve is like having money in the Bank: you can never have too much of it. Even a small increase in speed will disproportionately increase the Corner Force, which increases with the square of the Speed element of the car's Velocity. I.E. If speed in the bend doubles, the Corner Force goes up 'four times'!

Therefore, Motorway bends are Superelevated so that there is less demand for Friction, leaving more Friction in reserve, as some of the Corner Force demand is met by the component of the car's Weight trying to pull it down the slope, towards the centre of the bend.

Superelevation does not increase the available grip, but it does reduce the demand for grip, which amounts to the same thing: I.E. the car has more grip in reserve than it would otherwise have if the road surface were flat!

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