

## THE HIGHWAY SAFETY PROBLEM

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## SYNOPSIS

It is apparent that there is no panacea for the hazards that have grown up along with the development of highway transportation. No single corrective measure can solve the problem of highway safety.

Recent research indicates the presence in the driving population of three classes of drivers: a considerable group of accident free individuals, a relatively small group of accident prone or high accident individuals and a large number of drivers who participate in a large number of accidents more or less according to the laws of chance.

While a first objective should be to segregate the accident prone operators and either eliminate them or change their habits by educational methods, it is evident that to reduce highway accidents to the lowest possible terms a long pull must be directed toward reduction of the total number of mishaps suffered by the great number of drivers who may be considered normal.

To do this, it is equally apparent that sustained effort directed against many accident causative factors must be put forth. The roads and vehicles must be built and maintained in the safest possible condition for normal use, uniform rules and control methods must be adopted throughout the nation, and the driving public must in some way be brought to adopt better driving habits and a better attitude toward the use of motor vehicles. Owing to the statistical fact that the average driver's expectancy of being in a serious accident is only about one in twenty years, there is an indifference on the part of individuals that must be overcome. Two factors which would repay immediate attention are the disproportionate share of highway accidents involving young drivers and the high rate during the hours of darkness.

While the objectives can be clearly seen and the principal lines of approach are to some extent indicated, much more information on many phases is needed to make the attack all along the line effective. The hazards of the road must be studied in relation to driving practice and motorists' behavior under all conditions must be exhaustively studied before the characteristics of good driving behavior can be authoritatively stated. Definite information on the relation of intoxicants to highway hazards must be secured.

Much money and well directed effort have already been expended in combating the hazards of highway travel. Although substantial reduction in the ratio of accidents to traffic as measured by gasoline consumption has been effected, still with increasing travel the total of mishaps is growing. It is generally recognized that something more is needed. But what?

To devise corrective measures logically, knowledge of the facts is required. Before any problem can be solved it must be broken down into its component parts and the available pertinent facts determined.

During the past year a large amount of work and study has been carried on

jointly by the Bureau of Public Roads and Highway Research Board in cooperation with many other organizations for the purpose of collecting definite information about some factors which are suspected of being near the core of the situation. From study and observation during the progress of this work and study of the data secured, I have developed a picture of the situation that has clarified the matter for me. Although nothing startling or revolutionary can be said the analysis of the facts so far as they are known brings into sharper focus some of the things that can be done now, and some upon which further light must be shed.

The picture in broad outline is simply

this Only a minor part of the accidents can be assigned to definite groups in the population that can be identified as such. The majority of the accidents happen to the great bulk of the drivers who cannot be segregated into independent groups. This means that although definite measures are indicated in the cases of two groups, the young drivers and the accident prone, both of whom have more than their share of accidents, the attempt to reduce the accident rate in the great undivided class must make intensive and continuous use of every weapon that can be thought of. This majority has every conceivable kind of person in it and they have traffic accidents in every imaginable kind of way. There is no panacea. The problem cannot be solved by attack along any one line.

I propose to discuss the problem in three parts. Facts, What can we do about it? and Needed Information.

#### FACTS

##### *Individual Indifference*

To me a most significant fact is the indifference we all display as individuals to this serious situation. True, we talk about it, we hold meetings, we make speeches, and sometimes we even give money, but to get right down to it and apply everything we hear about bad drivers to ourselves is not done. When we drive, all of us—drunk or sober—think we are good drivers and none of us expects to have an accident. The reason for this is understandable. Of 28,270,000 motor vehicles about 43,470<sup>1</sup> were involved in 37,800 fatalities in 1936 and proportionately there were probably about 1,400,000 vehicles involved in the 1,200,000 personal injuries in traffic accidents of 1936. The chance of my car or yours being in one of these

accidents is slight. If the average vehicle is driven 10,000 miles per year there are approximately 283 billion vehicle miles traveled or 202,143 for each vehicle involved in a personal injury accident. This means, if you drive your car 10,000 miles per year, your chance, if you are an average driver, is one serious accident in 202 years. The plain mathematics of the situation is that no driver either consciously or subconsciously expects to have an accident now, but the possibility of only one personal injury accident in a lifetime is something to be concerned about.

##### *Accident Prone and Accident Free*

It is well known that some individuals have the unhappy faculty of being on hand when accidents happen. Recent investigations of the Bureau of Public Roads and the Highway Research Board in cooperation with the Connecticut Commissioner of Motor Vehicles demonstrates the presence in the driving population of a relatively small group of high accident individuals, a larger group of comparatively accident free individuals and the residue, which comprises the bulk of the drivers among whom the larger part of the accidents are distributed more or less according to chance. The distribution is no doubt affected by ages of drivers, liquor, recklessness, physical conditions and in fact by all of the myriad factors that figure in accidents.

A random sample of every tenth one of 408,000 drivers re-licensed to operate in Connecticut in 1932 resulted in a list of 29,531 drivers who were licensed through the six-year period 1931-36 and whose accident records were known. In the six-year period these 29,531 drivers had 7,082 accidents that were reported. However, 23,881 drivers had no accidents and 4,503 had one accident leaving only 1,147 who had two to seven accidents.

According to Poisson's law of small

<sup>1</sup> Accident Facts 1937, National Safety Council

chances, if the 7,082 accidents had been distributed among the 29,531 drivers without regard to identities and personal histories, 23,234 of them would not have an accident, 5,572 would have had only one accident and 725 would have had two or more accidents. There were, therefore, 647 more drivers who had no accident and 1,069 fewer drivers who had only one accident than would be expected if the accidents were distributed on this basis. The better-than-to-be-expected results in these two groups indicate that there must be a fairly large group of drivers in the population who are more than ordinarily free from traffic accidents.

And on the other hand, the fact that there were 422 more drivers who had 2 to 7 accidents than expected indicates the presence of a smaller group who are more than ordinarily susceptible to traffic accidents.

The significance of these facts is not so much that there is an accident prone group, for that has long been recognized, but that this group is relatively small. In the six-year period studied, only 1.5 per cent of the population appeared to be accident prone. With longer experience this figure would presumably increase since no doubt some accident prone individuals might luckily escape with only one accident in such a short period as six years. But even if we estimate that one quarter of the one accident group are also accident prone, we have accounted for only 5 per cent of the population and 30 per cent of the accidents.

Of course, it is imperative that this group of accident breeders be reduced but even if they could be "liquidated" altogether, the larger part of the accident problem would still remain.

It is true that these figures are based on study of a limited population in a single locality for a comparatively short period. Other populations, accident defi-

nitions, and times would produce other figures. However, I believe that this experience is sufficiently close to a cross section of the accident situation to justify the rather broad conclusions I have here set down.

#### *Identification of the Accident Prone*

Comparison of the first three years of the six-year period with the last three years showed that, given the histories of a group of drivers in one half of an experience such as this, it is possible to predict the performance in the second half. This demonstrates that if adequate driver histories are recorded they can be used to sort out the high accident individuals in a comparatively short period even though an average individual's chance of being in a personal injury accident is only once in 20 years.

Far better than detecting accident prone drivers from their records after they have done much damage, would be to examine prospective drivers and determine in some way whether or not they might be expected to have this propensity. To this end scientists have experimented with tests that require the operator to use skills that presumably are necessary or related to those that are necessary for good driving. With the cooperation of the Iowa State College, the Harvard Bureau for Street Traffic Research and the Connecticut Department of Motor Vehicles the tests developed by Lauer at Iowa State College and DeSilva at Harvard were applied to about 3,000 drivers in Connecticut where their records could be ascertained. The analysis of the data has not been completed but so far it appears that a subject's reaction to the whole of either set of tests will not indicate his propensity to accidents in general. Whether or not individual tests may show leanings toward particular kinds of accidents has not yet been determined.

### *Younger Drivers*

Data from Connecticut, Massachusetts and the District of Columbia demonstrate that the younger drivers, ages 16 to 25 years, have nearly twice as many accidents involving death or personal injury as would be their share according to their number in the population. In the Connecticut study of 2,467 fatal accidents it appeared that if the fatal accident rate among the drivers less than 25 years in age could have been reduced to the average rate of the whole population 291 fatalities or 11.8 per cent would have been avoided. This fact points to a definite part of the population which needs and should be susceptible to educational methods. Of course there is some overlapping of the accident prone and young driver groups.

### *Multiple Causes of Accidents*

No one can read even a part of the 1,715 case histories of fatal accidents collected by the Bureau of Public Roads and the Highway Research Board with the cooperation of the Yale Transportation Committee without being impressed by the innumerable combinations of conditions and circumstances relating to vehicle, road, driver, passenger, and bystander, which are involved in highway traffic mishaps. It is seldom that a single cause can be assigned, in most cases at least three important factors contribute to the unfortunate result.

### *Reports, Records, Laws, Rules, Signs*

It would seem, without argument, that a primary requisite for traffic control would be accurate and complete reports and records of accidents, continuous accident histories of all licensed drivers, a reasonable, sensible and helpful system of laws and rules; and an adequate system of signs and signals for the information of the traveling public. It

would furthermore seem, in view of the total lack of significance of state lines to motor vehicle traffic that these various functions should be uniform throughout the United States. In spite of the elementary nature of these postulates, and in spite of the fine work for a number of years of the Conference on Street and Highway Safety the report of the Secretary of Agriculture to the Congress exhibits a truly chaotic condition in these important safety requisites.

### *Day and Night Accidents*

If night driving could be made as safe as daytime driving, highway accidents would be reduced by one third and almost half of the lives lost might be saved. As reported by Arnold Vey<sup>2</sup> in New Jersey in 1933, 44 per cent of the total accidents and 55 per cent of the fatalities occurred at night. This is corroborated by the National Safety Council's "Accident Facts" for 1937 which reports that in 26 States 48 per cent of all personal injury and 60 per cent of all fatal accidents occur at night. Approximately half of all accidents occur at night when the traffic is much less than in the daytime. According to Vey, night traffic in New Jersey is about 20 per cent of the 24 hour traffic. These facts mean, therefore, that daylight traffic must be four times as dense as that at night in order to make travel by day as hazardous as by night.

In New Jersey in 1933 there were 1,185 fatal accidents, of which 651 occurred at night. By elimination of the hazards due to darkness, 488 of the night fatalities or 41 per cent of the total deaths might have been avoided.

In view of our groping efforts to lessen the traffic toll the conclusion that by overcoming the hazards of darkness the problem can be reduced by one third or

<sup>2</sup>"The Relation of Highway Lighting to Highway Accidents," Arnold Vey, Proceedings, Highway Research Board, Vol 14, Part I, p 429

more is startling Here is a point of attack that warrants almost any expenditure of time or money

There is evidence to indicate that for roads where the density of traffic justifies the cost, effective overhead lighting is being developed Data from New Jersey in Table 1 show that the lighting of one heavy traffic road did make day and night driving comparable

dent rate of only 4.25 per million vehicle miles with fatalities at the rate of only one per 7½ million vehicle miles

#### WHAT CAN BE DONE ABOUT IT

Having thus assembled certain facts which are particularly pertinent to a broad picture of the condition that confronts us, what do they indicate can be done to improve the situation?

TABLE 1  
COMPARISON OF DAY AND NIGHT ACCIDENTS ON LIGHTED AND UNLIGHTED  
ROADS IN NEW JERSEY

Route	Miles	Av No of vehicles per 24 hours	Day accidents per million vehicle miles	Night accidents per million vehicle miles
No 25, Lighted	4 22	32,000	3 10	2 61
No 26, Unlighted	6 52	8,800	2 42	7 70
No 26, Unlighted	2 27	8,400	2 08	8 80
No 26, Unlighted	3 90	8,400	2 79	7 55

#### *Safeguarding the Highways*

The type of highway that can be built in any given location depends fundamentally upon its earning power through charges against highway users and in some cases other beneficiaries In congested regions reasonable charges will provide four lane divided roadways, grade separations, limited access, lighting and all the other safety arrangements yet devised, but on thousands of other miles of main roads, raising the cost of such improvements would tax the highway user out of business As not even an approach to this condition is likely to be tolerated by public opinion, it remains that the only hope of improving the accident situation on huge mileages of roads and streets lies in persuading the drivers to operate carefully, and in improving those features that constitute hazards to reasonably careful drivers It is a fact that our so-called "inadequate highway system" somehow manages to carry an annual traffic of 300 billion vehicle miles with a personal injury acci-

The United States, if not the whole world has enthusiastically adopted this form of speedy personal transportation, in which, I think, all will agree there are some inherent risks Our problem is to learn how to live with it in such a way as to minimize the hazards to life and limb<sup>3</sup>

It is apparent that there is no panacea for the hazards of highway transportation No single corrective measure can satisfy the need The majority of the accidents happen to the great body of the drivers in myriad ways and through almost infinite combinations of circumstances

It is evident that in so far as millions of drivers are concerned there is a large element of chance The long-time objective, therefore, must be the lowering of the accident rate level for those drivers that are not accident prone nor susceptible to accidents on account of lack of experience

<sup>3</sup> After T H MacDonald

But before discussing that problem, let us consider the cases of the youthful drivers and the accident prone

### *Youthful Drivers*

There is no evidence as to why it is the younger drivers have so much more than their share of the accidents. Whether it is because of lack of manual skill or lack of good judgment in the pinches we do not know. It is probably some of both. However we do know that in most States new drivers are required to demonstrate some degree of manual proficiency before being licensed and that very little attempt is made to make sure that they are taught those more extensive attributes of judgment and attitude that are necessary for good driving.

However, one treatment is plain, better training for new drivers. Just how this is to be accomplished is not to be gone into here. It is enough to say that training and examination of new drivers must be undertaken on a hitherto unthought of scale. The fine pioneer work in this field of the American Automobile Association must be vastly extended.

### *Accident Prone Drivers*

The case of the accident prone is not so plain. First he must be isolated as an individual, then he must either be eliminated or reeducated so that his hazardous tendencies will disappear. As has been shown it is possible from adequate records to select the group of drivers which contains the accident prone individuals. How to select the individuals and what to do about them is a problem for continued psychological research. Tests and measurements of physical and mental attributes that may affect a person's driving ability have been under intensive investigation, notably by Lauer and DeSilva for some time. Although I do not think the applicability of these tests to pre-identification of hazardous

drivers and to granting of driving licenses has been defined, there can be little doubt of their educational value, in that anyone should profit from knowledge of his own characteristics. If one has defects in skills that are related to driving a car, knowledge thereof should at least tend to make him more careful.

It is at least evident that an adequate system of accident reporting and recording is essential for control of the high accident drivers. To do anything at all on this situation administrative authorities must have at their finger ends the histories of all drivers who have participated in accidents.

### *Lowering the General Accident Level*

The only apparent fact about the problem of reducing the accident rate for the great mass of unsegregated drivers is that to affect this situation intensive and continuous work on every possible angle must be prosecuted for a long time. The brunt must be borne by the highway transportation industry (which takes in most of the population in one way or another) and government. Neither can handle the situation alone and both will have to put some very large scale money and effort into it before the accident rate can be reduced to its lowest level.

To discuss all of the possibilities would require a volume. I shall only mention in passing what seem to me to be some of the fundamental factors in the situation.

*Drivers* An entirely new attitude of mind toward the use of highways by fast moving vehicles is needed. We still retain too highly individualistic a concept of our rights and duties. Highway transportation at the speeds that are bound to prevail will always be hazardous and community safety as well as personal safety must become a first concern of the individual.

It would help if we could all adopt the frame of mind that we must be in some way at fault ourselves whenever we get into a risky situation or are involved in a mishap. There is considerable truth in the thought that "Good drivers do not get into tight places." There are some people—I do not know how many, I have only met a few—who have a judicial attitude toward their own acts and can adopt that point of view, but there are plenty to whom it is mentally impossible to take that position. Nevertheless continual bearing down upon such points should ultimately have some effect.

Better driving habits must in some way be inculcated. It is obvious that we cannot be frightened or intimidated into better habits. The apathy of the individual, previously mentioned as being accountable for by the low accident expectancy of the average driver, demonstrates this. The only answer I can think of is, better training of the new drivers and reeducation of the old ones. Better training of new drivers will in the course of time account for the whole population and is therefore of tremendous importance. In the case of the present older drivers some system of tests that will show them their weaknesses in places that may affect their driving ability may prove to be effective. Of course it would be a huge task to test 28 million drivers, but if such ideas are found to be effective we must cease talking about costs being prohibitive.

*Pedestrians* Two out of five traffic accident deaths are pedestrians<sup>4</sup>. Certainly attack on this phase of the problem is clearly indicated. The record<sup>4</sup> shows that 52 per cent of the pedestrian accidents occur between 6 P. M. and midnight, which indicates that light must be an important factor in their occurrence. A significant fact reported recently by

Michael A. Conner, Connecticut Commissioner of Motor Vehicles is that, of 1,238 pedestrians killed in Connecticut during 1932-1936 (inclusive) only 48 were operators of motor vehicles. This shows the necessity of impressing upon the non-driving public the difficulties of handling motor cars in heavy traffic and the fact that although a walker may clearly see an approaching vehicle, conditions may be such that the driver may not see him. It is quite possible that a man may be within the visibility range of a car's headlights and still the driver may actually not see him until it is too late. All drivers are aware of this possibility.

The fine work being done with school children should be supported and extended. It will not only save the lives of juveniles now but should lower the accident rate when those who are children now are grown up.

*Vehicles*. It is perhaps needless to say that the driver is entitled to a vehicle which is originally safe for reasonable use, and that thereafter he has a responsibility to others as well as to himself to keep it in safe condition. The producers of motor cars are well aware of the necessity of embodying in their design every practicable feature likely to contribute to safe operation, and improvements in this respect are made continually. I shall only mention three items that seem to me to offer possibilities: (1) Better range of vision for the driver, (2) Obviation of the time lost in moving the foot from the accelerator to the brake pedal in emergencies, and (3) Elimination of headlight glare along with increase in visibility at night. On thousands of miles of road the vehicles must continue to carry their own illumination and the need for something better than we have is obvious. Although many headlighting improvements have been made, it is still dangerous to meet another car at night.

<sup>4</sup> Accident Facts 1937, National Safety Council

when all one can see is the lighted space between the two cars and that made indistinct by the glare of the approaching headlights

*Roads* The normally careful driver is entitled to roads safe for reasonable use. He is entitled to more than that, he is entitled to a factor of safety that will give him some measure of protection against the hazards over which he has no control. Of these I know of three <sup>5</sup> (1) The acts of other drivers, (2) The acts of pedestrians (particularly when one steps into your path from behind a parked car), and (3) blind intersections.

Much has been learned about elimination of hazardous features of highways, width of lane, sight distance, super-elevations, shoulder width and treatment, ditch sections, skid resistant surfaces, and gradient are details of design that are now studied much more carefully in relation to safety than in the early days of the motor vehicle. If what we now know is desirable could be applied at once to all old as well as new roads highway accidents could be greatly reduced.

Since the greater part of the rural roads cannot be made accident-proof, or even fool-proof, the only road solution to the accident problem is to build into the type of road justifiable on economic grounds at a given location, all of the known safety features applicable to its type or class. This will involve due attention to the prevailing and to be expected customs as respects speed and vehicle characteristics. On existing improved roads it will involve careful study and treatment of specific locations potentially and actually hazardous from the standpoint of modern operating practice. Dependent on traffic conditions improvements for safety should range from treatment of hazardous spots to the construction of limited access super-highways.

<sup>5</sup> After H. C. Dickinson

*Traffic Control* Much can be done to lower the accident rate through proper control of the traffic, but there is an urgent need for unification of practice throughout the nation. The driver is certainly entitled to uniform rules, regulations and practices in everything that affects driving habits. He is entitled to freedom from conflicting and meaningless laws and regulations. Certainly when this objective is reached it will be reasonable to expect improved conditions.

Law enforcement is a necessary adjunct to traffic control but it is axiomatic that no law affecting the entire population can be enforced without popular support. It follows therefore that regulatory measures that are needed for safety must be sold to the public. In this connection it must be recognized that most of the acts in violation of motor vehicle laws or ordinances are not criminal in nature, and that treatment of such offenders from the criminal standpoint will not promote popular support for law enforcement.

Remarkable results have been secured in Evanston and several other cities by using the police power from the standpoint of accident prevention, and it is through this type of activity that the law enforcement agencies may contribute most toward lowering the accident rate.

More patrolmen on rural highways are urgently needed. Drivers en masse cannot be influenced much by reading the record of arrests, convictions, and license revocations in the daily papers, but most of us can be impressed into carefulness by frequent sight of uniformed policemen.

#### RESEARCH

In discussing corrective measures little was said about the details of how they might be accomplished. This was partly because in many respects little or nothing can be said until more knowledge is available. For instance it was said that



better driving practice should be inculcated, but who knows with certainty just what constitutes the best driving, or who knows what should be done to solve the problem of vehicle headlighting

It would be easy to go ahead and generalize on the subject of needed research and compile a long list of matters that should be studied. However, what is needed at this time are concrete suggestions for research projects that can be undertaken now with hope of constructive results

From the research point of view the driver is the most interesting factor as he is the element about which we know the least and which is the least under control, but there are several aspects of the road and vehicle that should be mentioned

#### *Road Factors*

*Design* In drawing plans for a given road the designer must take into account as best he may the volume of traffic and the expected speeds. Better understanding is needed of the inter-relations of speed, traffic volume and day and night visibility, and such roadway characteristics as gradient, curvature, surface friction, sight distance, width, and cross section. Some suggested research projects are

(1) Observations of vehicle behavior on curves of different radii and super-elevation at different speeds

(2) Study of road conditions and accident records in every highway jurisdiction to locate hazardous spots

(3) Observations of conditions and distances by which objects variously placed can be seen or not seen at night by drivers of moving vehicles

(4) Experimental lighting of a sufficient number of roads and hazardous spots of known accident history to establish criteria for the use of overhead lighting

*Surface Slipperiness* The resistance of pavements to skidding is of great importance. Recently apparatus has been devised by which the frictional resistance between surfaces and tires can be measured, but only comparatively few surfaces have been tested. Every road building authority could improve its practice by measuring the frictional properties of the surfaces it has built and is now building, and by constructing experimental sections for the purpose of determining upon the best design

*Guard Rail Tests* Numerous uncorrelated tests have been made of different types of guard rails. There is need for a correlation study of all of them with a view to devising a standard method of test by means of which guard rail designs can be evaluated

*Warning and Informational Signs* There is a great lack of uniformity in the methods used to convey important information to the speeding driver. The standards of the Association of State Highway Officials do not go far enough, stripes and other markings on the pavement should be included as well as roadside signs. There are great differences of opinion over the use of stop signs, and over the locations and spacing of all signs. A national survey is needed of the use and observations of all kinds of signs with a view to producing a complete standard code

#### *Vehicle Factors*

*Headlighting* The need for portable lighting equipment that will eliminate glare and give greater visibility has already been stressed. This is a form of research for which the reward of success will be very definitely in lives saved

*Fleet Accident Records* The preliminary survey of fleet accident records made by the Bureau of Public Roads and the Highway Research Board in cooperation with the Society of Automotive

Engineers and the Harvard Bureau for Street Traffic Research, indicates that valuable information concerning the relation of vehicle characteristics to safety could be secured from detailed study of such records

*Inspection of Vehicles* It is generally agreed that lack of maintenance of certain mechanical details may create hazards. However, the extent to which vehicular details have contributed to accidents is not known, nor has the value of the compulsory inspection of vehicles carried on in many jurisdictions been demonstrated. A thorough study of all information bearing upon this factor is recommended.

#### *Operators*

Here we come to the factor that is complicated by all the idiosyncrasies of the human race. It is a field of research that will tax the ingenuity of the psychologist, the physicist, the engineer, and many other scientists.

Before better driving habits can be inculcated we must know what constitutes good driving practice, and the obvious place to start to learn that, is to study drivers' behavior as it is to be found now.

*Drivers' Behavior.* Without attempting to exhaust the possibilities the following studies are suggested:

(1) Study of a large number of drivers' histories, both good and bad in order to ascertain the attitude of mind displayed toward the job of handling a motor car in traffic—suggested by Dr. Ralph Lee.

(2) Study means of identifying reckless and hazard creating drivers. Dr. H. C. Dickinson has suggested that if in a given area a large corps of observers note the license numbers of all cars they see doing one or more of a short list of dangerous acts, it should be possible to sort out many repeaters who habitually cause hazardous situations. A brief preliminary study has indicated the validity of this assumption. This method should

be checked extensively enough to demonstrate whether it is a feasible method of identifying bad drivers before they have accumulated a costly accident record. If the method should prove to be sound the next step would be a study of what to do about them.

(3) Studies of motorists' habits with respect to speed under specific conditions, reactions to signs and signals, and reactions to various physical conditions such as steep hills, sharp turns, narrow roads.

(4) It has been suggested by Dr. H. C. Dickinson that valuable insight could be secured into what constitutes good and bad driving by equipping cars with automatic speed recording devices and running extensive tests with drivers of known records, both good and bad. This idea was extended by Dr. Ralph Lee who suggests that the automatic recording device be arranged to give a record of the movements of the steering wheel, brake, clutch and accelerator.

*Driver Training.* Considering its infancy much good work has been done on this educational problem. Well developed methods of demonstrated efficacy are available.<sup>6</sup> However, it is hardly to be expected that the last word has been said and if development of educational methods in this field follows the usual course, it will only reach perfection over a term of years through the research and experimentation of many individuals. The most pressing need at this time is for the application of what we know today.

*Driver Tests.* The early detection of accident prone and hazardous drivers is so important that investigators should be encouraged to go ahead and exhaust the possibilities of physical and psychological testing.

*Alcohol and Motor Vehicles.* Although all jurisdictions have drastic penalties for driving while under the influence of

<sup>6</sup> American Automobile Association

liquor and in spite of the fact<sup>7</sup> that accidents traceable to this influence have been increasing, the penalties are not often applied

This is not necessarily due to laxness of enforcement, but rather to the difficulty of proving in court that the person was intoxicated at the time the accident occurred. Unfortunately, the moral certainty of the arresting officer is not sufficient proof in the eye of the law. For this reason the charge is often changed so that the offender can be convicted of some lesser offense rather than be permitted to go scot free.

Although it is practically impossible to prove intoxication from symptoms alone, in the lesser degrees, the debatable cases make driving dangerous for the sober drivers. Even before a person is intoxicated, in the common interpretation of the term, there are effects that decrease driving ability—slower reactions, lesser coordination, narrowing of attentional field and that increased self-assurance which makes one think he is performing brilliantly while in fact doing anything but that.

A definite method of determining the degree to which a person's actions are influenced by a certain amount of alcohol is needed. Three methods of test are receiving research attention. Analysis of the blood, the urine, and the breath. The blood test is the most positive but it requires the voluntary cooperation of the subject. The other two need further correlation with the blood test. And for all three the percentage of alcohol found present must be more definitely related to traffic hazards. Also the problem of making use of such scientific methods in judicial procedure needs thorough study.

Research is needed to determine the real part played by alcohol in traffic accidents. "During 1936 the reported percentages in 26 States of 'had been

drinking' or 'intoxicated' participants in fatal accidents averaged 7 per cent for drivers and 11 per cent for pedestrians. Cities reported an average of 8 per cent for fatal accident drivers, and 10 per cent for pedestrians killed. That these percentages understate by an unknown amount the true situation is the belief of most traffic authorities. How high is the true percentage? That is the question."<sup>7</sup>

### *Spot Investigations*

Cutting across all of the divisions of the accident problem—roads, vehicles, drivers, pedestrians—is the need for study of accidents themselves. After all it is the combinations of circumstance which cause accidents that we must learn about in order to devise remedial measures.

Much has been learned from the recent study of public records of fatal accidents, but it is felt that much more can be learned from study of the reports of technical investigations of accidents made on the spot immediately after the occurrence. A competent technical observer should note many details, the significance of which would escape the police officer.

Since the combinations of factors causing accidents seem to be countless, adequate prosecution of such a research project will require examination of a large number of cases.

### CONCLUSION

In conclusion let me merely repeat that the big job will be to lower the accident rate among the great body of drivers, most of whom are reasonably careful, and whose serious accident expectancy is slight but whose numbers are so great that in the aggregate they produce a heavy toll in serious injury and loss of life.

This is no small problem.

<sup>7</sup> Accident Facts 1937, National Safety Council.

## DISCUSSION—THE HIGHWAY SAFETY PROBLEM

MR MAURICE HOLLAND, *Director, Division of Engineering and Industrial Research, National Research Council*

Mr Chairman, I have knowledge of this specific subject before you I am the voice of the pedestrian I live in New York City I have never driven a car I don't own one I have driven airplanes during the war and later I have definitely enlisted the sympathies of a group of pedestrians to form a Pedestrians' Protective League and although some of you plutocrats may be automobile owners or drivers, you are also pedestrians I do not know how many of you have tried to get across the streets of New York City when a taxi comes tearing round a corner with blast of horn or screeching brake Your life is not worth a nickel I gather that if we could mobilize in New York a considerable group, we could get a bunch of lawyers to defend our cases and to also educate our group in how much of that road is open to us, the pedestrians, as is the traffic for the motorist—that in a good many instances we would have New York's "Finest"<sup>1</sup> on our side

I had an experience recently at Sixth Avenue and Thirty-Ninth Street In trying to get across the street with the green

<sup>1</sup> New York City Police

light—I never cross except with a light—half a dozen impatient automobile drivers had to beat the gun before the traffic got across, but there was an alert cop there who put those boys where they belonged Everybody got across the street safely It was my particular pleasure to cite that man to the Commissioner of Police of New York City and shortly after he was promoted for his vigilance in the interest of pedestrians I do not know how the ratio is of pedestrians, automobile owners and drivers in New York City, but I have only to walk some 30 blocks in New York City twice a day and I am here to put on record the voice of the pedestrian who is going to rise in his wrath and use the same protective measures that you have on automobiles—safety devices, or organizations to see that he gets a square break

MR C M JOHNSTON, *Bureau of Public Roads*

Pedestrians, particularly in the South with its colored people, should wear lights or some sort of reflectors when walking on the highways at night It is not always the motorist's fault when he fails to see a pedestrian in the dark The pedestrian takes the attitude that the motorist can always see him It is not true, not even when the automobile has bright lights