

REPORT OF COMMITTEE ON CAUSES AND PREVENTION OF HIGHWAY ACCIDENTS

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Dean, Engineering College University of Maryland

Mr Fletcher's death last spring seriously set back the work of the committee which had scarcely been organized at that time, therefore an informal report is now presented

The committee was recently enlarged to include the following organizations

American Automobile Association
Highway Education Board
National Automobile Chamber of Commerce
National Safety Council
American Road Builders' Association
Bureau of Public Roads
Bureau of Standards
Bureau of the Census
American Railway Engineering Association
American Association of State Highway Officials
Chamber of Commerce of the United States

The idea being, that there should be represented on this committee as many organizations as have more or less direct contact with problems connected with highway safety. Just before his death, Mr Fletcher had completed an annotated bibliography on the subject of highway safety. This is now in mimeographic form, some 400 pages and arrangements have been made whereby those who would be particularly interested may secure copies. It remains to be decided whether it will be put in printed form.

COMMITTEE RECOMMENDATION

"The Committee is of the opinion that much will be accomplished towards the prevention of accidents by the wide adoption of uniform regulations, such as have resulted from the study by the National Conference on Street and Highway Safety, and the Committee therefore recommends that the Highway Research Board give its endorsement to the Model Municipal Traffic Ordinance and Model Motor Vehicle Law of the National Conference on Street and Highway Safety."

THE PERSONAL FACTOR IN HIGHWAY ACCIDENTS

SIDNEY J WILLIAMS

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Everyone agrees that in causing or preventing a highway accident the personal factor is even more important than the engineering or the legislative factor. In Connecticut the State Motor Vehicle Bureau attributes over 75 per cent of motor vehicle accidents to the operator, about 10 per cent to the pedestrian, and only 13 per cent to all other causes including mechanical equipment, weather and road conditions. Rhode Island attributes 65 per cent to the operator, 30 per cent to the pedestrian and 5 per cent to all other causes. The Massachusetts figures are similar although charging an even greater percentage to the driver. Without going further, these figures prove two things that in the judgment of competent state officials, the human factor, and especially the motorist himself, is chiefly responsible for most accidents, and that even in three adjoining states, with a great deal of travel back and forth across the state boundaries, the exact allocation of such responsibility is quite different, the percentage assigned to the pedestrian being three times as great in one state as in another. In brief, the personal element is extremely important, and yet we have little or no exact knowledge concerning it. The inexactness and paucity of our knowledge is shown by our frequent mention of "carelessness," "recklessness," "inattention" and the like as causes of accidents. These terms are themselves general and inexact and indicate a mental or physical condition of the driver which may be due to any one of numerous real causes.

The practical importance of the whole matter lies, of course, in this fact. that if the personal factor is so important in causing accidents, then in view of the great and increasing number of such accidents, there is vital need for us to learn more about the nature and extent of these personal characteristics and causes and how they may be controlled and the accidents prevented.

We have already learned, by experience, some very important lessons regarding the personal factor. We have learned from industrial experience that if a man or a group of men become sufficiently impressed with the necessity for avoiding accidents, accidents will stop. This impression can be created by education, discipline, or both. If the active interest of a plant or a department is aroused by putting it into a contest with other units—and it can be so aroused to a point where the man who suffers an accident and thus spoils the record becomes literally a social outcast—the accidents drop to almost nothing, and the reduction is just as great among the class of accidents hitherto regarded as unavoidable as among those regarded as avoidable. In other words, the will to avoid accidents is all important.

We have learned also that education and instruction, of the mass and of the individual, are effective in reducing accidents. We have learned that control of one's physical condition through physical examinations and other health and sanitary measures decreases susceptibility to accidents and that other measures for development of plant or individual morale are likewise helpful.

We have learned that these remedies work, that they produce practical results, even if we cannot always give scientific names to the exact causes which they remove or alleviate. We have learned all this chiefly in industry because we were studying accident causes and remedies in industry long before the advent of the modern traffic problem. We know also that the same sort of remedies are equally effective when applied to motor vehicle drivers who are under control as operators of taxicabs or other commercial vehicles.

It is in respect to the private driver that our problem today is the greatest and our knowledge the least. Even here we are not entirely in the dark. We know that it is possible to organize a large community for safety, to mobilize the community forces for a continuous campaign which combines engineering improvement, education, and law enforcement and thus to influence the personal factor sufficiently to bring a large and consistent reduction in motor vehicle fatalities. And we have learned that it is possible to produce similar results through the proper enforcement of drivers' license laws such as are in effect in some of the Eastern states. A careful statistical study of state automobile death rates, published in the December *National Safety News* and available in reprint form, shows conclusively that these license law states have reduced these fatalities by about 20 per cent as compared with what they would otherwise have been. This happy result is to be attributed to the combination, found in these states, of adequate examination of new drivers before licensing, revocation or suspension of licenses for illegal or dangerous driving, and a better than average enforcement of all the vehicle laws by a competent centralized state bureau.

But 20 per cent is not enough. These relative reductions, gratifying as they are, can hardly more than make up for the rapidly increasing number and mileage of vehicles on the highways. We must go further—much further—toward exact knowledge of personal characteristics as accident causes and how to control them.

Let me stop at this point to say a word regarding the relation between the personal factor, the engineering factor, and the legislative factor, not to mention any others. If the personal factor is so all important why do we concern ourselves at all with the engineering design of highways and of vehicles and with traffic laws and ordinances and control systems?

One answer is, that only rarely is an accident due to but one cause. Assuming a driver with a certain level of intelligence, skill, and desire to avoid accidents—he and the others will be less liable to accident on a well built highway than on a poorly built one, in a good car than in a car in poor condition, under a reasonable, uniform system of traffic regulation than under the opposite. Furthermore, to maintain a given level of safety, one can drive faster and more comfortably in a good car, on a good highway, under good traffic regulations. Just because these physical conditions are so much easier to deal with than the elusive individual, we must continue to do everything possible to eliminate or reduce highway hazards through building highways of adequate number and width, proper surface, easy grades, gentle curves, proper sight lines, uniform legible signs, and all the present or possible safeguards that engineering genius can devise.

And as for legislation, there is a very close connection between the right sort of legislation, and the control of the personal factor. I need not take your time to expound the obvious facts that the Uniform or Model Vehicle Code and Traffic Ordinance now before the American people offer the best possible basis for education in proper use of the highways, that unreasonable, archaic laws and engineering practices discourage and that good laws and good traffic engineering encourage observance of the rules of safe driving, and that, as I have already pointed out, proper enforcement of good laws is one of the very best methods of controlling the dangerous human traits which we term carelessness and recklessness. No—the more extensive and intensive study and control of the human factor is not a substitute for, but goes hand in hand with, better engineering, better legislation and better law enforcement.

How are we to get at this human factor? It is ever so much more difficult to study than an automobile headlamp, a piece of concrete road, or a traffic signal. Every individual is different, even to classify them is difficult, and the system of classification may itself beg the question which we are seeking to answer.

When the National Safety Council decided a few months ago to undertake a serious study of personality in relation to public accidents, we tried to outline certain definite and practical studies which would throw light on the general problem. We set up a committee to advise us on every step of the work, composed of both eminent psychologists and experienced safety men, as follows:

Dr. Walter V. Bingham (chairman), Personnel Research Federation
Lewis A. DeBlois, National Bureau of Casualty and Surety Underwriters.

Dr. Knight Dunlap, Johns Hopkins University.
Charles B. Scott, Bureau of Safety

Dr Miller McClintock, Bureau for Street Traffic Research, Harvard University

Sidney J Williams, Director, Public Safety Division, Nat'l Safety Council

J S Baker, Engineer, Nat'l Safety Council

Dr Forrest A Kingsbury, Prof of Psychology, Univ of Chicago

One of the specific things we undertook was a classified list of the personal causes of highway accidents. This list is presented as a part of this paper. The three main divisions are physical and mental deficiencies, ignorance, and inadvertency or lack of will to prevent the accident. Each of these is divided and sub-divided. In this list there is also indicated tentatively the method by which information may be obtained on each of the items—in some cases from the driver, in some cases from eye-witnesses or by special investigators. This classification is presented for the use of other students of the subject, as well as to be used by ourselves, as a basis for any scientific study of actual accidents to determine the relative importance of these various factors.

The next specific study that we took up was a study of accident repeaters, that is, persons (especially drivers) involved in more than one accident within a certain period. Thanks to their excellent laws and administrative systems, complete records of all personal injury and some property damage accidents are available in New York, Connecticut and perhaps a few other states, filed by the name of the operator. It will be possible to ascertain from these records how many persons have been involved in two, three or any other number of accidents as compared with those involved in only one or in no accidents over a certain period. By mathematical analysis this can be compared with the similar distribution on the basis of pure chance, thus proving whether or not it is true that certain individuals are more susceptible than others to accidents. Then the further study of the case records of these repeaters will disclose whether there is any tendency to repeat the same type of accident and whether the accidents involving repeaters are of any different type from the others. I cannot report to you the results of this study because it has not yet been completed.

The third important line of inquiry is to set up a scientific clinical examination of drivers involved in accidents to determine whether, individually or as a class, they exhibit any characteristics different from the general average. Steps are under way to set up such an inquiry in Pittsburgh as a joint enterprise of several interested bodies. It is planned to send to this clinic all drivers among certain groups who are involved in accidents, making it perfectly clear that the examination does not imply any responsibility or blame, certainly not any abnormality, and that we are simply making a scientific study to determine whether we can help this particular driver, and drivers in general, to avoid accidents. It is proposed that the examination will include, on the

physical and psychological side, certain standard tests of vision, reaction time, etc for which we already know the average figures for the general population. It will also include a further study of the driver and his accident, by a psychiatrist, to elicit, if possible, further information regarding personal factors bearing on the case. This expert examiner will then determine what were in his opinion the principal and contributing causes, using the classified list which I have already referred to, or some modification of it.

I am happy to report also that the National Research Council itself has recently set up a somewhat similar study to be made by Ohio State University at Columbus, following a procedure which is just sufficiently different to afford an interesting and valuable comparison of the methods and results. We hope very much that within a year some significant data will be available from both these researches.

Another very practical study has been proposed recently, which is not directly a study of personality but a study of present administrative methods in relation to personality. The proposal is to make a comparative study of the various methods of giving license examinations in the different states and the results obtained, the approach being made from the educational standpoint, the same as an educational expert might study the methods of giving arithmetic examinations in different schools. Such a research should bring forth some interesting and valuable comparisons which would greatly assist any states passing license laws next year and facing the problem of setting up the best possible administrative system. We are hoping to arrange for such a study as this in the near future, probably through the educational or psychological department of a leading university.

How can state highway departments or the highway engineering departments of colleges cooperate in the study of this vitally important problem?

The first thing that the state highway departments can do is to get and classify records of all accidents on their highway systems following the uniform method recommended by the American Association of State Highway Officials and developed by Mr. Hinkle of Indiana and his associates on the committee of that organization, the system being entirely in harmony with the Standard Accident Reporting System of the National Safety Council. Such reports will not yield much information directly on the personal factor but they will help greatly by narrowing down the problem and yielding accurate information on the external circumstances of accidents which must be considered in connection with the personal factors. Better still, any highway department which has the staff facilities can undertake a real investigation of the accidents on its system and attempt to classify them according to personal causes as well as according to external circumstances.

The universities and other research organizations have a remarkable

opportunity to contribute to the public welfare by conducting parallel or additional researches along any of the lines I have indicated. It goes without saying that the National Safety Council, its committees and staff, will gladly give all the information they have to anyone willing to devote time and energy to this work.

OUTLINE OF PERSONAL CAUSES OF ACCIDENTS

Method of Obtaining Information

In the outline of personal causes of accidents, the items are followed by letters which indicate the probable method of investigating

O—*Observation by Investigators*—Investigators need only to observe an individual to ascertain certain physical deficiencies.

T—*Tests*—Certain objective data may be obtained by tests.

S—*Special Tests*—In a few cases special tests or examinations may be necessary definitely to establish the condition of the individual

F—*Facts from the Individual*—Certain facts must come from the statements of the individuals involved in accidents. If possible, these should be obtained both at the scene of the accident and at a subsequent interview, to permit comparison.

C—*Conclusions of Investigators*—The opinions of investigators must be the last word regarding many of the factors. If an investigator or policeman is at the accident when or shortly after it happens, his conclusions should be compared with those of the investigators who interview the witness subsequently.

W—*Information from Witness*—Certain information can best be obtained from witnesses, among whom may be those who witnessed the accident and also those who are familiar with the life and habits of the individual being examined. Probably not much data may be obtained from witnesses but they should be used where available.

The first letters after the personal causes of accidents indicate the probable methods of determining them, the subsequent letters denote secondary or additional methods.

Technique of Investigating

Any general technique which may be developed at the present time for investigating the personal causes of accidents will unquestionably be modified materially as soon as it is applied in actual practice. The general plans suggested in the following paragraphs, therefore, are subject to continual modification and refinement.

It is to be expected that the personal causes of accidents will be complex. In many cases, two or more factors may appear to be equally

important but in general one can probably be isolated as the most important cause. There will be several less important contributing factors, and also some factors which appear to be unimportant in any given accident, but which might cause accidents.

Whenever possible, quantitative and objective information should be obtained.

The personality report must, of course, be supplemented by a factual report regarding the conditions of the accidents.

After having checked over carefully all of the items on a list of the personal causes of accidents, and after having had time enough to thoroughly picture the accident in his mind, the investigator should record his opinions of the causes. This statement of opinion should indicate the primary causes—those which, having been absent or different, would have prevented the accident, contributing causes which complicated or aggravated the accident, and finally those other factors which might cause accidents but apparently had no bearing on the one under consideration.

Copies of the conclusions ought to be kept by the investigator, the individual investigated, the National Safety Council and possibly others.

The exact steps required to complete an investigation may vary widely, depending on the local conditions. For instance, the police department accident investigation squad may be able to contribute much valuable information gained at the scene of the accident while the operator is still excited, and before he has had time to "rationalize" his actions. A psychologist or other skilled interviewer may make certain tests and complete the data. Still more refined information may be obtained by a psychiatrist interviewing the operator with psychological tests and data on the accident before him.

It is evident that much tact will be required of the investigators in examining individuals involved in accidents. A large part of the information necessary to determine the personal causes of the accidents must come directly from those involved and unless they are kept in the right frame of mind, the data obtained will be useless. Care must also be taken not to waste time on individuals who fear that the examination will be used against them, or of individuals who, for other reasons are apt to try to deceive the investigator.

All types of operators and of pedestrians should be examined. Both the investigators and those questioned must keep clearly in mind that the aim of this work is not to place responsibility for the accident but to determine its cause. For this purpose, the question of guilt should be left out, even the innocent person might, had he behaved differently, have prevented the accident.

Experience alone will indicate the best technique for investigating the personal causes of accidents.

TABLE I
PERSONAL CAUSES OF ACCIDENTS

Number	Description	Determined by	
100	PHYSICAL AND MENTAL DEFICIENCIES—HANDICAPS		
10	<i>Physical</i>		
1	Loss of limb.....	O	FC
0.1	Arm or hand.....	O	FC
0.2	Leg or foot.....	O	FC
2	Loss of fingers.....	O	
3	General lack of strength or weight.....	T	FC
4	General ill health.....	F	C
5	High blood pressure.....	S	F
6	Paralysis, and other defects.....	F	S
7	Right or left handed.....	O	TF
20	<i>Sensory defects</i>	T	
1	Eyesight.....	T	
0.1	With glasses.....	T	F
0.2	Without glasses.....	T	F
0.3	Color blindness.....	T	
0.4	Stereoscopic vision.....	T	
2	Hearing.....	T	FC
3	Reaction time.....	T	
0.1	Sight.....	T	
0.2	Sound.....	T	
0.3	Touch.....	T	
0.4	Thought, rapidity of making decisions.....	T	OC
4	Motor control.....	T	O
0.1	Hands.....	T	O
0.2	Feet.....	T	O
30	<i>Mental defects</i>	C	
1	Insanity.....	C	
0.1	Chronic alcoholism.....	C	FO
0.2	Epilepsy.....	C	F
0.3	Addiction to drugs.....	C	F
0.4	Other serious mental diseases.....	C	O
2	Feeble mindedness, imbecility, etc.....	C	O
200	IGNORANCE		
10	<i>General education</i>		
1	Schooling.....	F	C
0.1	Number of years in school or age at leaving.....	F	C
0.2	Highest class reached.....	F	C
2	Language.....		
0.1	Speaking or understanding.....	O	CF
0.01	English.....	O	CF
0.02	Other.....	O	CF
0.2	Reading.....	T	F
0.01	English.....	T	F
0.02	Other.....	T	F
3	Information regarding the accident problem.....	C	

Number	Description	Determined by	
20	<i>Training as a motor vehicle operator</i>		
1	Source of instruction.....	F	C
0.1	Automobile dealer.....	F	
0.2	Friend or relative.....	F	
0.3	Self.....	F	
0.4	Other source.....	F	
2	Nature of instruction.....	F	C
0.1	General instruction and road practice.....	F	C
0.2	Formal course of instruction to form proper habits.....	F	
3	Period of time over which instruction extended.....	F	C
4	Experience.....	F	C
0.1	Kind.....	F	CW
0.01	On country or suburban roads.....	F	CW
0.02	In city traffic.....	F	CW
0.2	Amount.....	F	CW
0.01	Years.....	F	CW
0.02	Miles or miles per year.....	F	CW
0.3	Drivers' license.....	F	
0.01	Kind and place.....	F	
0.02	Length of time held and times withdrawn.....	F	
5	Driving habits.....		
0.1	Habitual speeds.....	W	FC
0.2	Daily distance in touring.....	F	
0.3	Method of making stops.....	W	OFC
30	<i>Knowledge of motor vehicle laws</i>	T	C
1	State laws and road rules.....	T	C
2	City laws and ordinances.....	T	C
3	Penalties for violations.....	T	C
40	<i>Knowledge of mechanics involved in driving</i>	C	
1	Effect of speed on.....	C	
0.1	Stopping distance.....	C	
0.2	Collision damage.....	C	
2	Weight of car in relation to its kinetic energy.....	C	
3	Power of car.....	C	
300	INADVERTENCY—LACK OF WILL TO PREVENT		
10	<i>Mental sets</i>		
1	Overgrown idea of rights.....	C	W
2	Wilful violation of law.....	C	W
3	Showing off.....	C	W
4	Failure to allow for fallibility of others.....	C	WF
5	Faulty attitude.....	C	W
0.1	Non-cooperation.....	C	W
0.2	Feeling that because others do it, it is right.....	C	WF
20	<i>Predispositions</i>		
1	Intoxication.....		C
0.1	One drink.....	W	C
0.2	To extent of hilariousness.....	W	C
0.3	To extent of wobbliness.....	W	C

Number	Description	Determined by	
2	Monotony from uneventful driving.....	F	CW
0.1	Nothing expected to happen.....	F	CW
0.2	Asleep.....	F	CW
3	Preoccupation.....	F	C
0.1	Day dreaming.....	F	C
0.2	Thinking about other things.....	F	C
0.3	Worry.....	F	CW
4	Hurry.....		
0.1	Emergency.....	F	CW
0.2	Haste to make appointments.....	F	C
0.3	Haste to arrive at home, resort, etc.....	F	CW
0.4	Habitual haste.....	W	OC
5	Excitability.....	C	OW
0.1	Irascibility.....	C	OW
0.2	General nervousness.....	C	FOW
0.3	Nervousness that prevented action.....	C	FOW
6	Previous accident experience.....	F	
0.1	Motor or traffic.....	F	
0.2	Industrial or home.....	F	
30	<i>Distraction</i>		
1	Conversing with companion.....	F	CW
2	Smoking.....	F	CW
3	Back seat driving.....	F	CW
4	Adjusting car, clothing, or load.....	F	CW
5	Watching something on street.....	F	CW
0.1	People on sidewalks.....	F	CW
0.2	Advertising signs.....	F	CW
0.3	Other automobiles.....	F	CW
0.4	Signals.....	F	C
6	Sudden illness.....	C	F

DISCUSSION

ON

REPORT OF COMMITTEE ON CAUSES AND PREVENTION OF
HIGHWAY ACCIDENTS

FRANK B. BOSCH, *Manager, Paving Division, Central Construction Corporation, Harrisburg, Pennsylvania*: I cannot agree with Mr. Williams' statement that you cannot analyze the causes of these accidents. I am here as a paving contractor, but am also president of the motor club in my home town, and have been engaged in the past sixteen years in an endeavor to analyze the underlying causes of automobile accidents, as far as the human factor is concerned. Mr. Williams has said a great deal about psychology. We hear that word every day. I never hear it in an assemblage such as this without believing that about fifty

per cent of the audience would be unable to give a plain definition of what psychology is. It seems hard to define, but in psychology—to get down to fundamentals—the first law is that behind every action there is an actuating motive. I meet a great many who ask for proof. I say “Hold out your hand.” The man holds out his hand. I then say, “Now what made you do it, my suggestion had no power to move your hand, your hand has no power within itself to move, therefore the hand is moved because something up here, in the head, ordered the hand to move.” Now we will pass along and I will ask you to go back in your minds to your early school days, to the time when you could first coordinate words, or read them. What is your recollection of the first thing you learned to read? Just a moment now, I’ll try to tell you, the “Declaration of Independence.” How much of that Declaration do you recall? Isn’t it “that all men are created free and equal?” and our boys and girls come from our schools in this great Republic imbued with the idea that they are kings and queens by their own right.

I believe that the foregoing will furnish the solution. It seems quite simple, but, as we endeavor to solve difficult problems we are quite likely to search for difficult solutions, and if we do solve them are often amazed at the simplicity of the answer.

Now, we will go back to psychology or in other words “actuating motive.” A car comes down a street, another approaches from an intersecting street, they arrive at the intersection at approximately the same time, then the simultaneous thoughts—“I’m as good as you are” and neither gives way and we have our accident. The records show that a big majority of what we call accidents occur at intersections. If we were more considerate and less insistent on what we regard as our rights I believe we could eliminate over 90 per cent of our accidents.

Most of you can probably recall the campaign of a year ago last October put on by the American Road Builders Association, their newspaper and magazine matter, their printed form of pledge to observe “Courtesy and Caution.” Thousands of pledges were signed and sent in, over eight hundred thousand if I remember right, and while eight hundred thousand seems a lot it is a pitifully small percentage of over twenty millions of passenger cars. Caution and Courtesy happens to be the official slogan of my own motor club. If Courtesy and Caution or Caution and Courtesy—in operating a motor car they mean practically the same thing—were generally observed by those of us who operate cars on the highways from day to day, I believe we could practically eliminate highway accidents involving the motor car.

Some few years ago the Bureau of Standards was asked for an operating rule looking toward reducing highway hazards and accidents and the following was their proffered rule, “Always operate your car so

that you may come to a full stop within the distance of the clear course ahead" The "clear course ahead" is a very variable distance but the observance of that rule would work wonders in reducing road accidents

Now a few words on the mechanical side It is the almost universal practice when putting a new pair of tires on a car to apply them to the rear wheels For fifteen years or more I have made it a practice to put new tires on the front wheels only, and never to keep them there for over ten thousand miles, often less As a consequence I have not had a blow-out in fifteen years and only can recall one puncture I observe that rule for the reason that if I have a tire blow-out I want it to be one on a rear wheel.

How many of you can tell offhand how many feet per second a car travels at 20 miles per hour? It is 29 feet 3 inches Our standard highways are 18 feet wide, say a car at 20 miles per hour, 1 foot from right edge of an improved highway with a 5-foot berm, blows a right front tire, you are but 6 feet from ditch, bank or embankment and can traverse that distance in less than one-quarter of a second Blow a left front and you are but 18 feet from ditch on left and can traverse that distance in less than three-quarters of a second How many of us travel as slow as 20 miles per hour? Put the speed to 40 miles per hour and the time required to drag you into a ditch, or over an embankment, or into a bank by the explosion of a front tire, is cut to one-half the time calculated for 20-mile speed In these days of balloon tires the 4- or 5-inch drop by blow-outs, especially on front wheels is bound to drag the car to right or left as the case may be, if to the left, possibly into another car passing in the opposite direction I even discard rear tires if they reach 18,000 miles total on front and rear Possibly I throw away some mileage, but I consider it cheap insurance