

Science & Technology

Central Television

We print with permission, the notes for the first programme of the important new schools television series currently being transmitted by the Independent Television network in Britain. The notes form part of a volume *Science and Technology* by L. Scott, P. Howard and C. Edwards published by Central Television, Broad Street, Birmingham B1 2JP. Copies of the book and further details can be obtained from the Education Officer at this address.

PROGRAMME 1

CAR DESIGN

PROGRAMME SUMMARY

This programme is concerned with two aspects of car design which contribute to improved levels of passenger safety,

a. the combination of a rigid safety cage and crumple zones to lessen the impact on the occupants of the vehicle during impact, and

b. the design and use of passenger restraints as exemplified by a child seat fitted in the rear of a car.

In each case the product is followed from the drawing board through the testing of prototypes to the finished item.

The programme suggests some answers to the following questions,

how do engineers test their new designs?

when a vehicle is in a collision, how can its kinetic

energy be absorbed to minimise the forces experienced by its occupants?

do passenger restraints reduce the injuries received by passengers in the event of an accident?

The following questions may be of use in preparing for or following up the viewing of the programme,

what are the important things to consider in the design of a car?

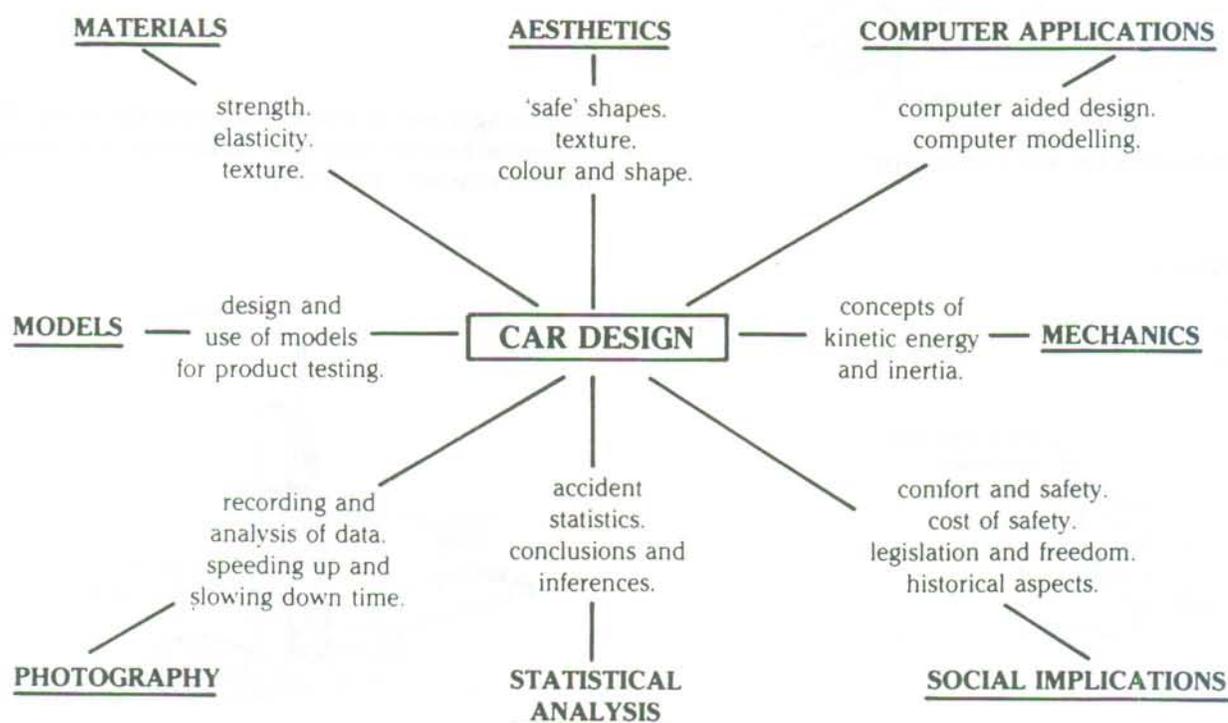
is safety the most important aspect of design?

are fast cars good cars/safe cars?

how have car safety features changed over the years?

what are the disadvantages/advantages of seat belts?

RELATED IDEAS



References

Science at Work. *Science of the Motor Car*. Addison-Wesley Ltd.

Nuffield 13-16. Longman Group Ltd. for Nuffield. Chelsea Curriculum Trust.

Science and Technology in Society (SATIS) project unit. *How safe is your car?* available from the Association for Science Education.

SCISP. Longman Group Ltd. for Nuffield. Chelsea Curriculum Trust.

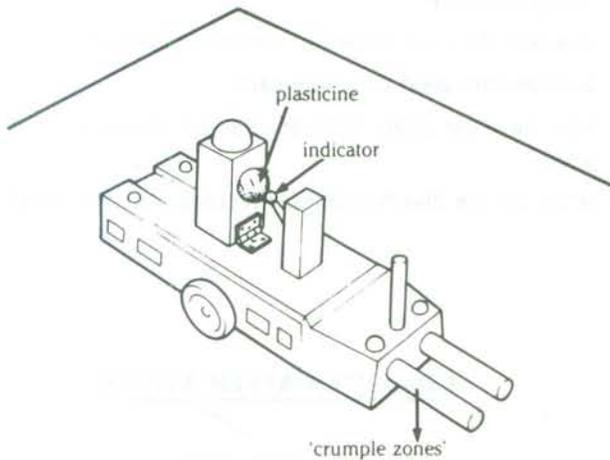
Deceleration of vehicles

The use of trolleys to stimulate vehicle collisions fall into two main categories,

- a) those which demonstrate the degree of injury sustained by passengers under different circumstances, and
- b) those which investigate the idea of absorbing the energy dissipated during an impact by the controlled collapse of the vehicle, so-called 'crumple zones'.

a. Injury

On impact the plasticine is thrown forward onto the indicator. The forces experienced can be judged by the depth of the impression.



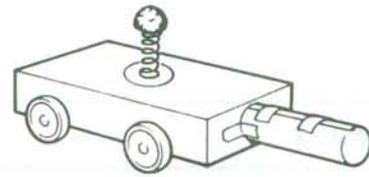
What factors effect the size of that force?

How could you give this passenger a safer ride?

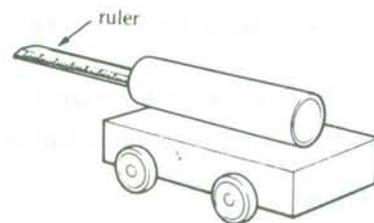


b. Crumple zones

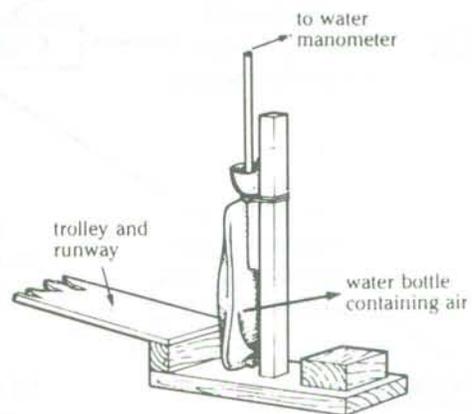
For quantitative results the following devices can be used with any arrangement of trolley and runaway.



The passenger is represented by a spring with a plasticine head, the crumple zone by cylinders of different material. How does such an arrangement model the crumple zone on a car?



Try placing a ruler in a tube attached to the trolley. The greater the force of impact, the further the ruler moves forward, relative to the trolley.



The water manometer provides a measure of the force on impact. How is the measurement affected by 'crumple' zones?

Rigid structures

The centre section of most cars is designed as a safety cage, a rigid structure that will resist distortion at times of accident. That cage includes a structure around floor level, the pillars at the side of the windscreen, between the front and back doors and at the rear, strengthening in the doors themselves and a roof line structure. Soft-top cars complete the cage with an anti-roll bar. The most exposed area for passengers is along the sides of the vehicle. Impacts at front and back have, usually, either the engine or the boot space between the car occupants and the colliding vehicle. The effect is to distance passengers from the point of impact, but, in itself this may not prevent injury. Forcing the engine and steering system into the body of the car can cause dreadful injuries to the legs and chest. The fuel tank is normally situated in the rear, below the boot.

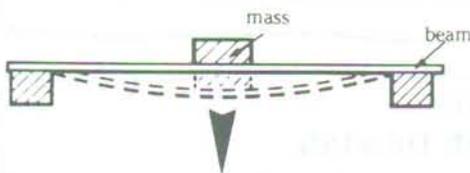
An investigation into motor car construction will certainly provide solutions that have application in quite different structures such as bridges and building generally.

Safety cages

At the time of an accident, the parts of a safety cage may be put under

- tension
- compression
- shear force or
- any combination of the three.

Using lengths of balsa wood or card, collect data about the ability of these materials to support weight. What variables influence the beams ability to support weight?



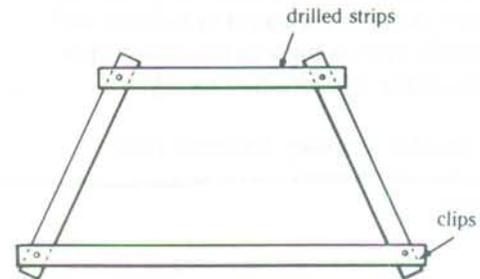
When the beam bends, its upper surface is under compression, the bottom surface under tension. The parts of a car's safety cage would experience similar forces.

Mass is important in a car. The greater the mass of a car, the more energy is required to get it moving. Try using a beam made with paper. Will this support different masses? Try folding the paper in various ways.

Boxes

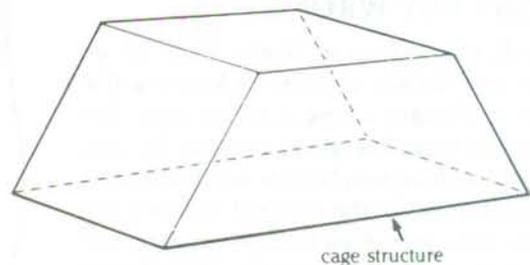
This is the side view of a car's safety cage. Add pieces to the cage to make it stronger.

A car will need spaces in the frame for windows.



The cage can be built from balsa strip, Meccano type materials or drinking straws. Where is it most vulnerable?

How can it be strengthened, and still leave room for the passengers?



Protection

Suppose you want a box to hold four identical, fragile objects such as eggs. What structure would be both rigid and economical to make? Corrugated card would be a good starting material.

KEEP ICE ON ROADS

Government scientists think they have found a new way to keep death off the roads. Keep the ice on! Not as silly as you might think said an un-named Government spokesman. When the roads are icy then people drive more carefully. When you drive carefully there are less accidents. So, keep ice on the roads and death off. And, if the figures are anything to go by, the icy roads stays safer night and day. The same statistics are found in Sweden, and they should know a thing or two about snow. So keep up the bad weather we say.

based on New Scientist, February 1986.



RIGHT BUT WRONG

John Eve, a lecturer at Worlds End College, today has the sad pleasure of knowing that what he thought wrong is in fact right. Eve predicted some five years ago that the only result of making people wear seat-belts would be an increase in the accident statistics. If a driver feels safer, then he'll drive faster, said Eve. And, if he drives faster then there will be more accidents. Civil servants who laughed at the idea only five years ago now find that Eve's ideas have come true. The latest accident figures show more pedestrians and more cyclists killed on the road than last year. But less drivers were killed and the deaths between 10 pm. and 4 am. dropped by an amazing 23%. It just means that less drunks are killing themselves, said Eve. A Government spokesman said that they would need to look at the figures to see if they could mean something quite different.

based on New Scientist, December 1985.

SAFER SAYS WHO?

So seat belts save lives, do they. Well, get this. They don't. And don't believe me. Believe the Government's own figures. Driver deaths down 421. Front passenger deaths down 235. But 77 more pedestrians and 63 cyclists were killed by belted up drivers. So, stop the seat-belts, we say. If drivers want to kill themselves, then let them. But, lay off the innocent by-standers.

based on New Scientist, April 1985.



SAFER BUSES!

Many of the injuries received by several hundreds of people in recent coach crashes could have been avoided if the Government had introduced the package of four safety measures recommended by *Which?* magazine almost two years ago, said the Consumers Association today. The Government is now proposing that coach roofs should be made strong enough to prevent crushing in roll-over accidents, and coach seats that do not have other seats in front of them be required to be fitted with seat belts.

newspaper reports, April 4 1986.

LAG ON DRUNK DRIVING

Britain is lagging behind other countries in its approach to drink and driving. Nearly half of all the injuries and deaths to drivers, passengers and pedestrians are linked to alcohol consumption. The main reason for the high level of drinking and driving, which leads to 100,000 convictions each year, is the low risk which drivers face of being caught.

Health Education News, January 1986.