

P2 Topic 9 – As Fast As You Can.

Table of Results:

Speed	Thinking Distance/m	Braking Distance/m	Stopping Distance/m
20mph	6	6	12
30mph	9	14	23
40mph	12	24	36
50mph	15	38	53
60mph	18	55	73
70mph	21	75	96

After closely analysing the graph, I can now see that Jake is indeed correct because it can be seen that the speed at which you are travelling does affect how quickly you are able to brake. However, this can also be attributed to various other factors. The equation for stopping distance is:

$$\text{Stopping Distance} = \text{Braking Distance} + \text{Thinking Distance}$$

It is clear that the results follow a positive correlation and that the stopping distance equals the braking distance plus the thinking distance. Therefore, because the overall stopping distance must be a larger integer then the result for this must possess a steeper gradient. The stopping distance is therefore dependant upon the speed at which you are travelling because as the speed increases, the gradient of the stopping distance increases. This is evident because when the speed is at 30mph, the stopping distance is 23m but when the speed has increased to 60mph then the stopping distance inclines to 73m.

Thinking Distance

Thinking distance is calculated by the general equation:

$$\text{Thinking Distance} = \text{Speed} \times \text{Reaction Time}$$

Thinking distance is the distance covered in the time it takes for a reaction to occur. In what can be a fraction of a second, a substantial amount of ground can be covered.

Human reaction time is usually between 0.2 and 1 second. However, there can be various conditions and factors that can dramatically affect this. Smoking whilst driving or in general causes a stimulus affect which can speed up reaction times or create a neurotic result. Alcohol usage will affect reaction times because it is a depressant therefore reaction times will be increased, as the driver will feel drowsy and therefore take a longer time to respond to any given situation. Drugs may affect reaction time by either a depressant or a stimulant effect depending on which drugs are consumed. Finally, talking to a passenger or permitting yourself to hold a conversation on a mobile phone will have a potentially serious effect on your thinking distance. Because the mind is trying to focus on two things simultaneously, consequently, reaction times will be slower .

Another factor that will certainly affect the thinking distance is the speed at which you are travelling at. This is evident within the provided graph and it can be seen that the greater the speed at which you are travelling, the greater the stopping distance. Therefore, due to the stopping distance being dependant upon the thinking distance – thinking distance is related to speed.

Braking Distance

Braking distance is the distance the car will travel after the brake is pressed. Braking distance will increase should the car be travelling at a high speed. This can also be seen in the graph – as the speed increases upon the horizontal axis, the braking distance increases and possesses a steeper gradient. If the car is travelling faster, the brakes have to transfer the car's kinetic energy (to heat). The formula for Kinetic energy has the speed squared. Therefore, if the car travels at three times the speed, it has nine times the energy and so the braking distance is nine times as long.

Should the car be heavier, the breaking distance will increase also, and if a car is extremely aero-dynamic then it will take longer to stop as there will be less air resistance causing it to stop. In addition, if the road surface is smooth or wet. On a wet road the braking distance is about twice as long. Also, the car may skid. Special high-friction surfaces are often used before traffic lights in order to prevent this.

Lastly, if the car is poorly maintained – with worn brakes or worn tyres then this will almost definitely increase the braking distance. The grooves in the tyres must be at least 1.6mm deep and the grooves are carefully designed to clear away water on a wet road.

Implications

The higher the speed at which you are travelling, the higher both the braking and stopping distances will be. Therefore, the overall time it takes to stop is directly affected by speed, this is because overall stopping distance is the product of both thinking distance and braking distance.

The implications of an increased stopping time can have serious consequences. An increased overall stopping time may mean that a driver may not be able stop in time in order to prevent themselves from hitting a child. In most built up areas, the speed limit is generally 30mph with a flexibility of around 1-3mph each way. Should any driver increase their speed to just 10mph over the limit then their overall stopping distance will increase by 13 metres. It is therefore essential that any given driver does everything within their power to keep their stopping distance as low as possible at all times in order to potentially save lives and reduce the risk of fatalities. Drivers should therefore concentrate on their driving whilst in motion in their vehicle so as not to increase their overall stopping time as well as ensuring that their motor vehicle parts such as brakes and tyres are of an exceptional standard.

Reliability and Validity

The data source is reliable as it is produced by the highway code. However, the data was accumulated in 1965 (by the Highway Code), and has not been updated ever since. Even though reaction time will not change any time soon, braking distance could certainly be altered due to various factors such as road enhancement, motor vehicle advances (brakes and tyres).