MULTIDISCIPLINARY
ACCIDENT INVESTIGATION

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MARTHA S. WILLIAMS
ROBERT K. YOUNG

RESEARCH REPORT 61

OCTOBER 1978

TEXAS OFFICE OF TRAFFIC SAFETY

COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

The University of Texas at Austin
MULTIDISCIPLINARY ACCIDENT INVESTIGATION

Deborah Valentine
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RESEARCH REPORT 61

October 1978

Prepared by
Council for Advanced Transportation Studies
The University of Texas at Austin
Austin, Texas 78712

For
Texas Office of Traffic Safety
State Department of Highways and Public Transportation
Austin, Texas
The conclusions and opinions expressed in this document are those of the author and do not necessarily represent those of the State of Texas, the Texas Office of Traffic Safety, State Department of Highways and Public Transportation or any political subdivision of the State or Federal Government.
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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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.

\(^1\)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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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 Multidisciplinary 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.

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

- Multidisciplinary
- Tri-Level
- Bi-Level

Figure 1.

into each in-depth case. Positive clues that may develop during the course of the investigation are then followed up in detail.

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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Figure 2. INTEGRATED TRI-LEVEL ACCIDENT INVESTIGATION STUDIES

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

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

---


### 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
- Late used

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### Activities Prior to Collision:
- Sleep
- Work
- Recreation (strenuous)
- Travel (long distance)
- Immediate condition and
  - infirmities (medicines)
- Pressures--state of mind
- Alcoholic beverages or drugs
- Smoking or eating

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

### 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

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Figure 3. Human Factors: Interview Process

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

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." 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.

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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8 Ibid., p. 22.
Figure 5.

PROGRAM MATRIX FOR HIGHWAY SAFETY RESEARCH

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 investigative 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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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.


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.  

It appears that, although disadvantages and problems do exist in multi-disciplinary 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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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

17 Ibid., p. 18.
Human Factors Were Involved in Nearly All Accidents

PERCENT OF ACCIDENTS INVESTIGATED

PROBABLE

CERTAIN

HUMAN FACTORS

ENVIRONMENTAL FACTORS

VEHICULAR FACTORS

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. 13, 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

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

18 Ibid., p. 20.


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 MDASI 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.


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."

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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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.

\(^{25}\) 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.


28G. 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.

\(^{29}\) U. S., D. O. T., SDR, p. 22.

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.

25
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 much 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

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 Affairs, May 1, 1973), p. 16, Figure 4.
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


32Cromack and Williamson, "Human/Psychological Factors."
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Martha Williams, Professor of Social Work, joined the faculty of the University of Texas at Austin in 1966. She received both her undergraduate training in psychology (B.A., 1957) and her graduate training in psychology and management (M.A., 1962; Ph.D., 1963) at the University of Texas at Austin. She was a social science research associate in the Business School and the Law School at UT prior to joining the Social Work faculty. She is a member of the American Psychological Association and is a licensed psychologist in the State of Texas.

Williams' research and interests lie mainly in the areas of applied research methods, organizational psychology and evaluation research in human services organizations. She has published numerous articles on these topics.
Robert K. Young, Professor of Psychology, joined the faculty of the University of Texas in 1956. He received his B.A. in psychology from Miami University in 1951 and his Ph.D. in psychology from Northwestern University in 1954. While in the U.S. Army from 1954 to 1956, he served as chief of the Psychological Services Branch of the Quartermaster Research and Development Field Evaluation Agency at Fort Lee, Virginia.

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APPENDIX A*

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-- CTR Library Digitization Team
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

8. Case resulting from:
   (1) Single-vehicle fatality
   (2) Multi-vehicle fatality
   (3) Vehicle-pedestrian fatality

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

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

11. 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:

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

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

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

15. 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:

16. 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

   (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)
   (0) 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)
   (6) Constantly drinking (alcoholic)
   (7) 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
   (8) No drinks (abstainer)
   (9) Unknown

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

50. Blood Alcohol Concentration at time of crash:
   (0) 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 (5pm - 12am)
   (2) Late evening & early morning (5am - 3am)
   (3) Early evening (4pm - 8pm)
   (4) Afternoon (12pm - 4pm)
   (5) Early morning (3am - 7am)
   (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:
   (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
58. Driver ever arrested by ASAP enforcement patrols (including this crash)
   (1) Yes
   (2) No
   (0) Unknown

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

60. Driver diagnosed as an alcoholic by competent medical or treatment facility:
   (1) Yes
   (2) No
   (0) Unknown

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

62. Driver ever have a BAC of 0.100mg% or greater at time of arrest:
   (1) Yes
   (2) No
   (0) Unknown

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

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

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

66. 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

67. 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

68. Divorce in parental history:
   (1) Yes (Years __________)
   (2) No
   (0) Unknown

69. If married, age when first married:
   ___

70. Length of more recent marriage:
    (____) years

71. Conflict areas currently exiting in the marriage (fight or arguments)
   (1) Money, material objects
   (2) Sex, infidelity, homosexuality, incompatibility
   (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

72. Number of persons in household (excluding subject)
Has driver ever been under public financial care:

(1) Yes  
(2) No  
(0) Unknown

Does driver seem to repeat mistakes:

(1) Yes, frequently  
(2) No, seldom  
(0) Not applicable  
(9) Not applicable

Does driver have any fears which seem unrealistic or abnormal (high places, driving, etc.):

(1) Yes, ____________________  
(2) No  
(0) Unknown

Did driver ever depressed:

(1) Yes  
(2) No  
(0) Unknown

Has driver ever talked about suicide within past five years:

(1) Yes  
(2) No  
(0) Unknown

Has subject ever made a suicide attempt within past five years:

(1) Yes  
(2) No  
(0) Unknown

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

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

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 convinced 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 arrests for DK or NULL 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 & 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
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
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APPENDIX B*

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APPENDIX B

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

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APPENDIX C

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 ½ mile: _______ Poles/Trees per ½ 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
RESEARCH MEMORANDA PUBLISHED BY
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16 An Analysis of the Truck Inventory and Use Survey Data for the West South Central States. Michael Dildine, July 1974.
22 A Description of the Application of Factor Analysis to Land Use Change in Metropolitan Areas. John Sparks, Carl Gregory, and Jose Montemayor, December 1974.
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30 Executive Summary: Short Range Transit Improvement Study for the University of Texas at Austin. C. Michael Walton, May 1976.
31 A Preliminary Analysis of the Effects of the Dallas-Fort Worth Regional Airport on Surface Transportation and Land Use. Harry Wolle, April 1974.
34 Forecast of Air Cargo Originations in Arkansas, Louisiana, and Oklahoma to 1990. Deborah Goltra, April 1975.
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