



Tart Ma Cart

- J.A Hargreaves with
- thanks to Gregor Steele, SSERC



What would be your priorities for in a new car?

- Fast , Expensive , Space for friends and family, Green or long lasting, tall, off roader, Cute
- Anything else.....



The safest cars to buy

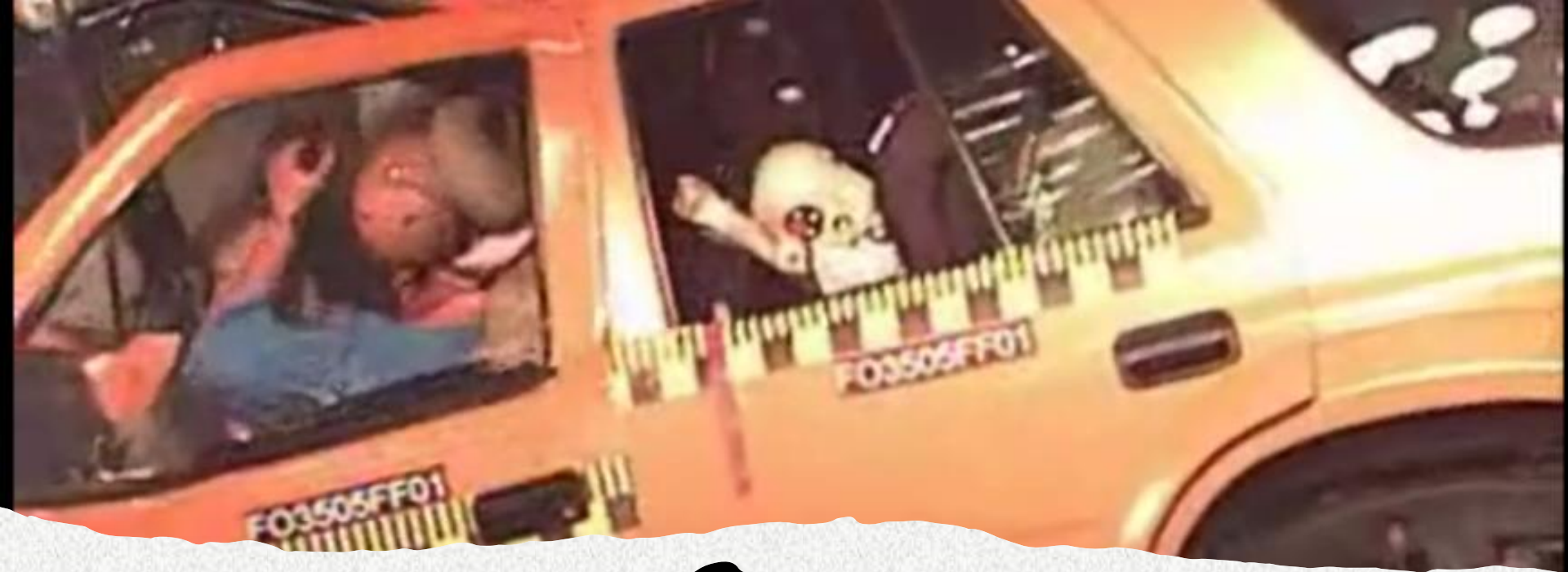
carbuye



Would you consider **safety** as the priority?

WATCH THE COLLISIONS VIDEO on CLICKVIEW

<https://online.clickview.co.uk/libraries/categories/12505323/videos/12531823/collisions>



How are cars safer?

- What makes a car 'safe'?
- Why are some cars better in crashes than others?
- What happens during a crash?
- Is this car safe?
- List all the ways that you can think of that would make a car safe.





Making a car safe

- Depends on
- driver education and attitude
- road design
- car maintenance
- car construction
- https://www.youtube.com/watch?v=FAh_ex6niTY

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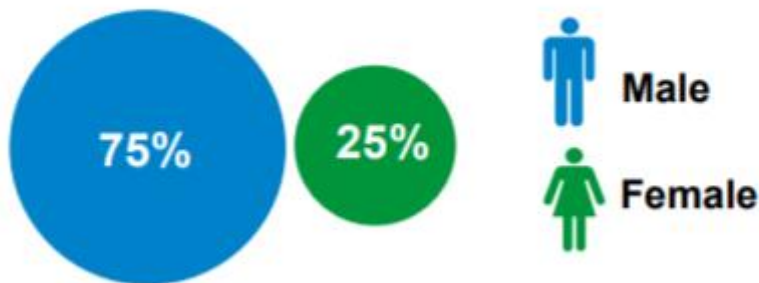
Driver education

2015,

7% of **UK full driving licence holders** are aged 17-24.

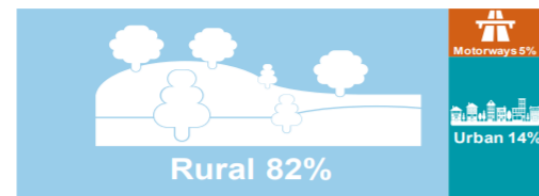
22 % of **fatal or serious collisions** occur if a driver is aged between 17-24.

Young car driver fatalities by gender



Young car driver casualties (aged 17-24) by severity and road type, GB: 2013

Killed (131)



- The majority of **young car driver fatalities** occur on rural roads. In 2013 of the 131 young car driver fatalities, 82 per cent occurred on rural roads, 14 per cent on urban roads and 5 per cent on motorways.

Serious injuries (1,159)



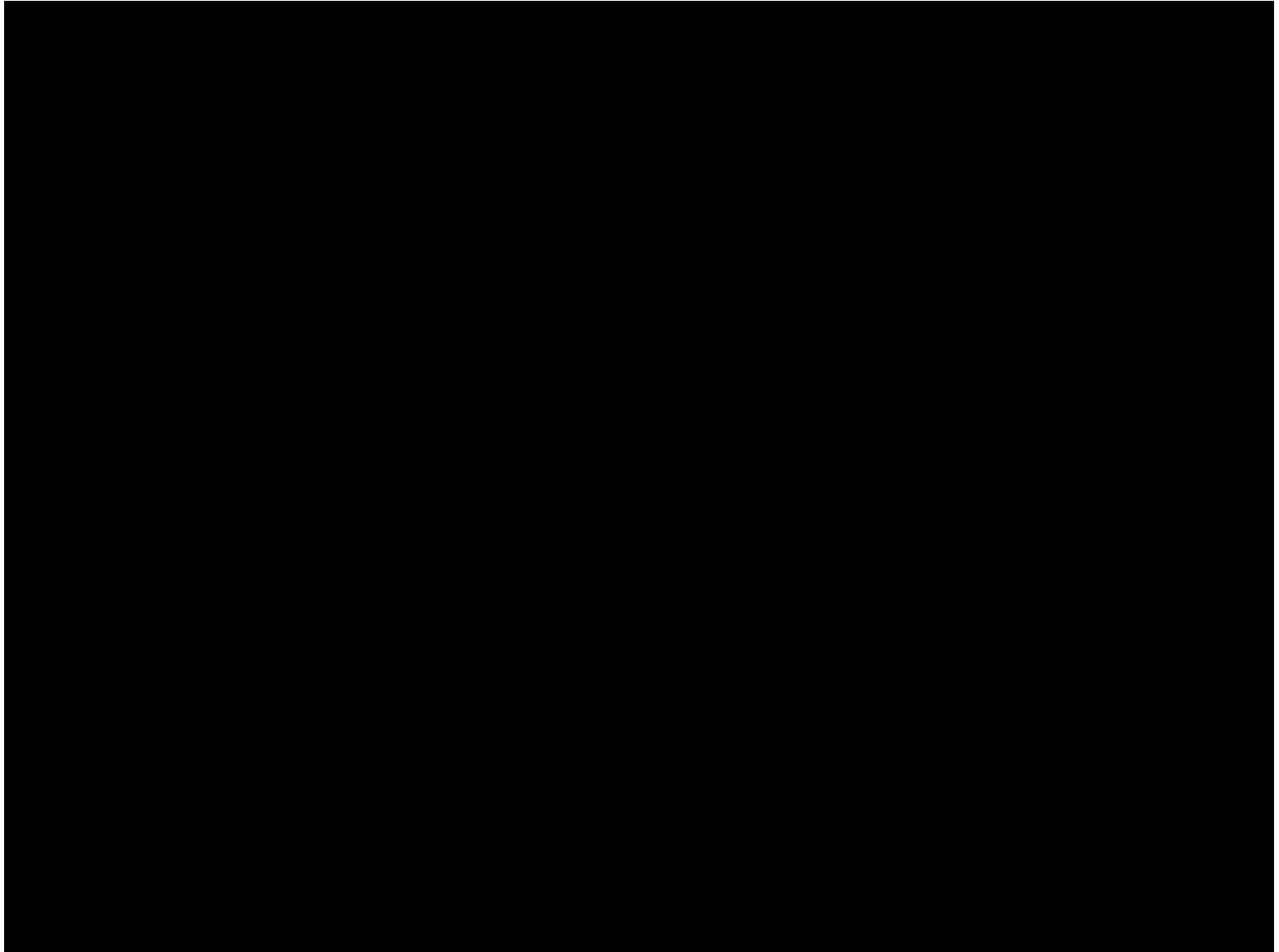
- Young car drivers are also more likely to be **seriously injured** on rural roads. In 2013 67 per cent of young car drivers were seriously injured on rural roads, 28 per cent on urban roads and 5 per cent on motorways.

Slight injuries (14,395)



- Lower severity accidents** are more likely to occur on urban roads. In 2013, 48 per cent of young car driver slight injuries occurred on urban roads, 46 per cent on rural roads and 6 per cent on motorways.

No need for speed



https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/448039/young-car-drivers-2013-data.pdf

Task

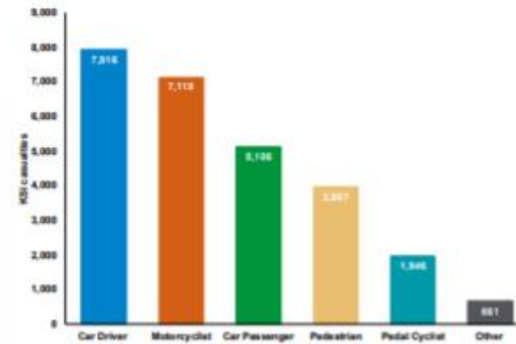
Using the document on Young Drivers Statistics make a

- leaflet
- video
- presentation

that would encourage young drivers to be safer.

You must include statistics and advice from the document

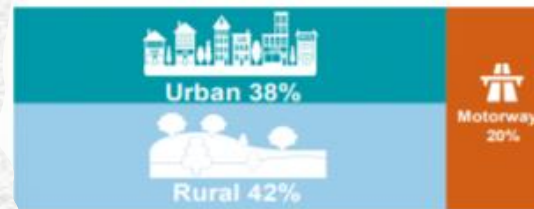
Killed or seriously injured 17 to 24 year olds by road user type, GB: 2009 to 2013



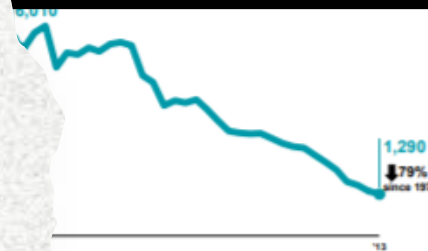
- In the last five years, young car drivers accounted for 30 per cent of 17 to 24 year old KSIs and motorcyclists accounted for 27 per cent. Car passengers accounted roughly a fifth of KSIs with pedestrians and pedal cyclists accounting for just over a fifth of KSIs.

Type of road

Reported car traffic (for drivers of all ages) by road type, GB: 2013



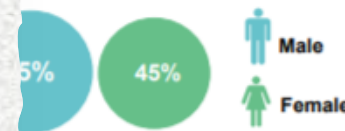
- In 2013, rural roads carried the majority of car traffic (42 per cent) followed by urban roads (38 per cent) and motorways (20 per cent).



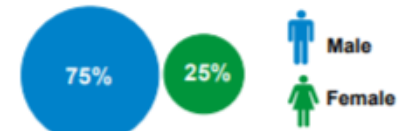
The value of prevention of young car driver accidents is estimated to have been £2.9 billion which compares with £14.7 billion for all accidents.

Gender comparisons

Young car driver distance travelled by gender



Young car driver fatalities by gender



How far do they drive?

On average young car drivers drive fewer miles than drivers aged 25 and over but drive more at night time

Young drink drivers

Young car drivers account for a quarter of drivers killed in reported accidents who are over the legal alcohol limit.



Road Design

<https://www.youtube.com/watch?v=6OGvj7GZSlo>

- New roads are subject to strict design standards covering gradients, radius of curvature of bends etc.
- Although sometimes it can be a bit confusing!

http://www.bbc.co.uk/wiltshire/content/articles/2005/11/22/pwao_d_roundabout_feature.shtml

Roads are Dangerous

. M74

- The number of serious or fatal accidents on the M74/A74, the road between Gretna and Glasgow, between 2017 and summer of 2019 was 35, making it the 7th most dangerous road in Scotland





Roadside Furniture

- Roadside furniture is being replaced with crushable structures to minimise vehicle intrusion in a crash.
- https://www.youtube.com/watch?v=rZ0PN_YPZeU



Vehicle Maintenance Checks

- Cars need regular care to make sure they perform at their best, particularly if you're not driving them as often. Disuse can create problems for your vehicle, but with just a few checks and actions you can minimise the risk of these issues happening.
-
- **Tyre pressure**
 - **Tyre tread depth**
 - **Brakes**
 - **Battery**
 - **Oil, coolant and antifreeze**
 - **DPF (diesel particulate filter)**
 - **Fuel**
 - **Air conditioning**
 - **Lights**
 - **Electric Vehicles**
 - **Security**
 - **Exterior and interior**

Car Safety

If your car has sat idle for an extended period, you should consider performing these simple checks before driving off:

Check the tyres and tyre pressure.

Make sure that all the lights are working.

Check your oil, coolant, and fuel levels are sufficient.

Ensure all the windows are clean.

Look out for any cats, hedgehogs, or other animals that may be sheltering under your car or around the wheels.

Drive carefully and test the brakes to remove any corrosion that may have developed.

Car Maintenance

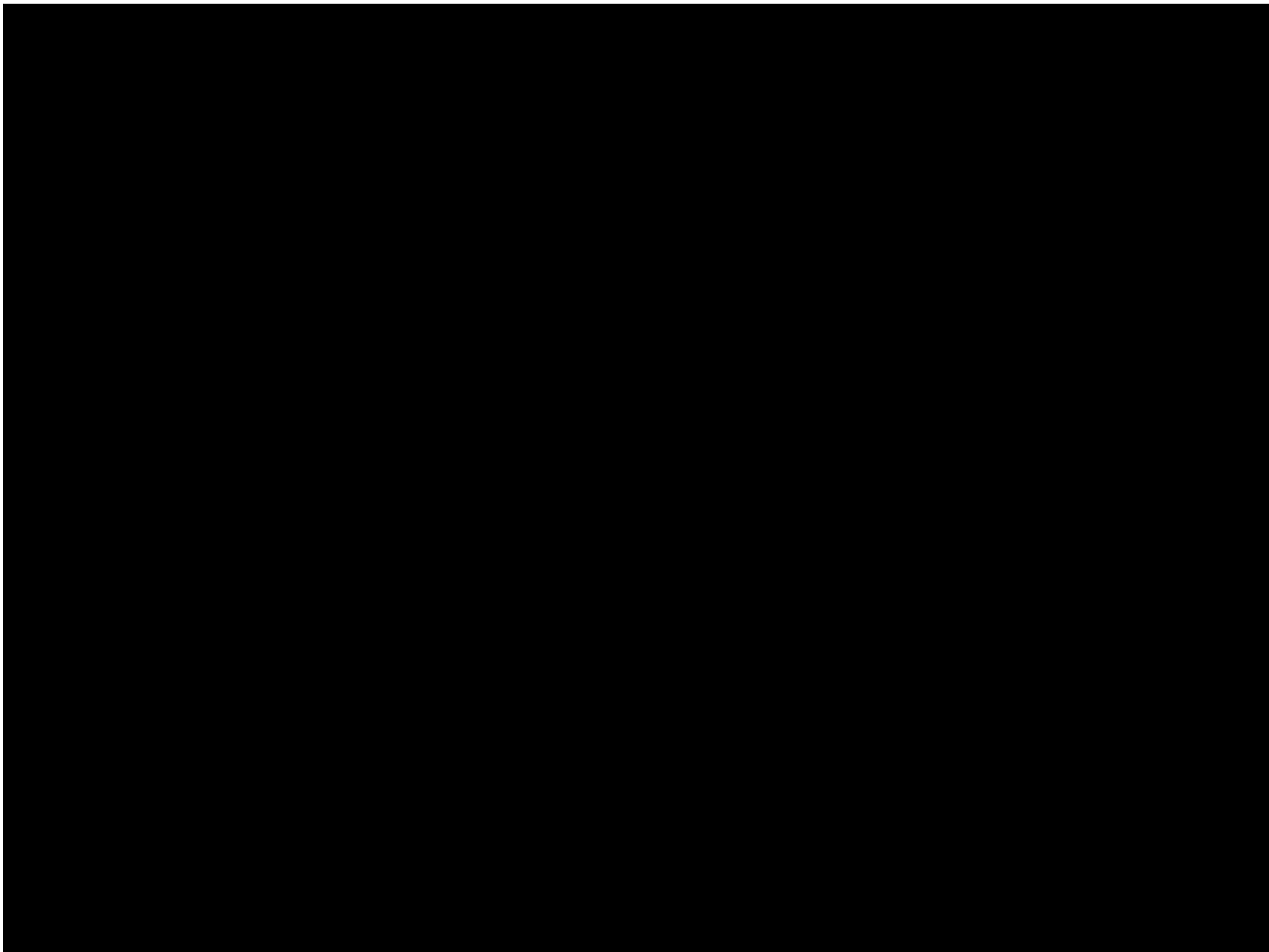
- Accident prevention is the best way of protecting people in cars.
- Proper maintenance of safety systems - brakes, lights, steering, suspension and tyres - is essential to preventing accidents.
- Very few accidents are attributed to mechanical failure.

- <https://youtu.be/ueafSvK9T-M?t=168>



Tyres

- A regular check of your car tyres can help you to avoid 3 penalty points and £2,500 (per tyre) in fines for having tyres worn beyond the legal minimum limit on your vehicle.
- The legal limit for minimum depth of the tread on your tyres is 1.6 millimetres, across the central $\frac{3}{4}$ of the tread around the complete circumference of the tyre.
- For safety reasons, it is recommended that you replace your car tyres before the legal limit is reached.
- Many vehicle manufacturers recommend replacing at 3 millimetres, as below this depth stopping distances start to dramatically increase.
- At 1.6 millimetres in wet weather it takes an extra two car lengths (8 metres) to stop at 50 mph, compared to if your tread was 3 millimetres.



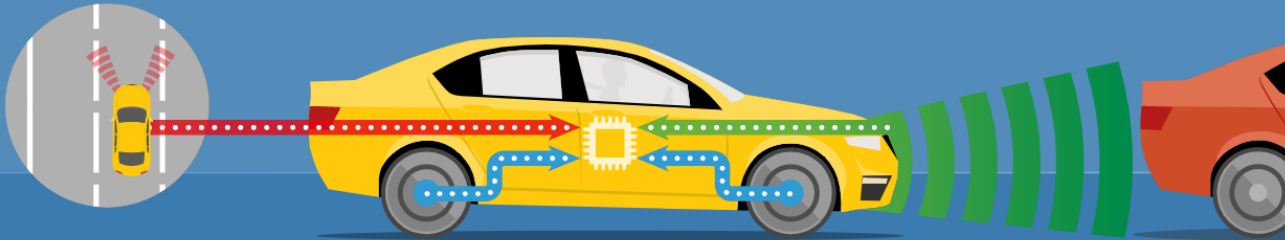
Car Construction –

Active Safety

ACTIVE SAFETY SYSTEMS: WHAT ARE THEY AND HOW DO THEY WORK?

ACTIVE SAFETY SYSTEMS

- Constantly monitor the performance and surroundings of a vehicle
- Can prevent accidents from happening altogether ...or actively help the driver to reduce the impact
- Avoid or mitigate an accident **pre-impact**, so before it happens



EXAMPLES OF ACTIVE SYSTEMS THAT GIVE THE DRIVER MORE CONTROL IN DANGEROUS SITUATIONS:



Anti-lock
braking (ABS)



Electronic stability
control (ESC)



Autonomous emergency
braking (AEB)



Lane departure
warning (LDW)

cannot replace a safe and attentive driver, these features can be relied on to engage when they are most needed.

- anti-lock braking systems,
- brake assist
- brake override

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Car Construction – Passive Safety

- **Passive safety features**
 - Passive safety features are those that help to protect vehicle occupants from further injury once a crash has already occurred.
- **Crumple zones** help to absorb and distribute crash forces before they reach the passenger and driver's seats. Similarly, **seatbelt**, **airbags**, and **headrests** help keep the driver and passenger(s) stationary within the cabin of the vehicle.
- Safety features like these reduce the risk of serious injury and allow drivers and passengers to ride out a crash.



Car Construction

Passive safety systems include

- seat belts,
- air bags,
- safety cages and padding hard surfaces.



Car Construction

- Cars are built with a passenger cage.
- A well designed cage should stay intact during a crash.
- Is this car safe?



Smart v Mercedes E Class

- Who do you think will come off best?

<https://youtu.be/ueafSvK9T-M?t=168>



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Safe?



For a 50 kg driver at 10 ms^{-1} (25 mph) No seatbelt, 5 mm flesh crumple zone!
(hitting the windscreen)

- $E_k = \frac{1}{2}mv^2$

- $= \frac{1}{2} \times 50 \times 10^2$

- $= 2,500 \text{ J}$

- $E_w = Fd$

- $2500 = F \times 5 \times 10^{-3}$

- $F = \underline{5 \times 10^5} \text{ N}$

- $\text{Acc}^n \text{ about } 1000 \text{ 'g'}$

$$F = ma$$

$$5 \times 10^5 = 50 \times a$$

$$a = 10^4 \text{ m/s}^2 \text{ as } g \approx 10 \text{ m/s}^2 \text{ this is } 1000 \text{ "g"}$$

For a 50 kg driver at 10 ms^{-1} (25 mph)
500 mm crumple zone! (e.g. Smart car)

- $E_k = \frac{1}{2}mv^2$

- $= \frac{1}{2} \times 50 \times 10^2$

- $= 2,500 \text{ J}$

- $E_w = Fd$

- $2500 = F \times 5 \times 10^{-1}$

- $F = \underline{5 \times 10^3} \text{ N}$

- Accⁿ about 10 'g'

For a 50 kg driver at 10m/s (25 mph) Large car 2.5 m crumple zone! (e.g. Mercedes E Class)

- $E_k = \frac{1}{2}mv^2$

- $= \frac{1}{2} \times 50 \times 10^2$

- $= 2,500 \text{ J}$

- $E_w = Fd$

- $2500 = F \times 2.5$

- $F = \underline{1 \times 10^3} \text{ N}$

- Accⁿ about 2 'g'

Safety and Style

- Your group's task is to take an ordinary physics trolley and fit it with a bumper or crumple zone to make it safer in a collision. You can make it stylish, but safety is more important! (You have probably seen TV shows where an ordinary car is fitted with an amazing body kit and a fancy stereo before being given a stunning paint job.)
- You will be given a choice of materials plus card and sticky tape.
- Your design must be able to be fixed to the front of the test trolley with velcro.
- It should not add more than 2 cm to the length of your trolley.
- It must not have a large effect on the performance of the trolley.
- Your design will be tested. The test will measure the deceleration of the vehicle in a head-on collision.

Do you think a large or small deceleration will be best in a collision? (Should the change of speed in the collision happen quickly or slowly?)