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A dissertation read before the Society on Friday. 10th November, 1967.
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THE MOST IMPORTANT NUT

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INTRODUCTION

A motorist once asked a motor mechanic what he thought was the most important nut on a motor vehicle and though there is no direct answer to such a question the one given by the mechanic not only put the driver in his place but also summed up the whole problem of Road Accident Prevention.

COST

Every twelve months, on the roads of Great Britain alone, nearly 8,000 people are killed and 350,000 injured, 90,000 of them seriously so*. This in itself is bad enough, but analysis of these figures by age and sex (Figure 1) makes the picture even worse. It can be seen that the greatest proportion of deaths and injuries are to young males between the ages of sixteen and thirty: the people that the country can least afford to lose whether human or economic factors are considered.

The exact financial cost of road accidents is difficult to assess, but the Road Research Laboratory has recently published figures for 1963 which are probably as accurate as they can be. Taking into account the loss of output, the damage to vehicles and property, the cost of medical treatment and the administrative costs of the police and insurance companies the Laboratory reached a total of £196,000,000. The report also gives the average cost of various types of accident; that of a fatality occurring in a rural area, for example, is over £4,000.

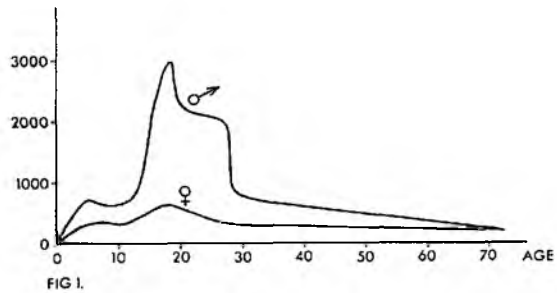

FIG 1.

Fatal and Serious Casualties per year by Age and Sex.

* A death is recorded when a person dies within thirty days of a road accident. A serious injury is one for which a person is detained in hospital as an in-patient, or any of the following: fractures, concussion, internal injuries, crushings, severe cuts and lacerations and severe general shock. A slight injury is one of minor character, such as a bruise or sprain.

CAUSES

The cost of road accidents is high therefore in both economic and human terms and must be reduced, but to do this some idea must be gained of their causes. They are not as simple as it might sometimes seem. No one factor, be it alcohol, speed or anything else, alone leads to road accidents. Each type of accident has a different cause and in the majority of cases there are probably several "causes" involved. Indeed it is probably better to think in terms of "*a factor which when it occurs in conjunction with others may lead to an accident*".

The consideration of almost any accident will show that it was caused by a number of factors, each of which can be placed in one of three categories. The factors are associated with one of the following:—

(a) the roads
(b) the vehicles
(c) the road users

Every accident is caused by the combination of various deficient aspects of each of these groups and in any attempt to reduce road accidents means must be introduced to improve the standards of each group.

So far attention has only been directed towards the causes of accidents so that methods may be found for preventing casualties by preventing accidents — the concept of Primary Safety. Unfortunately it will be many years, if ever, before accidents cease altogether and therefore something further must be done to prevent, or at least to decrease the severity of the injuries that still do occur — the concept of Secondary Safety. Thus increasing the standards of the three groups must be considered against the background of these concepts. Obviously nothing can be done to the human body to reduce injuries to it, but many alterations in road and vehicle design could help.

ROADS

It is well known that Motorways are much safer than the trunk roads that they are replacing (the fatality rate per million vehicle miles of the M1 is only a third of that of the stretch of the A1 that it replaced) and one of the greatest steps towards safer roads will be the completion of the motorway network. This is because the design of motorways incorporates many of the basic safety factors that all roads must have if they are to become safer. They have a good smooth, relatively anti-skid surface, have well marked lanes and are free from solid roadside objects such as lamp-posts and less solid ones such as pedestrians. They also provide a method of changing from one road to another with the least possible exposure to accidents. Their one major deficiency is in the separation of vehicles travelling in opposite directions. All road designs seeking to prevent head-on collisions must have a barrier between carriageways which should also serve to stop dazzle at night.

Since fifty per cent of all road casualties are pedestrians and most of these accidents occur in towns the finding of a solution for urban areas is more difficult. The only way to curb the British pedestrians' death-wish is to separate them completely from vehicles. To prevent accidents the towns of the future should have pedestrian-only shopping and business centres served by underground or monorail systems connected to multi-storey car parks and long distance transport stations at the fringes. Residential areas will be entered by urban motorways with service roads to houses having barriers between footpath and road to prevent pedestrians crossing in places other than those where they are specifically allowed to.

A final factor in road design is the provision of lighting at night. A good lighting system of any kind may reduce accidents by up to thirty per cent no matter where the road is. In towns the saving made by decreasing accidents is always greater than the cost of providing and illuminating the lamps. In the country it would be ideal but at present it is uneconomic except perhaps at major junctions. An important secondary safety feature is that the lamp-posts should be collapsible, as many injuries are due to the vehicle involved coming into contact with an unyielding post. Many years ago the Road Research Laboratory showed that the thin sheet-steel type was by far the best with regard to energy absorption, yet local authorities still continue to use others, particularly pre-stressed concrete.

VEHICLES

Analysis of the accident rates (measured in terms of vehicles involved per million miles travelled — Figure 2) of the various types of

vehicle found on the roads of this country shows that motor-cycles are far more dangerous than any other type of vehicle. The only way to stop this is to ban them. Pedal cycles also come high on the list but are not sufficiently high to justify removing them from the roads. All riders however should have passed some test such as the National Cycling Proficiency Test. Buses also seem to be dangerous, but this is probably because large numbers of minor injuries occur to passengers who move around on the vehicle, or get on or off, whilst it is in motion. Motor cars and commercial vehicles appear relatively safe but much can be done both in terms of primary and secondary safety to improve this.

Figure 2
VEHICLE ACCIDENT RATES

Motor Cycles (+ Scooters)	19.5
Buses	9.6
Pedal Cycles	8.4
Motor Cars	3.8
Commercial Vehicles	3.6

Primary Safety

To design a vehicle which is less likely to have accidents two main principles must be followed: firstly, the performance of the vehicle must be of a very high standard and secondly, the driving position must allow the driver full control over this performance. In this context performance is considered in the widest sense of the word as including such factors as acceleration, top speed, road holding, controllability and braking power and efficiency. Of all the types of vehicle design that are to be found on the roads of this country only one combines all the above to a sufficiently high degree. This is the one which comprises the Ferguson Formula four-wheel-drive transmission used in conjunction with the Dunlop "Maxaret" braking system. These items are used in the Jensen FF but they add £1,300 to the cost of the car before tax so the unit is too costly, but it is to be hoped that with development the price will come down and allow more general use. Until such time more traditional systems must be employed and the most important contribution towards primary safety is that all vehicles be maintained in the state that the manufacturers intended. To allow the driver full control the driving position must be comfortable, so that he is able to reach all the controls. An uncomfortable position leads to fatigue which leads to accidents and therefore both seat and steering column must be fully adjustable to suit all possible drivers.

Secondary Safety

All injuries to vehicle occupants are due either to the occupant moving relative to the vehicle and striking some solid structure or to the reverse happening. The wearing of safety belts will prevent the occupants moving and research has shown that in accidents where safety belts have been used the injuries are fifty per cent less both in numbers and severity than in comparable accidents where safety belts were not worn. Many of the remaining fifty per cent can be prevented by designing vehicles in which the cab position is rigid and the boot and engine compartments will collapse in a linear fashion to absorb the impact energy. The steering column must of course be collapsible. Apart from the removal of obviously dangerous projections little can be done to prevent injury to those outside the vehicle such as pedestrians and cyclists.

ROAD USERS

There are three main road-user mediated factors that lead to accidents. They are mental attitudes, driving technique and alcohol.

Mental Attitudes

The part that these play in accidents is difficult to assess but some evidence may be gained from Figure 1. Women usually are far safer than men because they are by their nature more placid and have less need to be assertive on the roads. However, in the premenstrual part of the cycle, when it is recognised that they are more unstable, women are between five and seven times more likely to have an accident than at any other time.

Further evidence comes from an admittedly small scale survey of unconscious attitudes towards motoring as exhibited under hypnosis. Three quotes will illustrate the point. A final year medical student when asked to describe how he felt about driving on the open road said:—

". . . and that wonderful feeling of power: it's the feeling of power, I suppose . . ."
and another male subject when asked the same said:—

"It's the power, a sense of superiority, a feeling of being master of it all; it's a bit like sex really . . . You see you have to be gentle too — and careful!"

A third questioned after having tried a car fitted with the Dunlop "Maxaret" braking system said:—

"I'd show them — you could get away with murder in that car."

These are not good attitudes to carry into the driving seat even subconsciously.

Driving Technique

People today are not taught how to drive; they are taught how to pass a test at speeds which never exceed 30 m.p.h. The technique that should be taught is that of defensive driving, that is anticipating possible accidents in the most innocent looking of situations. Ideally a test would consist of papers on mechanical and driving theory as well as a practical part. In Russia, prospective drivers have to pass such papers even before they are allowed on the road.

Alcohol

Drinking and driving are two of the most important social functions in this age and to try and separate them overnight would have been impossible. A start has been made though with the introduction of the new laws and automatic conviction on the finding of a blood level of over 80 mg.%. This level must be dropped even lower soon. A committee set up by the British Medical Association to investigate the relationship between drinking and driving came to the conclusion that a level of 50 mg.% was the highest compatible with the safety of others.

SUMMARY

The accident rate of this country must be reduced. This can be done by three methods: by improving the design of roads and vehicles and by increasing the standards of all road-users. In the ultimate analysis though it is the road-users who must take the whole blame, for by using their influence to improve roads, particularly via the motoring organisations, and by consideration of safety features when buying vehicles they can do much. Finally, everybody must always be on their guard against accidents whether on foot or in the driving seat. As the mechanic said, "The most important nut" really is "The One behind the Wheel".

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A Remedial Matter

" In my opinion the skill of healing seems to be of greater antiquity than the study of philosophy, because when men first began both the study of physic and philosophy, every one being determined to them either on account of his body, or his mind, the reasons for philosophy were only casual and accidental, but those for physic were perpetual. For the elder race of mankind maintained life in a poor condition, exposed in the open fields to the injuries of the weather, their first sustenance being the products and fruits of the earth, their next advancement to its creatures the cattel (sic): they first felt the inconveniencies of heat and cold, that is, they grew sick, before they thought of providing clothes and houses for themselves. These then were the first diseases, those the first remedies ".

—from "The Works of Archibald Pitcairn", this quotation coming from an oration where the author waxes warm in proving "The Profession of Physic free from the Tyranny of any sect of Philosophers" (1713).