Stopping Distance
Stopping Distance

What is stopping distance?

Analysing stopping distance

What affects thinking distance?

Measuring reaction times

Summary activities

Text here
Why are speed limits important?
What is stopping distance?

Stopping distance is the overall distance that a vehicle takes to stop. It is made up of two parts: thinking distance and braking distance.

\[
\text{stopping distance} = \text{thinking distance} + \text{braking distance}
\]

Thinking distance is how far the vehicle travels whilst the driver is making the decision to stop. The braking distance is how far the vehicle travels after the driver has applied the brakes.

The faster a vehicle is going, the longer it will take to stop.
Factors affecting stopping distances

Do these factors affect thinking or braking distance?

- thinking distance
- braking distance

use of mobile phone

solve
Stopping Distance

- What is stopping distance?
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- What affects thinking distance?
- Measuring reaction times
- Summary activities

Text here
Stopping distances and speed

How does stopping distance vary with speed?
Graphing stopping distances
Stopping Distance

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Analysing stopping distance

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Measuring reaction times

Summary activities
Reaction times

The time it takes for someone to recognise and respond to a stimulus is their reaction time.

Reaction times vary from person to person. Typical values range from 0.2 seconds to 0.9 seconds.

Remember that thinking distance is the distance a vehicle travels in the time it takes for a driver to react to a situation and apply the brakes.

\[ \text{thinking distance} = \text{speed} \times \text{reaction time} \]
What affects thinking distance?

- alcohol
- other drugs and some medicines
- distractions, such as mobile phones
- tiredness
- speed

Do all of these factors affect reaction time? Do these factors increase or decrease thinking distance?
Alcohol affects thinking distance by increasing the time it takes for a driver to react.

Jamie makes an emergency stop with a thinking distance of 5 m. He later consumes three units of alcohol, increasing his thinking distance by 20%. What is his new thinking distance?

new thinking distance = 5 × 1.2 = 6 m

Increasing a driver’s thinking distance can have serious consequences. For this reason, it is illegal in England and Wales to drive with a blood alcohol concentration of higher than 80 mg/100 ml.
How can reaction times be measured?

A simple experiment to test reaction times involves two people and a ruler.

One person holds the ruler so that the zero mark is just above their partner’s fingers and drops it.

The other person tries to catch the falling ruler. By recording the distance that the ruler has fallen, it is possible to work out the person’s reaction time.

Can you design another experiment to measure reaction time?
Experimental data

Nina and Matt run the ruler experiment multiple times.

Nina’s results are:

<table>
<thead>
<tr>
<th>trial</th>
<th>distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.29</td>
</tr>
<tr>
<td>2</td>
<td>0.27</td>
</tr>
<tr>
<td>3</td>
<td>0.26</td>
</tr>
</tbody>
</table>

average = 0.27 m

Matt’s results are:

<table>
<thead>
<tr>
<th>trial</th>
<th>distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>0.29</td>
</tr>
</tbody>
</table>

average = 0.32 m

What is the relationship between distance and reaction time? Who has the shorter reaction time?
Nina wants to know what her reaction times are. She uses the formula:

\[
\text{time} = \sqrt{\frac{2 \times \text{distance}}{\text{acceleration due to gravity}}}
\]

and assumes that the acceleration due to gravity is 9.8 m/s.

<table>
<thead>
<tr>
<th>trial</th>
<th>distance (m)</th>
<th>time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.29</td>
<td>0.24</td>
</tr>
<tr>
<td>2</td>
<td>0.27</td>
<td>0.23</td>
</tr>
<tr>
<td>3</td>
<td>0.26</td>
<td>0.23</td>
</tr>
</tbody>
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What is Nina’s **average** reaction time?
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Multiple-choice quiz