MULTIDISCIPLINARY ACCIDENT INVESTIGATION

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RESEARCH REPORT 61

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62 *Psychological Analysis of Degree of Safety in Traffic Environment Design.* Charles J. Holahan, February 1979.

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64 *An Evaluation of the Utilization of Psychological Knowledge Concerning Potential Roadside Distractors.* Charles J. Holahan, forthcoming 1979.

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16. Abstract

This report reviews the literature generated by the Multidisciplinary Accident Investigation (MDAI) studies, sponsored under the Highway Act of 1966. The use of a wide variety of professional disciplines to evaluate accident causation produced detailed information and suggestions relating to human factors, vehicular factors, and environmental factors as causes of accidents. Results of MDAI studies will continue to be useful for generating further research and decisions related to highway safety.

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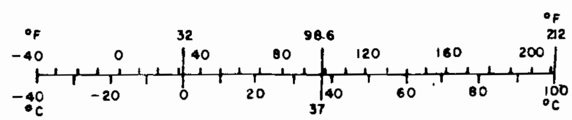
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



EXECUTIVE SUMMARY

The Multidisciplinary Accident Investigation (MDAI) technique is a relatively new and innovative concept in the area of accident evaluation. As part of the Highway Act of 1966, the MDAI concept was developed to utilize the skills of professionals and specialists as part of a united attack on traffic accidents. Twenty MDAI teams were sponsored by the National Highway Traffic Safety Administration (NHTSA) and the Motor Vehicle Manufacturers Association. The purpose of the MDAI teams was to provide public officials and citizens with the best possible description of the causes and associated injury-producing elements of traffic accidents. MDAI teams consisted of medical specialists, traffic engineers, automotive or mechanical engineers, human factors engineers, psychologists or psychiatrists, lawyers, and police technicians, whose purpose was to provide information for the development of new countermeasure techniques, to identify problem areas which could be analyzed through statistical evaluation of mass accident data, to provide topics for further in-depth evaluation, and to identify areas where laboratory research was needed.

Results of the MDAI studies were presented in terms of human factors, vehicular factors, and environmental factors as causes of automobile collisions. Human factors, which include conditions or states that are driver-related and which limit or impair the ability of the driver to perform driving functions, were reported to be a causative factor in most accidents (85-97%). Environmental factors were a causative factor in 18-31% of all accidents, and vehicular factors were causative in 6-16% of all accidents.[1]

Although MDAI teams are no longer federally funded, the results of the time, energy, and expertise expended by them can provide valuable information for countermeasure techniques and can further future safety research.

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[1]U. S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Public and Environmental Affairs, May 1, 1973), p. 15.

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TABLE OF CONTENTS

LIST OF FIGURES

I. INTRODUCTION

The National Highway Traffic Safety Administration (NHTSA) has been authorized to perform research and develop safety programs and standards in an effort to reduce the number of deaths, injuries, and the amount of property damage from traffic crashes. As part of the Highway Act of 1966, the Multi-disciplinary Accident Investigation (MDAI) concept was developed to utilize the skills of professionals and specialists as part of a united attack on traffic accidents. Twenty Multidisciplinary Accident Investigation teams were sponsored by the NHTSA and the Motor Vehicle Manufacturers Association. The purpose of the MDAI teams was to provide public officials and citizens with the best possible description of the causes and associated injury-producing elements of traffic accidents. Specifically, the objectives of the MDAI teams, as described by Fell, were to:

1) determine all the factors or conditions which contributed to the accident,
2) identify the mechanisms involved in injury causation,
3) evaluate the effectiveness of new safety features,
4) evaluate the relevant Federal Motor Vehicle Program Standards,
5) evaluate the relevant Federal Traffic Safety Program Standards, and
6) detect any design and functional problems of the vehicle and highway for immediate countermeasure action.[1]

The MDAI technique is a relatively new and innovative concept in the area of accident evaluation. The MDAI format and techniques will be discussed in detail along with the results of some of the individual MDAI team investigations.

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[1] U. S., Department of Transportation, National Highway Traffic Safety Administration, A State-of-the-Art of Multidisciplinary Accident Investigation Techniques: Human Data Generation, by James C. Fell. Workshop Session of Human Data Generation Committee, National Conference for Multidisciplinary Teams, Indiana University, Bloomington, Indiana, June 2-4, 1971 (Washington, D. C.: Department of Transportation, November 1971), p. 2. (Report No. DOT/HS-820-167)

II. DESCRIPTION OF MDAI

The collection of data through the Multidisciplinary Accident Investigation process differs greatly from most other accident research, which collects simple information from either police records or accident-involved individuals. MDAI teams, on the other hand, consist of various medical specialists (including pathologists and toxicologists), traffic engineers, automotive or mechanical engineers, human factors engineers, psychologists or psychiatrists, lawyers, and police technicians.

The teams, located at various universities and research centers throughout the country (See Figure 1), provided an adequate geographic coverage of the accident occurrences in the United States.

The MDAI units were organized to conduct full scope, in-depth studies of selected accidents. The accidents which were selected typically involved a fatality occurring within 24 hours of the collision, a serious injury, or a tow-away of the automobile, and in which at least one of the vehicles involved in the accident was less than three years old at the time. Special interest requests from police and other agencies were also evaluated.

The team immediately went to the site of the accident to report and evaluate causal and contributory factors using the methods and techniques of the various disciplines. Further in-depth analysis of the basic elements of the accident (human factors, vehicular factors, and environmental factors) were carefully explored and recorded in terms of the three phases of collision: pre-crash, crash, and post-crash phases. Findings ranged from obvious system and component failures to unique, subtle causal factors that would not have been detected by less sophisticated methods. The Annual Report to the Secretary on Accident Investigation and Reporting Activities - 1972 (hereafter referred to as ARS) states:

> Previously undetected, qualitative failures and causative factors, as well as accident trends can be determined by allowing these basic study teams the latitude to conduct broad scope inquiries

Multi-Level Accident Investigation Studies

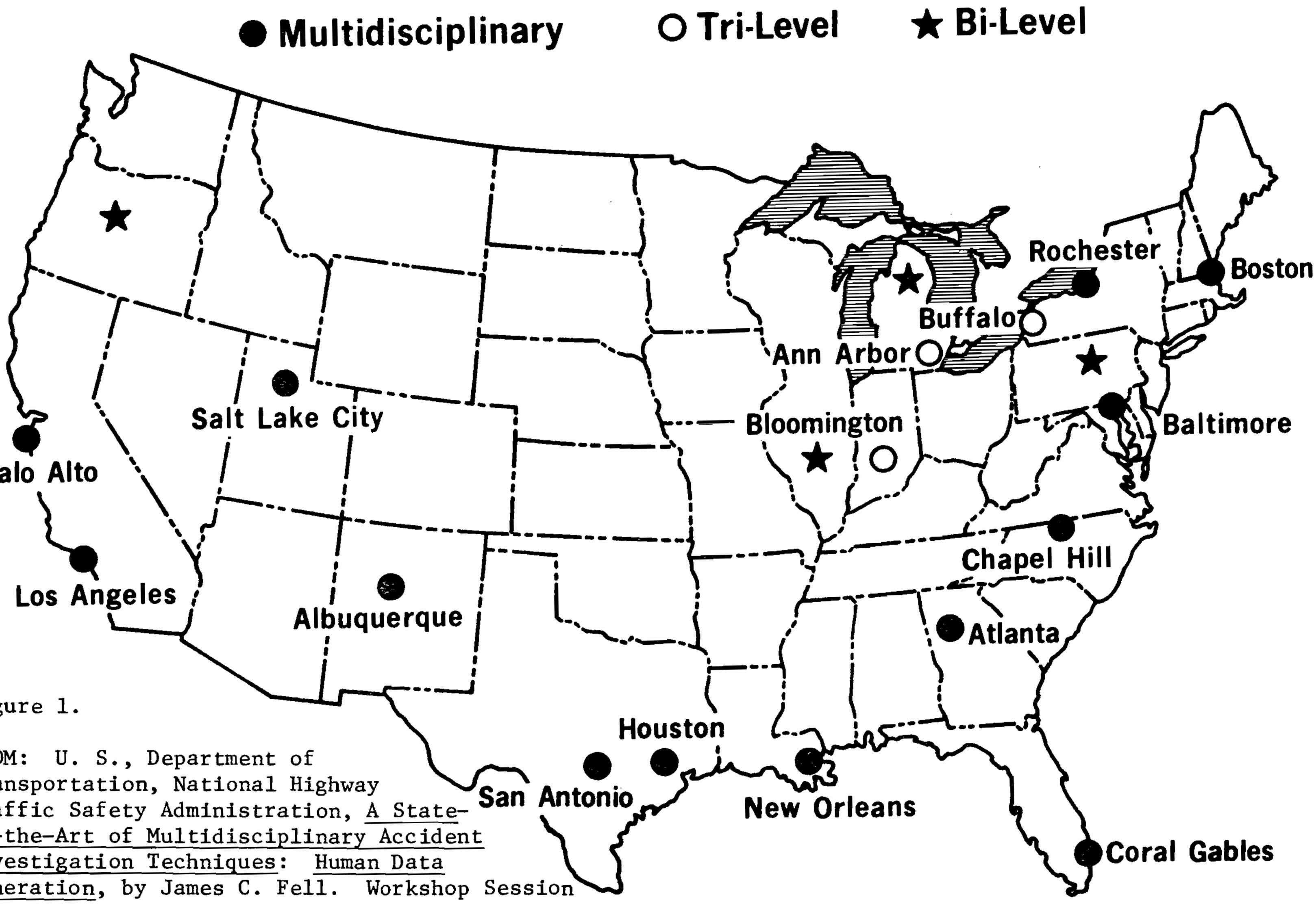

Figure 1.

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A State-of-the-Art of Multidisciplinary Accident Investigation Techniques: Human Data Generation, by James C. Fell. Workshop Session of Human Data Generation Committee, National Conference for Multidisciplinary Teams, Indiana University, Bloomington, Indiana, June 2-4, 1971 (Washington, D. C.: Department of Transportation, November 1971), p. 4. (Report No. DOT/HS-820-167) into each in-depth case. Positive clues that may develop during the course of the investigation are then followed up in detail.[2]

The case reports produced by MDAI teams can be utilized to provide information for the development of new countermeasure techniques, to identify problem areas which can be analyzed through statistical evaluation of mass accident data, to provide topics for further in-depth evaluation, and to identify areas where laboratory research is needed.

LEVELS OF RESEARCH

MDAI data collection was carried out according to an integrated tri-level accident investigation study design (Figure 2). Data was collected at each level to provide maximum information on highway accidents. Level I data were comprised of police-reported accident information which represented the universe of accidents and was often used to define general descriptions of accident modalities (time, day, general driver description, etc.). Level I data were usually referred to as "mass accident data" and provided a base level of general exposure, population, accident rate, mileage, highway characteristics, and other data necessary for proper interpretation of the study findings in the context of national accident trends.

Level II, or bi-level, investigations employed a technique whereby a limited number of special interest data items were added to the standard police reporting form over varying lengths of time. By this method it was possible to obtain a statistically significant volume of data on a particular safety related problem.

Tri-level studies (Level III) represented the most sophisticated in-depth accident investigation technique employed in the National Highway Traffic Safety Administration Accident Investigation Program. These studies were

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[2]U. S., Department of Transportation, National Highway Traffic Safety Administration, Annual Report to the Secretary on Accident Investigation and Reporting Activities -- 1972, by Office of Accident Investigation and Data Analysis (Washington, D. C.: Department of Transportation, February 1973), p. 48 (Report No. DOT/HS-820 255)

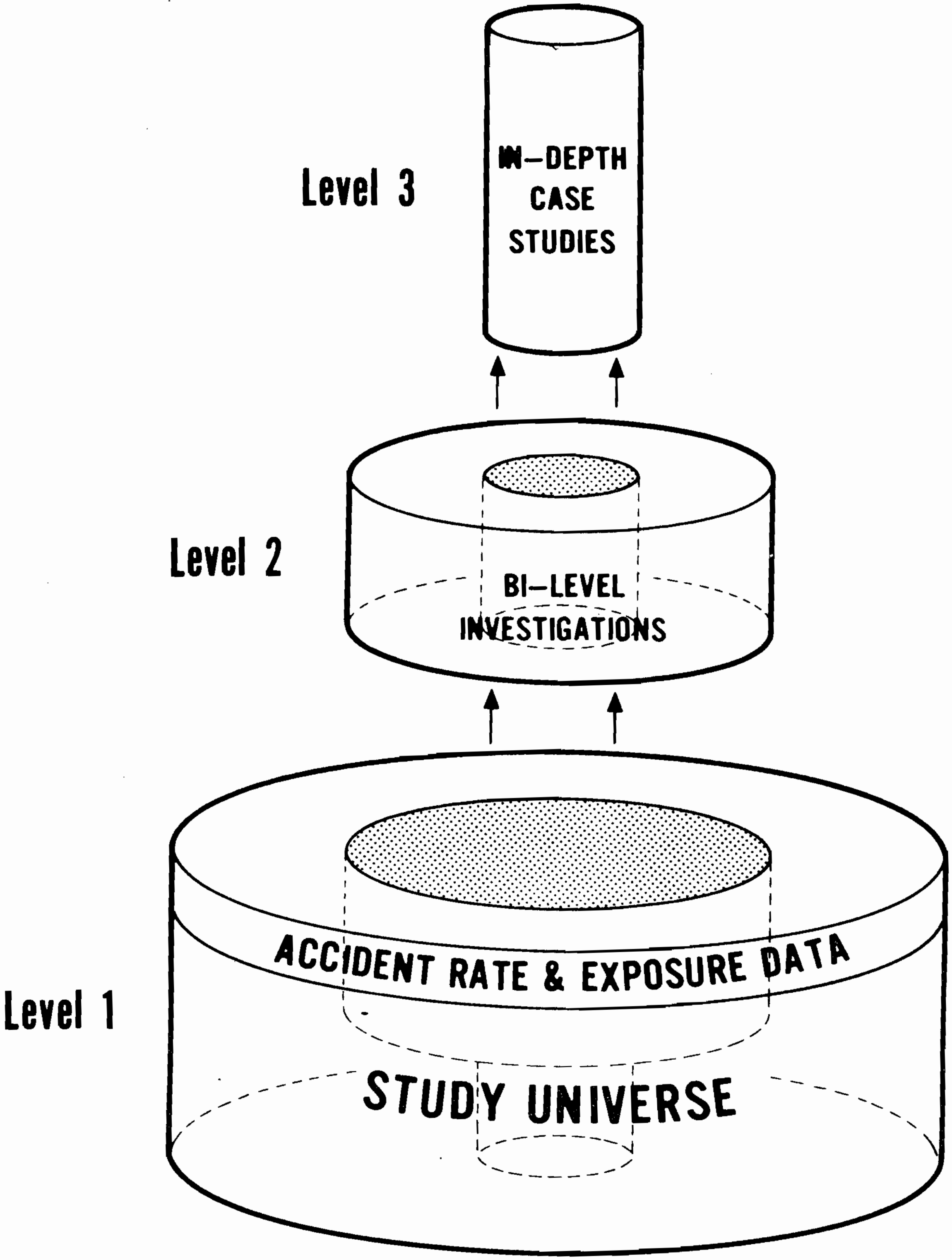

Figure 2. **INTEGRATED TRI-LEVEL ACCIDENT INVESTIGATION STUDIES**

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, Annual Report to the Secretary on Accident Investigation and Reporting Activities -- 1972, by Office of Accident Investigation and Data Analysis (Washington, D. C.: Department of Transportation, February 1973), p. 20. (Report No. DOT/HS-820-255) either exploratory in nature or were focused on a single highway or motor vehicle safety problem of critical importance. Tri-level studies included the top level of in-depth MDAIs as described earlier. The sample of accidents investigated in this level was small and was biased toward severe or "special interest" accidents. The tri-level studies represented the most detailed evaluations of accidents within the MDAI framework.

BASIC ELEMENTS OF ACCIDENT CAUSATION

Multidisciplinary Accident Investigation teams have operated and gathered data using all three levels of inquiry. The tri-level use of the MDAI team has yielded results based on three basic elements of accident causation: human factors, vehicular factors, and environmental factors.

Human Factors

Human factors were defined in A Study to Determine the Relationship Between Vehicle Defects and Crashes (hereafter referred to as SDR) as:

> . . . both acts and failures to act in the minutes immediately preceding an accident which increase the risk of a collision beyond that which would have existed for a conscious driver meeting a high but reasonable standard of good defensive driving practice.
>
> Human causes of accidents were categorized first as being either direct causes or human conditions or states. Direct causes are information processing failures on the part of the driver. These include delays; errors; and total failures in the perception, comprehension, decision-making, and action functions which the driver must perform in order to successfully complete the driving task. Conditions and states are driver-related factors which limit or impair the ability of the driver to perform these functions.[3]

Several methods have been utilized to obtain complete data related to human factors as a possible cause of accidents. A first-hand description of

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[3]U. S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Public and Environmental Affairs, May 1, 1973), p. 18.

the sequence of events of the accident, demographic data, and psychological data can be gathered in a variety of ways. Fell describes a tape-recorded interview process which involves cue cards used by the psychologist or trained interviewer (see Figure 3). On-the-scene use of the technique is successful mainly with uninjured or slightly injured individuals. Off-scene, it can be used at the hospital or in the home after hospital release. Fell also describes an additional psychological interview to obtain information from relatives, friends, and associates of a fatally injured driver, to obtain information pertaining to the accident sequence of events, and also to make a psychological assessment of the subject.[4]

Mill records the information regarding human factors variables in questionnaire form (see Appendix A). Katz Scale Analysis and other psychological questionnaires were utilized in an effort to obtain in-depth, complete information regarding socio-economic class, race, psychological factors, drinking habits, etc., of the "at-fault" driver. Autopsies were also performed by pathologists to determine drug levels in deceased, "at-fault" drivers.[5]

Fell suggests a technique for acquiring human data information which is depicted in Figure 4. The MDAI human data generation techniques suggested include an interview, a records assessment, and a psychological evaluation of each phase of the crash. Included in the evaluation of the human factors dimension would be not only the history of the driver (psychological as well as physiological) but also an evaluation of emergency medical services.[6]

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[4]U. S., D. O. T., State-of-the-Art of MDAI, pp. 8-11.

[5]U. S., Department of Transportation, National Highway Traffic Safety Administration, Multidisciplinary Accident Investigation Final Report -- Oklahoma, by R. A. Mill, M. L. Williams, J. L. Purswell, and H. Beaulieu (Washington, D. C.: Department of Transportation, January 1976). (Contract No. DOT/HS-219-3-708; Report No. DOT/HS-801-799)

[6]U. S., D. O. T., State-of-the Art of MDAI, pp. 10-17.

DRIVER

Identification Data:

- Vehicle identity
- # Occupants (where seated)
- Driving experience (years)
- Yearly mileage
- Driver education (type, completed)
- Vehicle familiarity (years, miles)
- Occupation
- Height
- Weight
- Date of birth
- Marital status
- Education level (grade, high, college, advanced)
- Physical impairments
  - corrective lenses
  - color blind

Pre-Crash Data:

- Trip Plan:
  - Origin (time)
  - Destination (ETA)
  - Purpose
  - Familiarity with route
  - Familiarity with area
    - % city driving
    - % suburb
    - % expressway

Collision Description:

- Exact details before impact
- Direction of travel
- Lane used
- Estimated speed (how determined)
- Traffic condition (both ways)
- Point of first awareness of danger (on road)
- Decision—Action
- Assumptions made by driver (vehicles, signals, etc.)
- View obstructions
- Distractions
  - Internal (passengers, radio)
  - External
- Driver in control of vehicle
- # Hands on wheel
- Left or right foot braking

Activities Prior to Collision:

- Sleep
- Work
- Recreation (strenuous)
- Travel (long distance)
- Immediate condition and infirmities (medicine)
- Pressures--state of mind
- Alcoholic beverages or drugs
- Smoking or eating

Vehicle Appraisal:

- Classification by driver (good, fair, poor)
- Equipment pertinent to collision (brakes, steering)
- Where serviced (last repair)
- Luggage or cargo (weight, location)
- Other vehicles owned/driven

Crash Data:

- Restraint system
  - used
  - not used
- Point of impact on car
  - on road
- Speed at impact
- Time of impact
- Driver action at impact
  - bracing
  - unaware
  - covering up
- Final resting position
- Description of injuries
- Loss consciousness
- Interior areas contacted
- Doors open upon impact (were they locked)
- Ejection
- Struck by any loose objects

Post-Crash Data:

- Description of post-crash travel
- Driver actions
- Injuries sustained
- Restraint release problems
- Exit from vehicle (assistance)
- First aid
- Ambulance service (time element)
- Manner of leaving scene

Other Areas of Inquiry:

- Was accident preventable (avoidable)
- Reasonable action by others (by driver)
- Action in similar situation
- Highway contribution to accident
  - Opinion of speed limit
  - Highway maintenance
  - Control device meaning (if involved)
  - Preferred lane of travel
    - (this road)
    - (in general)
  - Area speed limit
  - Safe following distance (at indicated speed)
- Previous accidents:
  - How many as a driver
  - When most recent
  - Involvement in similar type

Identification Data (if necessary):

- Name
- Address
- Phone #
- Insurance Company
- Drivers license # (restrictions, etc.)
- Registration

Figure 3. Human Factors: Interview Process

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A State-of-the-Art of Multidisciplinary Accident Investigation Techniques: Human Data Generation, by James C. Fell. Workshop Session of Human Data Generation Committee, National Conference for Multidisciplinary Teams, Indiana University, Bloomington, Indiana, June 2-4, 1971. (Washington, D. C.: Department of Transportation, November 1971), p. 9, Figure 4. (Report No. DOT/HS-820-167)

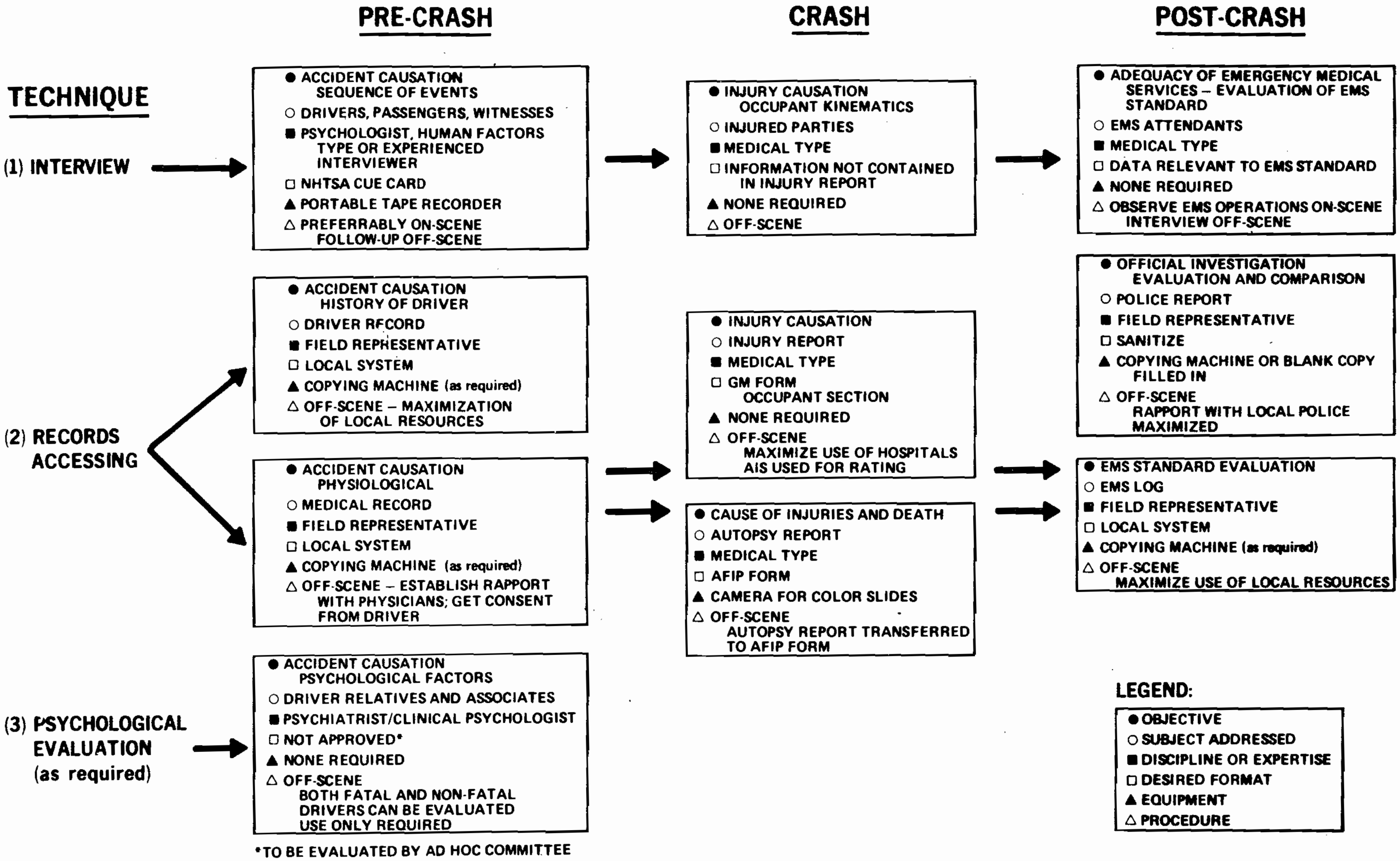

Figure 4. Human Data Generation Techniques (Multidisciplinary Accident Investigations)

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A State-of-the-Art of Multidisciplinary Accident Investigation Techniques: Human Data Generation, by James C. Fell. Workshop Session of Human Data Generation Committee, National Conference for Multidisciplinary Teams, Indiana University, Bloomington, Indiana, June 2-4, 1971. (Washington, D. C.: Department of Transportation, November 1971), p. 22. (Report No. DOT/HS-820-167)

Vehicular Factors

The vehicular factors which may cause accidents were defined in SDR as "all types of failures and degradations, both those associated with manufacture and those arising out of neglect or improper maintenance."[7] Vehicular factors most frequently implicated in accident causation were the braking system, tires and wheels, communication systems, steering systems, and body and doors. Appendix B is an example of the vehicle data form used by an MDAI team in Oklahoma.

Environmental Factors

The environment as a causative factor in accidents was defined in SDR as

> . . . factors external to the driver or vehicle which increase the risk of the accident involvement excessively or unnecessarily. Highway-related environmental factors are relatively permanent, and are closely associated with highway design, construction, and maintenance. Examples of ambience-related environmental factors include weather and traffic conditions.[8]

Figure 5 illustrates the program matrix for highway safety research. Evaluation of the human, vehicular, and environmental factors as related to accidents was made for each accident phase. The pre-crash phase evaluation stressed accident avoidance factors. Suggestions in this area may include: not driving while intoxicated (human factor); maintaining adequate tire tread (vehicular factor); and repairing stop light (environmental factor). The crash evaluation focused on injury prevention factors. Possible findings may include: cushioning head in arms (human factor); operative air cushion restraint system installed in the car (vehicular factor); and guard rails installed on a curb (environmental factor). The evaluation of the post-crash phase of an accident stressed severity reduction. Identifiable factors in this area may include those mentioned in the crash phase as well as the provision of adequate ambulance service (environmental factor).

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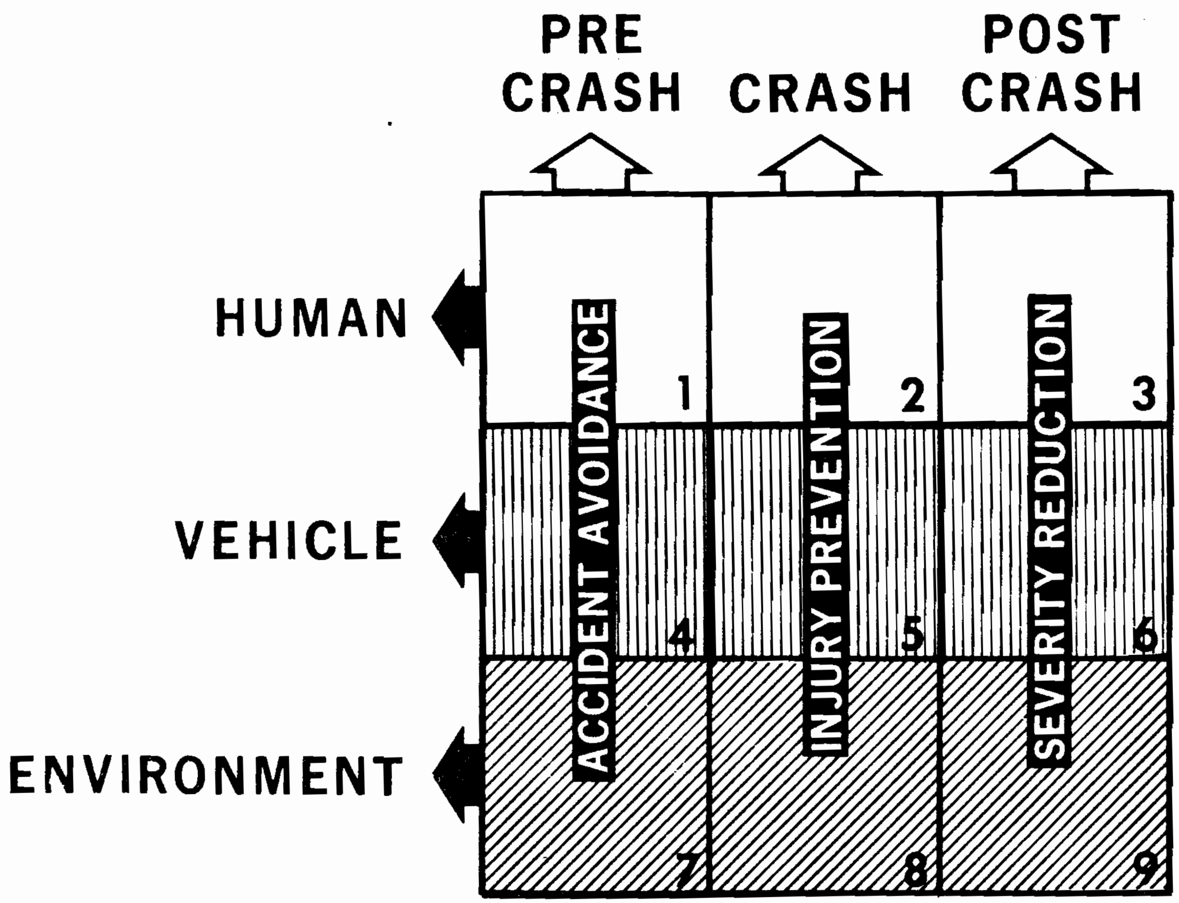
[7] U. S., D. O. T., SDR, p. 24.

[8] Ibid., p. 22.

Figure 5.

PROGRAM MATRIX FOR HIGHWAY SAFETY RESEARCH



FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A State-of-the-Art of Multidisciplinary Accident Investigation Techniques: Human Data Generation, by James C. Fell. Workshop Session of Human Data Generation Committee, National Conference for Multidisciplinary Teams, Indiana University, Bloomington, Indiana, June 2-4, 1971 (Washington, D. C.: Department of Transportation, November 1971), p. 6, Figure 3. (Report No. DOT/HS-820-167)

One level of accident investigation involves basic police reporting, which provides a large data base of accident information at a low unit cost, given that police must be on the scene, anyway. This method of accident study provides a sufficient amount of data to allow for statistical analysis. A second level of accident data acquisition involves specially-trained police, engineering teams, or police reporting techniques adapted to permit a more detailed data collection. Neither of these levels, however, is designed to provide the insight nor the detail into specific accidents that the multidisciplinary approach provides. Mill states:

> Traffic accidents are complex events which involve factors associated with human behavior, the vehicle, and the environment. Therefore, a panel review team must consist of persons with expertise in these various areas, in order to view the accident in total perspective and have all facts adequately evaluated. . . . Through interaction with each other they could arrive at the most probable cause, severity increasing factors, and the various contributing factors.[9]

The MDAI approach is the most sophisticated accident investigation procedure presently used in this country, requiring in-depth evaluations on several levels. Several obstacles to obtaining complete information have been identified by researchers. Cromack mentions problems in obtaining prompt notification of when accidents happen, not being notified of minor accidents, and not gaining cooperation from accident-involved individuals due to apathy or their fear of legal complications.[10] In the ARS, the authors reported that the teams' lack of intestigative authority and their vulnerability to subpoena has inhibited accident investigation research efforts. An estimated 20% of all cases were abandoned for investigation due to insufficient cooperation or actual resistance of accident-involved individuals.[11]

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[9] U. S., D. O. T., Final Report -- Oklahoma, p. 2.

[10] U. S., Department of Transportation, National Highway Traffic Safety Administration, Multidisciplinary Accident Investigations: Special Study of Active and Passive Restraint Systems in 1973-1976 Model Year Vehicles, Volume II, by J. Robert Cromack, et al. (San Antonio, Texas: Southwest Research Institute, March 1976). (Contract No. DOT/HS-801-973, 975, 976, 977)

[11] U. S., D. O. T., ARS, pp. 10-11.

Multidisciplinary accident investigation provides insight into highway safety problems that research, with less than in-depth investigation, cannot achieve. Larger scale statistical studies can use MDAI results to determine the magnitude of specific areas of accident causation. Other users of MDAI results include safety agencies, the auto industry, biomedical professionals, universities, research centers, and insurance companies.

However, there has been criticism of the MDAI approach. The pamphlet Automobile Collision Data - An Assessment of Needs and Methods of Acquisition suggests that decisions made on the basis of MDAI evaluations are based on a very small sample of an undefined and relatively undefinable population; thus our ability to draw inferences from them for the national accident picture is severely limited.[12] Campbell also criticizes the tri-level system because "these samples are larger, but the negative aspect is that the reporting threshold is based on accident severity which results in eliminating certain cases in which safety belt and perhaps other safety device effectiveness is greatest."[13]

Eldridge criticizes the MDAI approach on the basis of finances. She states:

> As a system for producing statistical information needed for supporting our safety standards, the on-scene, in-depth investigations can not be regarded as cost effective. The average cost per case is about $2,000.[14]

Eldridge also mentions that, although the accuracy of information for analysis is generally good, the representativeness of the sample that has been produced has been poor.

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[12] Economics and Science Planning, Inc., Automobile Collision Data - Assessment of Needs and Methods of Acquisition, pamphlet prepared under Contract No. OTA C11, Washington, D. C., February 17, 1975.

[13] B. J. Campbell, statement presented at the Automobile Collision Data Workshop [sponsored by Economics and Science Planning, Inc., Washington, D. C.], January 17, 1975.

[14] Marie E. Eldridge, "Adequacy and Limitations of Current Data Systems" (Washington, D. C.: National Highway Traffic Safety Administration, January 16, 1978).

The ARS lists two closely related, basic drawbacks to the tri-level, MDAI studies: such studies are expensive, and the set-up time in a geographic area is extensive. It takes approximately two to three years to begin to produce meaningful results from these tri-level studies. The ARS, therefore, states that

> . . . these studies are most cost-effective once the results begin to be generated. Exposure data are known in the area so extrapolation can be made; clinical trends can be followed up with intermediate level statistical studies; gross findings can be explained in-depth by the MDAI team; etc. . . . Long term benefit (up to five years), therefore, is at a maximum with tri-level studies. Once established, their payoff is then fast and reliable due to the amount of data they normally have for support.[15]

It appears that, although disadvantages and problems do exist in multidisciplinary accident investigations, the advantage of having the various professionals thoroughly examine and evaluate accidents is that this approach generates further research and decision-making. The following section will be devoted to a discussion of some of the results described by several MDAI teams.

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[15]U. S., D. O. T., ARS, p. 33.

III. RESULTS OF MULTIDISCIPLINARY ACCIDENT INVESTIGATION

The results of multidisciplinary accident investigations and the conclusions drawn from the teams are considerable and broad in scope. Several major investigations will be discussed in this section.

The results will be presented in terms of their relevance to human factors, vehicular factors, or environmental factors as the causes of automobile collisions.

HUMAN FACTORS

As stated earlier, human factors as a cause of vehicle accidents are driver-related factors which limit or impair the ability of the driver to perform driving functions. The Indiana University Institute for Research in Public Safety (IRPS), using MDAI information, reported in SDR that human factors were definite or probable causal factors in 97% of accidents. (See Figure 6). Environmental factors, on the other hand, were definite causal factors in 18% of accidents and definite or probable causes in 31% of accidents. Vehicular factors definitely accounted for only 6% of accidents and when "probably caused" was added to the "definitely caused" category, vehicular factors accounted for 16% of accidents investigated.[16] As can be seen, human factors are an extremely important area of investigation, and an understanding of them is essential for highway safety improvement.

The IRPS, in the same study, examined the human factors area in greater detail to determine most frequent causes of accidents. (See Figure 7). The report states:

> Among the general categories of human direct causes, decision errors were implicated most frequently, followed closely by recognition errors. Performance errors and critical non-performances were implicated much less frequently than either of these. The specific human errors most frequently implicated were improper lookout, improper evasive action, excessive speed, and inattention.[17]

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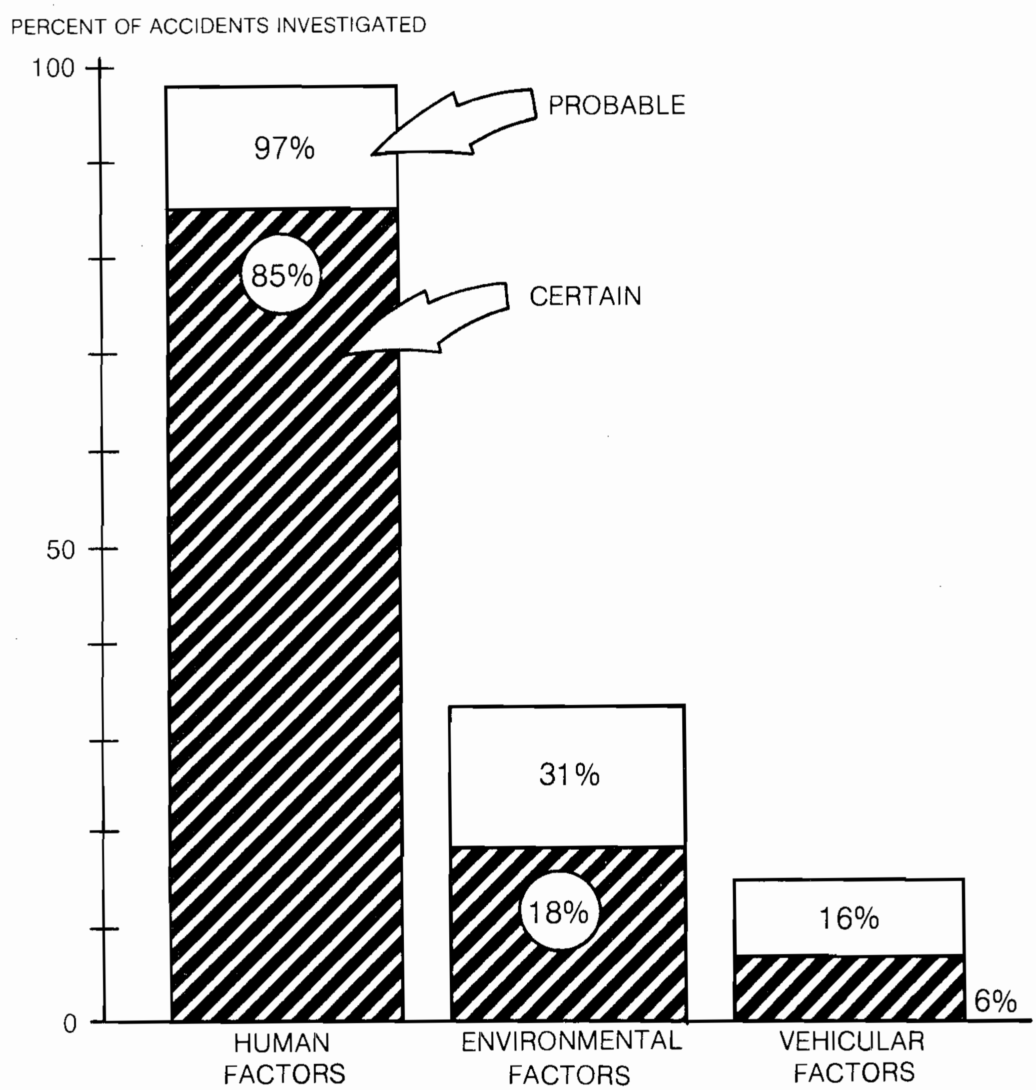
[16] U. S., D. O. T., SDR., p. 15.

[17] Ibid., p. 18.

Figure 6.

Human Factors Were Involved in Nearly All Accidents



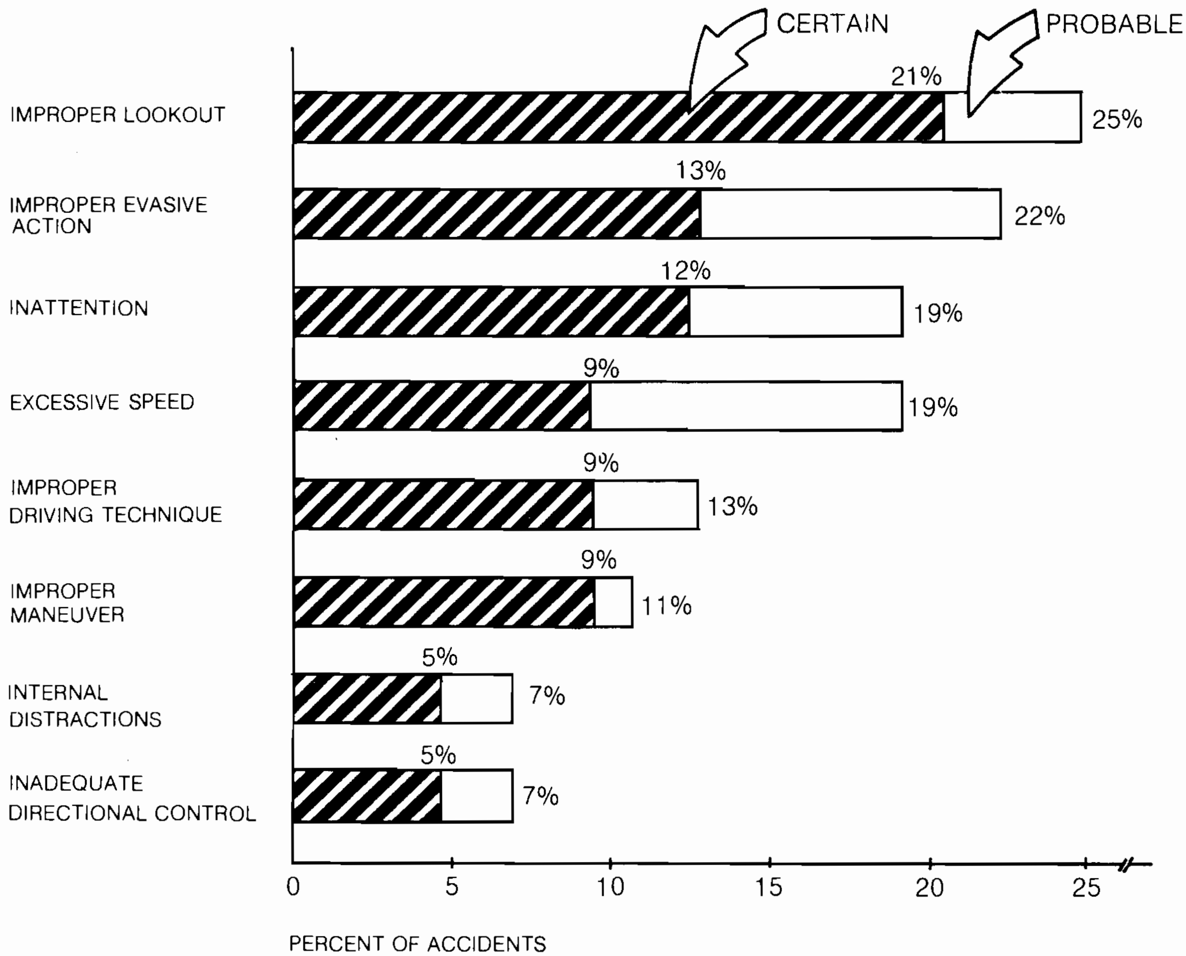
Based on Phase II, Level C Causal Data

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Public and Environmental Affairs, May 1, 1971), p. 15, Figure 3.

Figure 7.

The Four Human Factors Which Most Frequently Caused Accidents Were:

1. Improper Lookout
2. Improper Evasive Action
3. Inattention
4. Excessive Speed



Based on Phase II, Level C Causal Data

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Environmental and Public Affairs, May 1, 1973), p. 19, Figure 5.

In addition, the IRPS study reported that impairment by alcohol was a definite or probable cause in 16% of accidents studied in Phase I of the project.[18]

Perchonok reports results of MDAI from the Cornell Aeronautical Laboratory, Inc., which described the drivers involved and the accident settings. Some of the significant findings in the analysis were: that human errors alone accounted for 57% of the accidents (human and environmental problems accounted for another 30%); drinking drivers were much more likely to be culpable than non-drinking drivers; and, although persons with driver education training showed no advantages with regard to accident culpability or involvement due to high risk behaviors, they were less likely to be intoxicated than other accident drivers.[19]

Fisher reports from the findings of the Maryland Medical-Legal Foundation, Inc., that psycho-social factors play an important role in the etiology of serious motor vehicle accidents. Fisher discusses the findings of an MDAI team which evaluated 52 vehicular accidents (26 fatal and 26 non-fatal) occurring in the Greater Baltimore Metropolitan area from June 28, 1973, to June 24, 1974:

> Alcohol was considered as the primary factor responsible for 42% (11) of the 26 fatal accident cases investigated. In an additional five fatal accidents, alcohol consumption represented a contributory factor in accident causation. In summary, of 26 fatal accidents, the consumption of alcohol exercised a primary or causative role in 61% of these instances. Among the non-fatal group of 26 accidents, alcohol was considered as primary or contributory to the accidents in 34% of these cases.[20]

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[18]Ibid., p. 20.

[19]U. S., D. O. T., National Highway Traffic Safety Administration, Accident Cause Analysis, by K. Perchonok. (Buffalo, New York: Cornell Aeronautical Laboratory, Inc., July 1972) (Contract No. DOT/HS-053-1-109; Publication No. DOT/HS-800-716)

[20]U. S., D. O. T., National Highway Traffic Safety Administration, Maryland Medical-Legal Foundation, Inc. Multidisciplinary Accident Investigation: Volume I, Final Report by Russell S. Fisher, M. D., et al. (Washington, D. C.: Department of Transportation, May 1976) (Contract No. DOT/HS-198-3-770; Report No. DOT/HS-801-919)

These findings concur with other accident research as reviewed by Young, Valentine, and Williams.[21]

Fisher also reports that excessive speed was considered a primary causative factor in 15% and a contributing factor in an additional 25% of the fatal accidents. In the non-fatal accidents investigated, excessive speed was a primary factor in 30% of the accidents.

Fisher also notes that drivers with available restraint systems are not using these devices. He states that "twenty of the twenty-two drivers killed were not using the available restraints."[22] Fisher estimates that a 70% fatality reduction would have resulted if restraints had been used.

Mill, et al. report the findings of an MDAI team in Oklahoma.[23] The special interest in this investigation was alcohol-related accidents. Tulsa, Oklahoma, which has no Alcohol Safety Action Program (ASAP), was compared with Oklahoma City, which does have an active ASAP. Although no difference was found between the two cities in total percentage of alcohol-related fatal accidents, some interesting results were elicited from the investigation. Of the total 59 fatal accidents evaluated in Oklahoma City, 25 accidents, or 42.4%, were classified as alcohol-related. This compares with 12 out of 30, or 40%, of the fatal accidents in Tulsa being classified as alcohol-related. It was found that there was no statistical significance between these two values; however, the authors believe that there were enough indicators to conclude that the ASAP program was having a direct beneficial effect. Some of the results and conclusions drawn from the Oklahoma investigation include:

1. There appears to be a real difference in the marital status of drivers involved in alcohol-related (A/R) and non-alcohol related (non-A/R) accidents in both cities. The A/R driver is more likely to be separated or divorced than the non-A/R.

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[21] R. K. Young, D. Valentine, and M. S. Williams. Alcohol and Accidents, (Austin, Texas: Council for Advanced Transportation Studies, The University of Texas at Austin, 1977)

[22] U. S., D. O. T., Maryland Report.

[23] U. S., D. O. T., Final Report--Oklahoma.

2. There is a significant difference in the percentages of problem drinkers involved in fatal accidents between Tulsa and Oklahoma City. In Tulsa, 75% of all the A/R drivers were problem drinkers, while 44% were in Oklahoma City. It is believed that this could be the direct result of the Oklahoma City ASAP.
3. The time of collision in categories is consistent in both cities. The A/R accident is more likely to occur from 8:00 p.m. to 4:00 a.m. in both cities, while the non-A/R is more likely to occur from noon to 8:00 p.m.

Cromack and Williamson report that the Southwest Research Institute in a Texas MDAI study identified a total of 674 factors which were contributory causes of accidents. Fifty-one percent pertained to the human/psychological element. The majority of the factors were identified as pre-crash factors where avoidance measures can be instituted most easily. "Moreover," the authors state, "since nearly 75% of the pre-crash human/psychological elements were causative, improvements made in this area could result in a major reduction in accident and injury severity."[24]

Countermeasure techniques designed to address human factors as the cause of vehicular accidents should be initiated after further verification of MDAI results. Specifically, alcohol-related accidents and non-use of restraint systems could be the focus of highway safety countermeasures. Improper lookout, improper evasive action, inattention, and excessive speed have also been identified as major causes of accidents. The redesigning of driver's education training to more strongly emphasize these problems may aid in reducing traffic accidents and fatalities. Defensive driving courses which focus on these variables should also be helpful in reducing accident rates.

VEHICULAR FACTORS

Vehicular factors have also been found to be causes of automobile accidents by MDAI research. Although vehicular factors were found to be less

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[24] J. R. Cromack and T. R. Williamson, "Human/Psychological Factors in Multidisciplinary Accident Investigation," Proceedings of the Fifteenth Annual Conference of the American Association for Automotive Medicine, October 20-23, 1971, Colorado Springs. (New York: Society of Automotive Engineers for the American Association for Automotive Medicine, 1972).

often associated with accident causation than human factors, SDR reports that in 6% of all accidents vehicular deficiencies were indicated as a definite causal factor. Vehicular factors were found to be a definite or probable causal factor in 16% of all accidents studied.[25] Figure 8 illustrates that braking system deficiencies were the vehicular factors most frequently implicated. Other factors included deficiencies of tires and wheels, communication systems, steering systems, body and doors, power train and exhaust, suspension system, and driver seating and control system.

Treat and Joscelyn state, based on the Indiana University MDAI study results: "Given there was a vehicle causal factor, the fact that 43% of them were in the braking system and 28% in the tires and wheels provided important information for the Office of Operating Systems."[26]

Fisher reports that as a result of the Maryland Medical-Legal Foundation, Inc., MDAI study, vehicular change suggestions have been made to automobile manufacturers in hopes that these changes may reduce the frequency and/or severity of accidents. Examples of these alterations include usage of breakaway rear view mirrors; improvement of hood-latching components; use of energy absorbing materials in vehicle interiors; improvement in the door latching systems of many of the compact foreign imports; improvement of the seat structure and mounting on compact model vehicles; strengthening of windshield mountings, particularly in the compact model vehicles; installation of side door guard barriers in all vehicle models; and improvement of roof and supporting structures. Fisher also reported that head restraints, rearward displacement of the steering shaft, windshield glazing materials, and absorbing bumpers have performed satisfactorily in reducing severity of injury.

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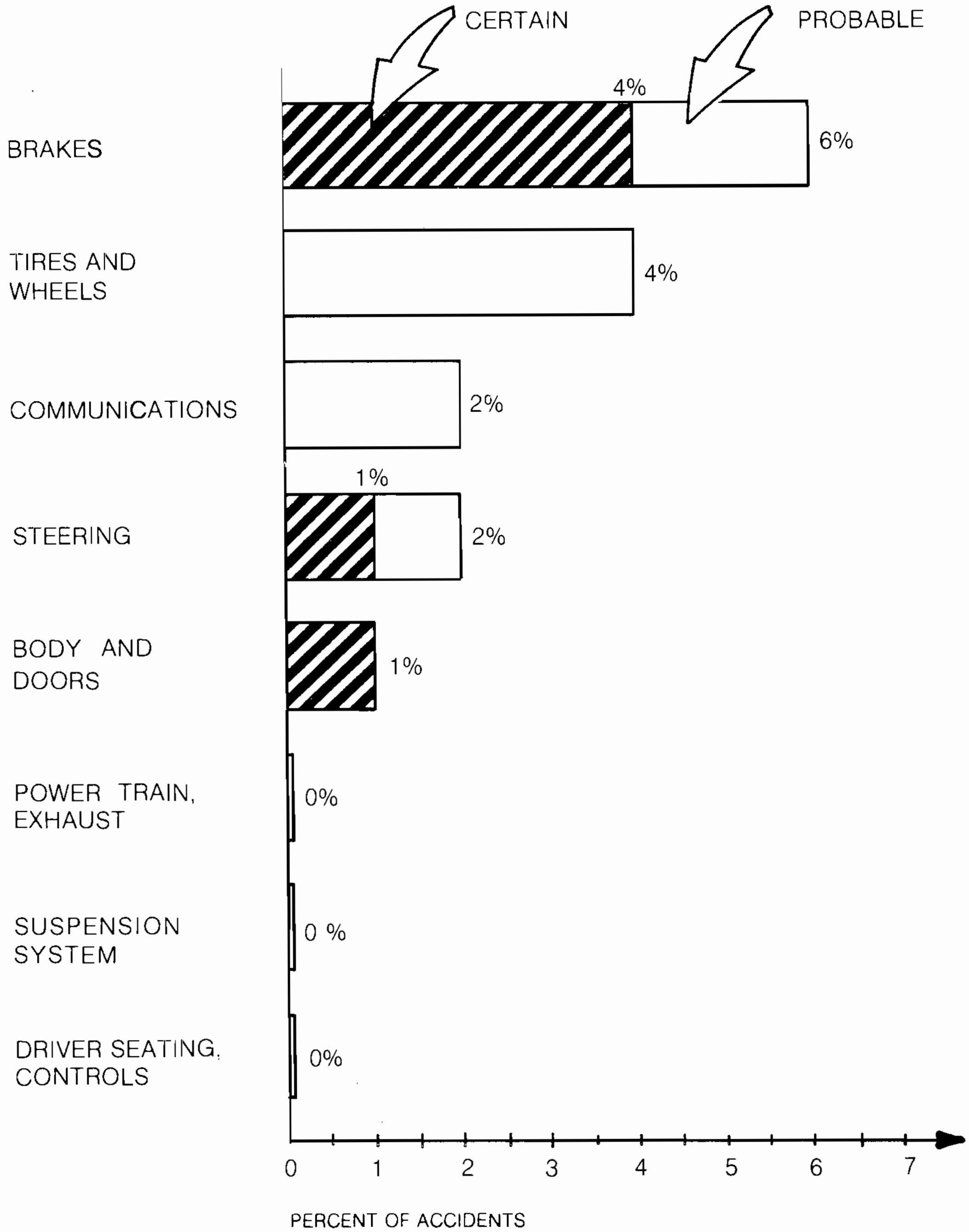
[25] U. S., D. O. T., SDR, p. 3.

[26] J. P. Treat and K. B. Joscelyn, Results of a Study to Determine Accident Causes, Society of Automotive Engineers Preprint SAE 730230, 1973.

Figure 8.

Brake Systems, Tires and Wheels Were the Most Frequent Vehicular Accident Causes



Based on Phase II, Level C Causal Data

FROM: U.S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Public and Environmental Affairs, May 1, 1971), p. 25, Figure 8.

Although the actual use of seat belts by drivers and passengers is a human factor element, the installation of effective restraint systems in vehicles can be considered a vehicular factor in accident causation. The primary objective of the study by the Southwest Research Institute in Texas was to determine the true injury-reducing effect of lapbelts and lap and shoulder belts. Cromack reported from this multidisciplinary accident investigation study that 12.2% of the unrestrained occupants of the vehicles studied sustained injury above a given level of severity. Only 6.2% of those wearing lapbelts only sustained injury above the same level of severity and 4.8% of those wearing both lap and shoulder belts were injured above that level. Cromack states:

> Consequently, Southwest Research Institute found that lapbelts were 49.7% more effective in reducing injuries than no belts, and lap and shoulder belts were 61.1% more effective in such cases. Lap and shoulder belts were 22.6% more effective than only lapbelts.[27]

Although the Southwest Research Institute attempted to establish the injury-reduction potential of the Air Cushion Restraint System (ACRS), the reduced sale of this system and the small number of cars equipped with the ACRS made any statistical comparisons invalid. For a further discussion of active and passive restraint systems, refer to Hales, Williams and Young.[28]

It may be concluded that vehicular deficiencies can be considered causal factors in a substantial number of accidents and can certainly increase injury severity. Several suggestions were made to automobile manufacturers for vehicle improvement. Vehicle maintenance, particularly of the braking system, tires and wheels, communication system, and steering system, is certainly recommended.

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[27] U. S., D. O. T., National Highway Traffic Safety Administration, Multi-Disciplinary Accident Investigations: Special Study of Active and Passive Restraint Systems in 1973-1976 Model Year Vehicles, Volume I, by J. Robert Cromack, et al. (San Antonio, Texas: Southwest Research Institute, March 1976) (Contract No. DOT/HS-801-973, 975, 976, 977)

[28] G. D. Hales, M. S. Williams, and R. K. Young, Seat Belts: Safety Ignored. (Austin, Texas: Council for Advanced Transportation Studies, University of Texas at Austin, 1978)

ENVIRONMENTAL FACTORS

Environmental factors, those factors which are external to the driver and vehicle and which increase the risk of accident involvement, were found to be a contributory cause rather than a direct cause of accidents in those cases where external factors were relevant. SDR found that:

> . . . . highway-related (permanent) factors such as poor design, construction or maintenance are accident causes slightly more frequently than are ambience-related (temporary) factors such as weather or traffic conditions. The specific factors most often involved were slick roads and view obstructions, followed by design problems, control hindrances (such as pavement-edge drop-offs), transitory hazards (such as animals or stalled cars in the road) and inadequate signs and signals . . . . (See Figure 9).[29]

Garrett, Braisted, and Morris report from data collected from Cornell Aeronautical Laboratory that several serious accidents on the New York State Thruway involved shoulder dropoffs of from four to six inches.[30] As a result of this Multidisciplinary Accident Investigation, the New York State Thruway authorities were contacted; and countermeasures taken for this condition included speed controls, cones, and painted, temporary wooden beams on the edge of the highway to delineate the dropoff. A change in highway construction policy was also instituted whereby the travelled portion of the roadway and the shoulder surfacing were completed at the same time.

Fisher also reported during the Maryland investigations that several factors related to the highway could have contributed to accident severity. Curvatures in the road which were not properly elevated and which contributed to the loss of vehicle control and highly polished highway surfaces which caused roads to be slippery when wet were mentioned as highway factors contributing to accidents. The MDAI team suggested that the installation of some type of warning signs or rumble strips in these areas, in the absence of repair or improvement, might warn drivers unfamiliar with the condition which existed and possibly prevent an accident.

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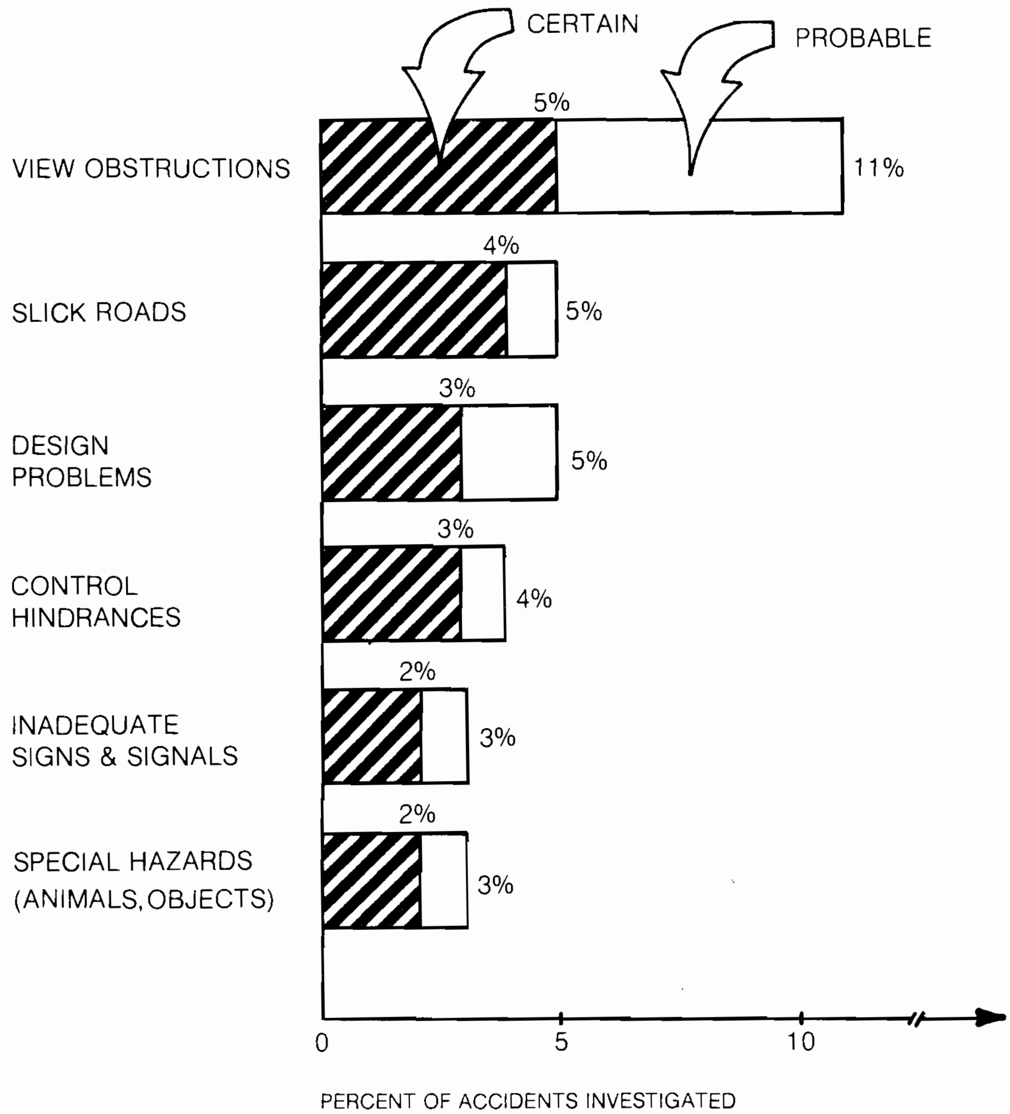
[29] U. S., D. O. T., SDR, p. 22.

[30] U. S., Department of Transportation, Tri-Level Accident Research Study: Second Annual Report, by J. W. Garrett, R. C. Braisted, and D. F. Morris (Buffalo, New York: Cornell Aeronautical Lab, Inc., August 1972) (Contract No. FH-11-7098, Publication No. DOT/HS-800-679)

Figure 9.

View Obstructions, Slick Roads and Design Problems Were the Most Frequent Environmental Accident Causes



Based on Phase II, Level C Causal Data

FROM: U. S., Department of Transportation, National Highway Traffic Safety Administration, A Study to Determine the Relationship Between Vehicle Defects and Crashes, by Institute for Research in Public Safety, School of Public and Environmental Affairs, Indiana University (Bloomington, Indiana: Indiana University, Institute for Research in Public Safety, School of Public and Environmental Affairs, May 1, 1971), p. 23, Figure 7.

Fisher also recommends that traffic signals at key intersections be equipped with a left-turn phase to enable the driver to execute left turns more safely to thereby aid in collision prevention. Several instances of unprotected steel overhead light poles and bridge abutments located adjacent to highway edges were deemed unnecessary hazards to motorists who might lose control of their vehicles and leave the highway at these locations. The lack or inadequate installation of a guard rail was responsible for increased injury severity to the driver and occupants.

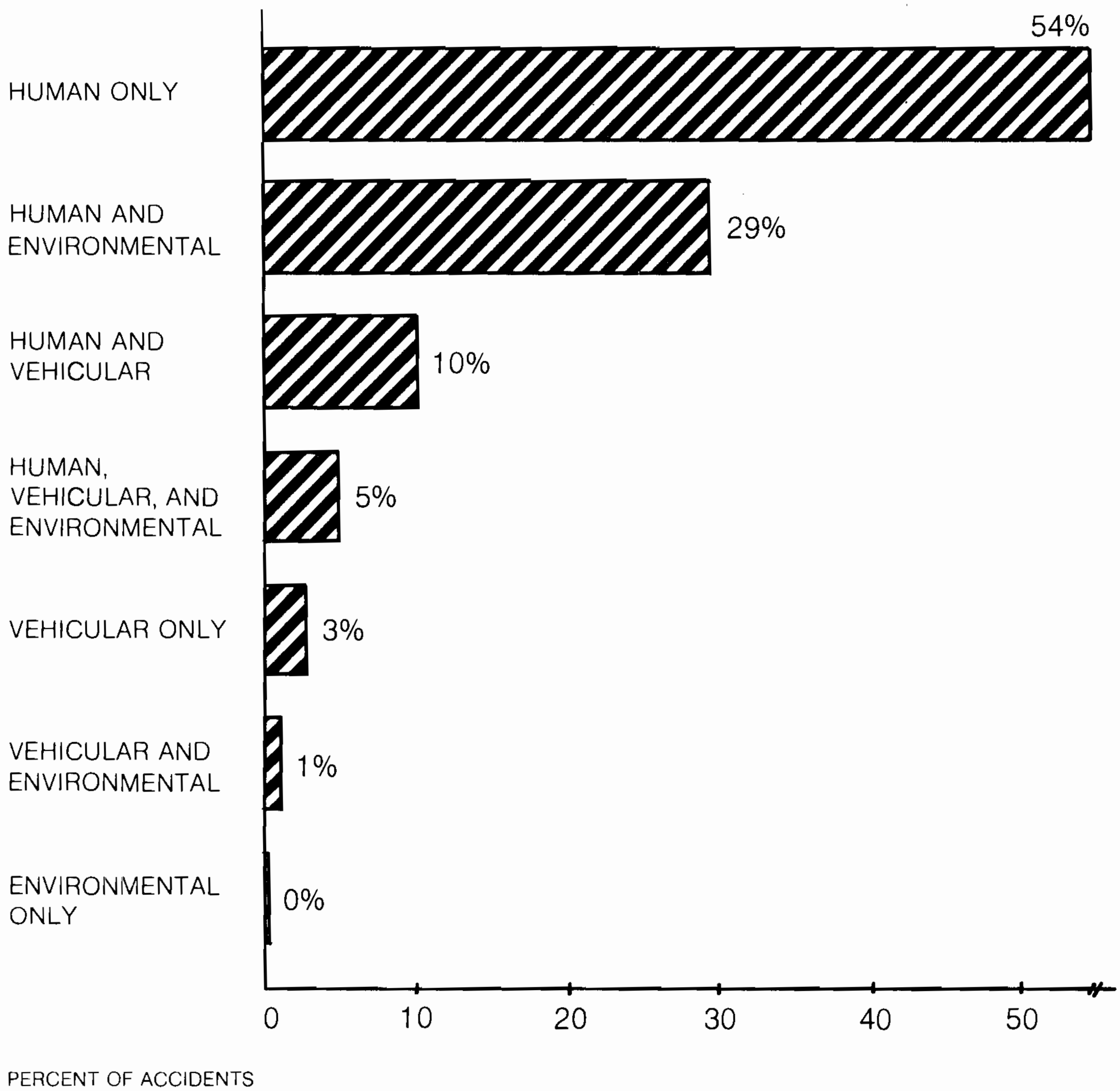
Although external factors play a relatively minor role in accident causation, environmental problems can be corrected through improved highway design and installation and/or immediate improvements.

Human factors, vehicular factors, and environmental factors interact to cause accidents and increase injury severity. Figure 10 illustrates this interaction. Human factors, as sole causative factor, were reported by SDR to represent 54% of accidents. Human and environmental factors, together, represented 29% of all accidents. Vehicular factors, alone, environmental factors, alone, and the vehicular and environmental factors in combination were must less represented.

It is evident from MDAI results that human factors play the most important role in accident causation. Unfortunately, human factors are considered to be the most difficult area in which to formulate and develop effective countermeasures. Although vehicular and environmental factors do not comprise the major proportion of causative factors, these areas deserve serious attention, and improvement in these areas certainly will reduce the number of accidents and decrease injury severity.

Figure 10.

Human Factors, Either Alone or in Combination with Other Factors, Were the Most Frequently Involved



Based on Phase II, Level C Causal Data

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CONCLUSION

The Multidisciplinary Accident Investigation (MDAI) techniques developed to study accidents in an in-depth fashion using interdisciplinary teams have produced interesting and useful results. Countermeasures can be developed as a direct result of MDAI data. MDAI results also offer new directions for future research and investigation.

Although human factors, vehicular factors, and environmental factors were discussed in terms of their roles in accident causation, it is important to consider the interaction of these three factors. May and Baker state:

> It should be kept in mind that an accident is the failure of a system consisting of environment, vehicle and human factors. A balanced effort should be expended in collecting data in all three domains, and systems analysis of the entire data should be made. Only if the interaction of all factors is more clearly understood can the entire system be redesigned for safety.[31]

Cromack and Williamson concur that the interaction between the three elements of the highway system is important in future highway safety analyses. They state:

> Perhaps the most useful results to be derived from the accident studies would be a clear description of how these elements (human, vehicle and environmental) interact. Sociologists and technologists can then address themselves to the tasks of developing socially and mechanically acceptable means for accomplishing improvements.[32]

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[31] U. S., Department of Transportation, National Highway Traffic Safety Administration, A Multidisciplinary Study of Alcohol-Related Accidents, Volume I, by G. W. May and W. E. Baker. (Albuquerque, New Mexico: University of New Mexico, April 1975) (Contract No. DOT/HS-258-2-462)

[32] Cromack and Williamson, "Human/Psychological Factors."

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APPENDIX A*

*FROM: U.S., Department of Transportation, National Highway Traffic Safety Administration, Multidisciplinary Accident Investigation Final Report -- Oklahoma, by R.A. Mill, M.L. Williams, J.L. Purswell, and H. Beaulieu (Washington, D.C.: Department of Transportation, January 1976). Contract No. DOT-HS-219-3-708; Report No. DOT HS-801-799.

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SUPPLEMENTAL HUMAN DATA FORM
MEDICAL/INJURY REPORT

BASIC INFORMATION

HOSPITAL____________________________

BAC/SOBRIETY__________________

SEATED POSITION____________________

DESCRIPTION OF INJURIES

AIS SEVERITY CODE

BASIC DEMOGRAPHIC DATA

(Human Factors) CASE NO.________

1. Trip Plan:
   Origin:________________
   Destination:____________

2. Route Usage:
   ____(1) Daily
   ____(2) Weekly (1-4 times)
   ____(3) Monthly (1-3 times)
   ____(4) Quarterly (1-2 times)
   ____(5) Annually (1-3 times)
   ____(6) Less than annually
   ____(7) Never
   ____(0) Unknown

3. Time of:

   Departure:______________
   Impact:________________
   ETA:__________________

4. History of imprisonment:
   ____(1) Yes:____________
   ____(2) None

5. Has subject ever had license suspended for any reason:
   ____(1) Yes
   ____(2) No
   ____(0)Unknown

6. Has subject ever been charged with driving without a license:
   ____(1) Yes
   ____(2) No
   ____(0) Unknown

7. Has subject ever been charged in an earlier fatal-involved accident:
   ____(1) Yes
   ____(2) No
   ____(0) Unknown

9. Case resulting from:
   ____(1) Single-vehicle fatality
   ____(2) Multi-vehicle fatality
   ____(3) Vehicle-pedest4ian fatality

10. How many vehicles involved in this accident:
    ____(1) One
    ____(2) Two
    ____(3) Three

11. Why is this case being investigated:
    ____(1) Driver fatality
    ____(2) Passenger fatality
    ____(3) Pedestrian fatality

13. Who was killed in this accident:
    ____(1) The principal driver
    ____(2) Another driver
    ____(3) One passenger
    ____(4) Two or more passengers
    ____(5) A pedestrian
    ____(6) Other:________________

14. Subject's condition following accident:
    ____(1) Not hospitalized
    ____(2) Hospitalized
    ____(3) Deceased

15. Disposition of charge to subject:
    ____(1) Subject not charged
    ____(2) Acquitted
    ____(3) Dismissed
    ____(4) Continued
    ____(5) Convicted:____________
    ____(6) Other:________________

16. Legal result of disposition:
    ____(1) None, subject cleared
    ____(2) License revoked
    ____(3) Suspended sentence
    ____(4) Incarcerated
    ____(5) Pending
    ____(6) Deceased

17. **Subject was formally charged with:**
    ____**(1) No charges**
    ____**(2) DUI**
    ____**(3) Driving to endanger**
    ____**(4) Manslaughter**
    ____**(5) Both 1 and 2**
    ____**(6) All of 1, 2 and 3**
    ____**(7) Other:** ____________

18. **Driver familiarity with vehicle:**
    No. of months driving: ________
    Miles driving this vehicle: ________

19. Driving experience:
No. of years driving: ____________________
No. of miles driven last year: __________

20. What was the purpose of subject's trip:
___(1) Business
___(2) Social
___(3) Other: _______________________

21. Approximately how close was subject to home at time of accident:
___(1) Over 50 miles
___(2) 30-50 miles
___(3) 15-30 miles
___(4) 5-11 miles
___(5) Less than 1 mile
___(6) Less than ½ mile

22. Was subject insured:
___(1) Yes
___(2) No
___(0) Unknown

23. Was vehicle equipped with seat belts:
___(1) Yes
___(2) No

24. Was subject using them:
___(1) Yes
___(2) No

25. Was subject's vehicle modified for speed:
___(1) Yes
___(2) No

26. During 24 hours pre-crash subject was:
___(1) Working at job: ______________
___(2) Working around house: _________
___(3) In school: __________________
___(4) On vacation: ________________
___(5) Partying, drinking: _________
___(6) Celebrating: ________________
___(7) Loafing around, doing nothing
___(8) Other: ___________________________

27. Year make and model of vehicles involved:
#1 __________ __________ __________

#2 __________ __________ __________

#3 __________ __________ __________

28. Day of week of accident occurrence:
___(1) Monday
___(2) Tuesday
___(3) Wednesday
___(4) Thursday
___(5) Friday
___(6) Saturday
___(7) Sunday

29. Occasion:
___(1) Week-end (6 pm Friday - 6pm Mon.)
___(2) Holiday
___(3) Weekday
___(4) Payday
___(5) Other: __________________________

30. Driver of Vehicle No.:
___(1) No. 1 (striking vehicle)
___(2) No. 2 (first struck vehicle)
___(3) No. 3 (second struck vehicle)
___(4) No. 4 (third struck vehicle)

31. Driver culpability:
___(1) Most responsible (single-vehicle collision or "at-fault" in multi-vehicle collision)
___(2) Contributing (other driver(s) also contributed in initiation of collision)
___(3) Not responsible (essentially an innocent driver in this collision)
___(4) Indeterminate

32. Driver sex:
___(1) Male
___(2) Female

33. Driver age: ____ _____

34. Driver height: ___' ___"

35. Driver weight: _____ lbs.

36. Driver's marital status:
___(1) Single
___(2) Married
___(3) Common -law
___(4) Separated
___(5) Divorced
___(6) Widowed
___(7) Other: __________________________
___(0) Unknown

37. Educational status:
___(1) Graduate school (or degree professional training)
___(2) College/University graduate
___(3) Partial college training
___(4) High school graduate
___(5) Partial high school training
___(6) Junior High school or Grammar school graduate
___(7) Less than 7 years of schooling
___(0) Unknown

38. Occupation (1970 Census Users Guide)
___(10) White collar
___(11) Professional, Technical
___(12) Manager, Administrator (except farm)
___(13) Sales worker
___(14) Clerical, kindred
___(20) Blue collar
___(21) Craftsman, kindred
___(22) Operatives (except transport)
___(23) Transport equipment operatives (driver)
___(24) Laborers (except farm)
___(30) Farm workers
___(31) Farmers, farm managers
___(32) Farm laborers, foreman
___(40) Service workers
___(41) Service workers (except below)
___(42) Private household worker
___(50) Housewife
___(60) Student
___(70) Military
___(80) Retired
___(90) Unemployed (over 1 month)
___(00) Unknown

39. Two factor index of social position:
___(1) Class (I (11-17)
___(2) Class II (18-27)
___(3) Class III (28-43)
___(4) Class IV (44-60)
___(5) Class V (61-70)
___(0) Unknown

40. Driver's race:
___(1) Caucasian
___(2) Latin American
___(3) Black
___(4) Oriental
___(5) Other: ____________
___(6) Unknown

41. Driver's family income:
___(1) $1,000 annually or less
___(2) $2,000 annually
___(3) $3,000 annually
___(4) Between $5,000 and $99,000 annually or greater
___(5) Unknown

42. Driver's residence:
___(1) Urban (core of city)
___(2) Urban (outskirts of city)
___(3) Suburban
___(4) Rural
___(5) Other: ____________
___(0) Unknown

43. Driver has a phone:
___(1) Yes
___(2) No
___(0) Unknown

44. Driver's number of siblings:
___(1) None
___(2) One
___(3) Two, etc.
___(4) Eight or more
___(0) Unknown

45. Beverage driver usually drinks:
___(1) Beer
___(2) Wine
___(3) Whiskey, Scotch
___(4) Other: ____________
___(0) Unknown

46. Frequency of drinking:
___(1) Daily
___(2) 4-5 times/week
___(3) 2-3 times week
___(4) Once/week
___(5) 2-3 times/month
___(6) once/month
___(7) 2-3 times/year
___(8) once/year (special occasions)
___(9) never (abstainer)
___(0) Unknown

47. Length of time usually drinking during a sitting:
___(1) 1 hour or less
___(2) 2-3 hours
___(3) 4-5 hours
___(4) 6-11 hours
___(5) 2-3 days (binge)
___(8) Constantly drinking (alcoholic)
___(9) No time (abstainer)
___(0) Unknown

48. Number of drinks per sitting:
___(1) 1-2 drinks
___(2) 3-4 drinks
___(3) 5-6 drinks
___(4) 7-8 drinks
___(5) 9-10 drinks
___(6) 11-12 drinks
___(7) 13 or greater
___(9) No drinks (abstainer)
___(0) Unknown

49. Use other drugs while drinking:
___(1) Yes: ____________________
___(2) No
___(0) Unknown

50. Blood Alcohol Concentration at time of crash: (Record actual BAC in mg% or the following):
___(80) No BAC test given, unknown drinking
___(90) BAC test given, unknown results
___(91) No BAC test given, Team Clinical evaluation that driver had been drinking
___(92) No BAC test given, no indication of drinking
___(99) Unknown

51. Location where driver usually drinks:
___(1) Home
___(2) Tavern/bar/nightclub
___(3) Parties
___(4) Family or friend's home
___(5) Restaurant (at lunch, dinner)
___(6) Recreation (golf, football, games, fishing)
___(7) Other: ____________________
___(9) No where (abstainer)
___(0) Unknown

52. Who does driver usually drink with:
___(1) Spouse
___(2) Other family
___(3) Friend(s)
___(4) Alone
___(5) All of the above (no preference)
___(9) No one (abstainer)
___(0) Unknown

53. What form of transportation does driver use to and from drinking locations:
___(1) Drives his car
___(2) Spouse or friend drives
___(3) Taxi
___(4) Chauffeur
___(5) Bus
___(6) Mass transit(subway)
___(7) Walks
___(8) None (drinks at home)
___(9) Not applicable (abstainer)
___(0) Unknown

54. What days does driver usually drink:
___(1) Week-end (Fri., Sat., Sun.)
___(2) Week-days (Mon. thru Thurs.)
___(3) Daily, no preference
___(4) Variable (no specific day but not daily)
___(5) Special occasions only
___(9) Not applicable (abstainer)
___(0) Unknown

55. What time of day does driver usually drink:
___(1) Late evening (8pm - 12 am)
___(2) Late evening & early morning (8pm - 3 am)
___(3) Early evening (4pm - 8pm)
___(4) Afternoon (12pm - 4pm)
___(5) Early morning (3am - 8am)
___(6) Morning (8am - 12pm)
___(7) All through the day
___(8) No specific time
___(9) Not applicable (abstainer)
___(0) Unknown

56. Did any member of driver's family have a possible alcohol problem:
___(1) No
___(2) Father
___(3) Mother
___(4) Siblings
___(5) Spouse
___(6) Children
___(7) Other: ____________________
___(0) Unknown

57. What were some of the indications as to why the driver drank: (choose up to two)
___(1) To relax or calm nerves
___(2) To be sociable or polite
___(3) Because friends drink
___(4) To celebrate special occasions
___(5) To forget troubles
___(6) To feel good, get high
___(7) Like the taste
___(8) Help sleep

___(9) Other: ____________________
___(10) Not applicable (abstainer)
___(0) Unknown

58. Driver ever arrested by ASAP enforcement patrols (including this crash)
___(1) Yes
___(2) No
___(0) Unknown

60. Driver ever referred to rehabilitation due to ASAP program (including this crash)
___(1) Yes (Type: __________________________)
___(2) No.
___(0) Unknown

61. Driver ever diagnosed as an alcoholic by competent medical or treament facility:
___(1) Yes
___(2) No
___(0) Unknown

62. Driver admission of alcoholism or problem drinking:
___(1) Yes
___(2) No
___(0) Unknown

63. Driver ever have a BAC of 0.10mg% or greater at time of arrest:
___(1) Yes
___(2) No
___(0) Unknown

64. Driver have a record of one or more prior alcohol related arrests:
___(1) Yes
___(2) No
___(0) Unknown

65. Driver have record of previous alcohol-related contacts with medical, social, or community agencies:
___(1) Yes
___(2) No
___(0) Unknown

66. Driver have any reported marital , employment, or social problems related to alcohol:
___(1) Yes
___(2) No
___(0) Unknown

67. Driver diagnosed as problem drinker on basis of approved structured written diagnostic interview instruments (e.g. Mast Johns Hopkins) Diagnostic test:
___(1) Yes
___(2) No
___(0) Unknown

68. According to above, was driver a problem drinker:
___(1) Yes (scored yes on 33 or 34, or scored yes on two or more of 35 to 39)
___(2) No
___(0) Unknown

69. Divorce in parental history::
___(1) Yes (Years _________)
___(2) No
___(0) Unknown

71. If married, age when first married:
___ ___

73. Length of more recent marriage:
(___ ___) years

74. Conflict areas currently exiting in the marriage (fight or arguments)
___(1) Money, material objects
___(2) Sex, infidelity , homosexuality, incompatability
___(3) Lack of consideration and affection
___(4) Failure to fulfill role expectations
___(5) Relatives, in-laws
___(6) Children
___(7) ETOH abuse, drug abuse
___(8) Illness
___(9) Other: ____________________
___(0) Unknown

75. Number of persons in household (excluding subject)
___ ___

76. Has driver ever been under public financial care:
____(1) Yes
____(2) No
____(0) Unknown

77. Does driver seem to repeat mistakes:
____(1) Yes, frequently
____(2) No, seldom
____(9) Not applicable
____(0) Unknown

78. Does driver have any fears which seem unrealistic or abnormal (high places, driving, etc.):
____(1) Yes, ____________________
____(2) No
____(9) Not applicable
____(0) Unknown

79. Was driver ever depressed:
____(1) Yes____________________
____(2) No
____(0) Unknown

80. Has driver ever talked about suicide within past five years:
____(1) Yes ____________________
____(2) No
____(0) Unknown

81. Has subject ever made a suicide attempt within past five years:
____(1) Yes, ____________________
____(2) No
____(0) Unknown

82. When faced with a really tough problem, how did driver usually react:
____(1) Try and face it and work constructively at solving it.
____(2) Find someone who will handle it for him
____(3) Take off and get away from problems
____(4) Get angry, hold his feelings inside
____(5) Get angry, blow-up
____(0) Unknown

83. To what extent did subject have trouble sleeping:
____(1) Almost always slept well, nearly nightly
____(2) Occasionally had trouble - not a serious problem
____(3) Had some trouble getting enough sleep
____(4) Usually had trouble sleeping, but occasionally had a good nights sleep
____(5) Almost always had trouble sleeping, had a serious problem
____(0) Unknown

84. Did subject report self as having had problem with non-prescribed narcotic drugs during 30 days prior to accident:
____(1) Yes
____(2) No
____(0) Unknown

85. Did subject ever lose memory for a certain period of time;(black-outs)
____(1) Yes
____(2) No
____(0) Unknown

86. Did subject ever have trouble remembering things:
____(1) Yes
____(2) No
____(0) Unknown

87. Did subject consume alcoholic beverages during the 48 hours prior this accident:
____(1) Yes
____(2) No
____(0) Unknown

88. Did subject ever see things that weren't really there:
____(1) Yes
____(2) No
____(0) Unknown

89. Did subject ever appear to be in a daze or stupor:
____(1) Yes
____(2) No
____(0) Unknown

90. Subject was/is:

____(1)	Independent			Dependent		
	1	2	3	4	5	
____(2)	Dominant			Submissive		
	1	2	3	4	5	
____(3)	Purposeful			Purposeless		
	1	2	3	4	5	
____(4)	Warm			Cold		
	1	2	3	4	5	

DEFINITIONS

Independent: this person dislikes being tied down in his relationships with people. He prefers to "stand on his own two feet", and be his own boss.

Dependent: This person seeks advice and help from others. If there is no one around to tell him what to do, he feels lost and does not really know who he is or how to behave.

Dominant: This person keeps people in line with very little difficulty and feels confident when directing the activities of others. He likes to make decisions and seeks after positions with authority.
Submissive: This person is usually quiet and unassertive. He does not like to tell people what to do, and would rather follow than lead.
Purposeful: This person feels that his daily activities are full of purpose. As a result he is conviced that the kind of life he leads is worthwhile.
Purposeless: This person's life has very little meaning and direction. As a result he usually is disturbed by vague feelings of emptiness. He has few definite goals and those he does consider seem beyond his reach.
Warm: This person is accepting, good-natured and easy-going. He likes making friends and enjoys being with people in general. He is loyal, cooperative and helpful and tries to be aware of the feelings and needs of others around him.
Cold: This person prefers to keep his distance from others. He is highly controlled and maintains a scientific objective view of life. He usually appears insensitive to the way other people around him may be feeling and conducts his life by principles and rules rather than emotions.

91. Was subject abnormally slow in learning or mentally retarded:
____(1) Yes
____(2) No
____(0) Unknown

92. What was subject's recent observable life style (past six months:)
____(1) Happy-go-lucky
____(2) Anxious, nervous, depressed
____(3) Industrious, hard working
____(4) Given up, lethargic, "not caring"
____(5) Making it, none of the above
____(0) Unknown

93. Was subject a very calm person:
____(1) Yes
____(2) No
____(0) Unknown

94. Subject's physical health:
____(1) Good/excellent
____(2) Fair
____(3) Poor
____(0) Unknown

95. Any change in physical health prior to accident:
____(1) Yes ________________
____(2) No
____(0) Unknown

96. How much concern did subject demonstrate about his health:
____(1) A great deal
____(2) Occasional
____(3) Little or no concern
____(0) Unknown

97. Did subject neglect medical advice or medication:
____(1) Yes
____(2) No
____(0) Unknown

98. Does subject smoke cigarettes:
____(1) Yes ________Packs/day
____(2) No
____(0) Unknown

99. Does subject have chronic physical illness:
____(1) Yes,______________
____(2) No
____(0) Unknown

100. Does subject wear corrective lenses:
____(1) Yes
____(2) No
____(0) Unknown

101. Was subject taking any medications prior to time of this accident:
____(1) Yes, ______________
____(2) No
____(0) Unknown

102. Does subject have history of chronic risk taking behaviors: (Yes = 1 or more)
____(1) Yes
____(2) No
  ____(01) More than 1 suicide attempt
  ____(02) More than 2 previous arrests for BTE, A&B, and other related charges
  ____(03) Prescription drug abuse
  ____(04) More than 2 arrest for DK or DUIL and other clinical observations of alcohol abuse
  ____(05) Street drug abuse and/or marijuana abuse
  ____(06) Participant of violent crime, rioting, etc.
  ____(07) Smoking more than 2PPD
  ____(08) Ignoring dietary restrictions
  ____(09) Seeking out dangerous situations ________________________________
  ____(10) Mountain climbing, bike/car racing sky diving
  ____(11) Other dangerous and/or life threatening behaviors

103. Last L M D visit:____________months

104. Surgery immediately (within 6 months):
____(0) Unknown
____(1) Yes: ________________
____(2) No

105. Physical handicap(s) disabilities:
____(1) Some
____(2) None

106. Does subject receive veteran's compensation:
____(0) Unknown
____(1) Yes
____(2) No

107. Does subject smoke pipe or cigars:
____(0) Unknown
____(1) Yes
____(2) No

108. Was subject pregnant at time of this accident:
____(0) Unknown
____(1) Yes
____(2) No

109. Was subject taking any of the following medications prior to time of this accident: (0 = no, 1 = yes)
____(01) tranquilizers
____(02) barbiturates
____(03) amphetamines
____(04) digitalis preparations
____(05) antihistamines
____(06) anticonvulsants
____(07) antibiotics
____(08) narcotics
____(09) antihypertensives
____(10) other:________________________

110. Have you read/heard of a campaign or program that would reduce alcohol related auto deaths?
_____(1) Yes
_____(2) No

111. Where did you read/hear of it?
_____(1) Billboards
_____(2) Posters
_____(3) Pamphlets
_____(4) Television
_____(5) Magazine
_____(6) Radio
_____(7) Word of mouth
_____(8) Don't recall

112. Do you recall what agency is sponsoring the program?
_____(1) ASAP
_____(2) Other
_____(0) Unknown

113. Previous driver contact with ASAP.
_____(1) Stopped by ASAP patrols
_____(2) Arrested by ASAP patrols
_____(3) Driver referred to rehabilitation
_____(4) Driver aware of ASAP patrols in area
_____(5) None

CASE No. ____________

INTERVIEW SUMMARY PAGE

DRIVER: ______ OCCUPANT: ______ PEDESTRIAN: ______

Sex: ______
Race: ______
Age: ______
Height: ______
Weight: ______
Road Familiarity: __________
Vehicle Familiarity: ______ months
Driving Experience: ______ years
Driver Education: Yes No
No. previous Moving Violations:
______
Physical Problems: ______________
Medication: ____________________
Legal Disposition: ______________
____
B.A.C. ________________________
Restraints Used: ______________
Injury: ______________________

Human Factors Related to This Accident:

___01 Domestic tension/anxiety
___02 Professional tension/anxiety
___03 Social tension/anxiety
___04 Depression
___05 Fatigue
___06 Chronic physiological problems
___07 Chronic emotional/mental problems
___08 Tardiness for appointment(s)
___09 Night blindness
___10 Excessive speed for condition(s)
___11 Legal pursuit
___12 Drug abuse
___13 Alcohol abuse
___14 Other: ____________________

A = Probable Causal Factor
B = Possible Causal Factor

INTERVIEW COMMENTS AND SUMMARY
(Accident Reconstruction)

(a)Origin,(b)Destination,(c)Purpose,(d)Time,(e)Driver's recollection of crash

____
____
____
____
____
____
____
____
____
____

APPENDIX B*

*FROM: U.S., Department of Transportation, National Highway Traffic Safety Administration, Multidisciplinary Accident Investigation Final Report -- Oklahoma, by R.A. Mill, M.L. Williams, J.L. Purswell, and H. Beaulieu (Washington, D.C.: Department of Transportation, January 1976). Contract No. DOT-HS-219-3-708; Report No. DOT HS-801-799.

Case No.: ______________________

Investigator: ____________________

VEHICLE DATA

Vehicle No.: ________________________ **Type:** ____

Year: ____________ **Make:** ___________ **Model:** ____________ **Doors:** _____________________

Color: ____________________ **Body Style:** _________________ **Odometer Reading:** ___________

Inspection Data: ____________________

Power Accessories: ________________, _______________________, ___________________________

_______________, ____________________, ____________________________, __________________

Padded Components: ___________________, __________________, ______________________,

_____________________________, ____________________________, ___________________

Restraint Systems: ______________________, __________________________, __________________

Defects: _________________________, ______________________________, _____________________,

___________________________, ____, _______________

Maintenance (Performed): _____________________________________-

Damages (Impact, Secondary · Impact): __________________________________, _________________

____

Vehicle Deformation Index: _________________________________

ACCIDENT RECONSTRUCTION: VEHICLE FACTORS

Pre-Crash

APPENDIX C*

*FROM: U.S., Department of Transportation, National Highway Traffic Safety Administration, Multidisciplinary Accident Investigation Final Report -- Oklahoma, by R.A. Mill, M.L. Williams, J.L. Purswell, and H. Beaulieu (Washington, D.C.: Department of Transportation, January 1976). Contract No. DOT-HS-219-3-708; Report No. DOT HS-801-799.

APPENDIX C

Case No: ____________________

Investigator: ____________________

ENVIRONMENTAL DATA

IDENTIFICATION

Highway or Street: ____________________ **City:** ____________________

Type of Location: ____________________ **Type of Area:** ____________________

Date & Time of Accident: ____________________

Type of Accident: ____________________

AMBIENCE

Light: ________ **Precipitation:** ________ **Temp:** ° ________ **Humidity:** ________

Wind & Direction ____________________ **Visibility:** ____________________

Road & Shoulder Surface Condition, Include coefficient of friction: ____________________

____

HIGHWAY(S)

Type: ____________ **Width:** ____________ **Lanes** ____________

Divider (Type, Width) ____________________ **Surface Type:** ____________

Road Edge: ____________________ **Configuration:** ____________________

Lighting of Roadway & Location: ____________________

Accesses per ¼ mile: ____________ **Poles/Trees per ¼ mile:** ____________

Accident History of Location: ____________________

TRAFFIC CONTROLS

Pavement Markings: ____________________

Lines: ____________________

Symbols: ____________________

Words: ____________________

Speed Limit: ____________ **mph**

Signals (Type and Activation): ____________________

(Over)

ACCIDENT RECONSTRUCTION: ENVIRONMENTAL FACTORS

Pre-Crash

Crash

Post-Crash

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