Tart Ma Cart
Thanks Gregor Steele
SSERC

Who’s idea this was and without whom none of this would have happened!
Collisions

- What makes a car 'safe'?
- Why are some cars better in crashes than others?
- What happens during a crash?
- Is this car safe?
Making a car safe

Depends on

• driver education and attitude
• road design
• car maintenance
• car construction
Driver education

- 30% of accidents involve a driver under the age of 21.
- 8% of driving licences are held by drivers under 21.
- One in three drivers will have an accident by the time they reach 21.
- Boys under 21 are twice as likely to be involved in an accident.
Road Design

- New roads are subject to strict design standards covering gradients, radius of curvature of bends etc.

Although sometimes it can be a bit confusing!
Road Design

- Existing roads are subject to review and accident black spots improved.
Road Design

- Roadside furniture is being replaced with crushable structures to minimise vehicle intrusion in a crash.
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.
WARNING!!

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Car Construction

- Active safety systems include ABS, traction control, brake assist, dual circuit brakes.
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?
Safe?
For a 50 kg driver at 10m/s (25 mph)
No seatbelt, 5 mm flesh crumple zone!
(hitting the windscreen)

- \( E_k = \frac{1}{2}mv^2 \)
- \( = \frac{1}{2} \times 50 \times 10^2 \)
- \( = 2,500 \text{ J} \)

\[ F = ma \]
\[ 5 \times 10^5 = 50 \times a \]
\[ a = 10^4 \text{ m/s}^2 \text{ as } g = 10\text{m/s}^2 \text{ this is } 1000''g'' \]

- \( E_w = Fd \)
- \( 2500 = F \times 5 \times 10^{-3} \)
- \( F = 5 \times 10^5 \text{ N} \)

- Acc\( ^n \) about 1000 ‘g’
For a 50 kg driver at 10m/s (25 mph) 
500 mm crumple zone! 
(Smart car)

- \( E_k = \frac{1}{2}mv^2 \)
- \( = \frac{1}{2} \times 50 \times 10^2 \)
- \( = 2,500 \text{ J} \)

- \( E_w = Fd \)
- \( 2500 = F \times 5 \times 10^{-1} \)
- \( F = 5 \times 10^3 \text{ N} \)
- \( \text{Acc} \approx 10 \text{ 'g'} \)
For a 50 kg driver at 10m/s (25 mph)
Large car 2.5 m crumple zone!
(Mercedes E Class)

\[ E_k = \frac{1}{2}mv^2 \]
\[ = \frac{1}{2} \times 50 \times 10^2 \]
\[ = 2,500 \text{ J} \]

\[ E_w = Fd \]
\[ 2500 = F \times 2.5 \]
\[ F = 1 \times 10^3 \text{ N} \]

\[ \text{Acc}^n \text{ about 2 'g'} \]
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?)