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ACCIDENT DATA ANALYSIS IN SUPPORT OF COLLISION AVOIDANCE TECHNOLOGIES

FINAL REPORT

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16. Abstract

This report summarizes the results of an effort to develop and rank collision scenarios. Review of existing literature showed that there has been relatively little work in this area. In exploring and building collision scenarios, police-reported accident files from Michigan and Washington were used, along with data from the National Accident Sampling System, and the Crash Avoidance Research Data file.

The project focused on common accidents of ordinary drivers. Ultimately, the project was restricted to passenger car accidents which did not involve pedestrians or pedalcyclists, and drivers who had not been drinking or indicated to have been driving recklessly. An 18-level collision configuration variable was constructed which included the number of vehicles involved, their relative orientation, intent to turn, relation to intersection, and traffic control at the intersection. Distributions of this variable were determined for driver age, area type (urban or rural), road type, and light condition. The distributions were quite stable across the four data sets.

Five collision types—single-vehicle, nonintersection; crossing paths at signalized intersection; crossing paths at non-signalized intersection; driveway/parking related; and same direction, non-intersection—accounted for about two-thirds of the accidents. A sample of Michigan police reports was drawn for each of the five collision types. Among other findings, these case studies suggested that in collisions at non-signalized intersections, older drivers often stopped and then pulled out in front of oncoming traffic, while younger drivers more often failed to stop at all. Overall, the case studies suggested that a collision typology based on vehicle movement might be most useful in developing crash avoidance technology.

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INTRODUCTION

Crash avoidance and crash avoidance technologies are rapidly becoming a major focus of highway safety research. Since the mid-1960's, most of the effort in improving traffic safety by the motor vehicle industry, the Federal Government, and the research community has centered on occupant protection. Federal Motor Vehicle Safety Standards led to marked improvements in vehicle design and structure, including increased integrity of the passenger compartment. Occupant protection, including both occupant restraint systems and improved interior design, as well as restraint usage laws, contributed to steadily declining motor vehicle fatality rates based on miles traveled. However, there is a growing view that most of the readily achievable gains in occupant protection have been realized and that further progress will be slower and more costly.

At the same time, the recently developed programs to design and implement Intelligent Vehicle Highway Systems (IVHS) have focused attention on the opportunities created by advanced technology to address crash avoidance. IVHS holds the promise of smoother, more efficient traffic flow through the application of advanced technology to help a driver avoid traffic congestion, plot the most efficient route to a destination, and optimize speed controls. The increased information about the traffic environment and the flexible, automated vehicle control that IVHS envisions will also allow a new approach to traffic safety. In this approach, the focus shifts from protecting occupants in the event of a collision to the design of automated controls and warnings which help drivers avoid a collision in the first place.

However, to realize the safety gains that advanced technologies can provide requires first an understanding of the traffic situations in which collisions occur. Accordingly, the present research project, sponsored by General Motors Research Laboratories and Hughes Aircraft, represents a first attempt at defining collision situations in ways that allow the assessment of the potential benefit of collision avoidance technologies. The goal of the project was to identify and rank collision scenarios, using existing data, which would be helpful in considering collision avoidance devices.

Developing collision scenarios appropriate to the issue of collision avoidance was an iterative process. Accidents can be classified in innumerable ways, depending on the research problem at hand. Moreover, as the literature review below indicates, there has been relatively little work done on developing collision typologies. Consequently, the process began with the identification of factors that earlier work of members of the research team had shown to be important in determining the probability of an accident. To this base of candidate factors were added variables covering vehicle type, collision configuration, and aspects of the collision environment, such as light condition, whether the collision occurred at an intersection, and if so, what type of traffic control was involved. In this process, it became increasingly clear that the precrash movements and intents of the involved vehicles are of great interest in thinking about collision avoidance technologies. Having gone as far as existing computerized accident files would allow, five collision type subsets were selected for case studies, and a sample of police reports was drawn to examine more precisely the relative movements of the involved vehicles.

This report briefly summarizes the results of the effort to develop and rank collision scenarios. The first section outlines some of the relevant literature. Next, the computerized accident data files are listed and described. A discussion of the accident data analysis follows. This includes a description of the collision configuration schemes as well as some of the results. Finally, the results of the review of hard copy police reports of a sample of accidents are presented. The attached appendices include the literature review, summary reports on the five collision type subsets selected for review, and tables showing the distribution of accidents across various collision scenarios.

LITERATURE REVIEW

As a first step in the project, a review of relevant literature was undertaken. Twelve papers and reports were found which provided and/or discussed accident typologies or which analyzed technological avoidance methods. However, only one of these provided a complete taxonomy of accident types. This came from the well-known study of accident causation by the Indiana University Institute for Research in Public Safety. This report included an elaborate "driver situation taxonomy," consisting of 4 major categories, 29 secondary categories, and an additional 61 subcategories to classify the 613 vehicles involved in 372 accidents which were studied in detail in the early 1970's. Accidents on freeways and accidents involving heavy trucks or motorcycles were not included, and most pedestrian and bicyclist accidents were excluded as well.

The classification system focused on the various precrash movements of the involved vehicles, whether these were at an intersection, whether one or more vehicles were in the crash, and whether there was a conflict with another vehicle (not explained). The report divided the 372 accidents into 35 accident types (17 multi-vehicle and 18 single-vehicle). The largest single category of accidents was "one vehicle travelling in an intersection and a second vehicle crossing in front of it from a stopped or slowed condition" with 13.7%. The second largest category (12.9%) was "one vehicle approaching from the rear another vehicle which had slowed or stopped ahead". Seven out of ten of all the accidents involved an "emergency conflict situation." The researchers estimated that, if the drivers who had time to do so had carried out the most appropriate evasive action, almost half of these conflict accidents would certainly or probably have been avoided.

In another interesting report, the Indiana researchers carried out a special analysis of 215 of these accidents in order to assess the collision avoidance or mitigation potential of radar warning, radar-actuated brakes, and anti-lock brakes. They estimated that a combination of radar warning (non-cooperative—i.e., not requiring reflectors on other vehicles and roadside objects), radar-actuated brakes, and 4-wheel anti-lock brakes could have had a beneficial effect in 38% of these accidents.

The full literature review is included in Appendix A.

ACCIDENT DATA SOURCES

The research team used four different files of accident data in attempting to develop a typology of the most common motor vehicle crash situations. For many years the UMTRI Transportation Data Center has maintained databases of all police-reported accidents in Michigan and in the state of Washington. These databases are updated annually from the central records divisions of the state police in each state. The project used the 1988 files, the most recent ones available, from Michigan and Washington. The Michigan file includes 410,437 accidents involving 700,431 traffic units (motor vehicles, pedestrians, pedalcyclists) and the Washington file contains 125,920 accidents involving 237,019 vehicles. Because of the size of the Michigan file, a 30% random-sample file was drawn for the actual analysis.

The National Accident Sampling System (NASS) files from 1985 and 1986 were also used. These files are produced by the National Highway Traffic Safety Administration (NHTSA), as part of a program begun in 1980 for carrying out special investigations on a nationally representative sample of police-reported accidents in the various states. The Transportation Data Center obtains these data from NHTSA annually and maintains them in a NASS database accessible to the general highway safety community. This is the only nationally representative database covering all types of accidents in the United States. However, it is by necessity rather limited in size. Consequently, the project combined two years of data, the 1985 and 1986 files, which together contain 23,371 accidents involving 38,482 vehicles.

The final source of data was the Crash Avoidance Research Data file, commonly known as the CARDfile. This database is the product of a recently established NHTSA project to collect all the police-reported accidents for three years from six states and to put these data together in a common format in order to have available a large database of accidents. The six states are Indiana, Maryland, Michigan, Pennsylvania, Texas, and Washington. This file is available in the UMTRI Transportation Data Center for 1984, 1985, and 1986, which, during the time computer runs were being made, were the most recent years available. In all, the file contains over seven million vehicle records. A special five percent random sample of this enormous file was used in the analysis for this project. The sample file contains 210,099 accidents involving 366,930 vehicles.

THE ACCIDENT DATA ANALYSIS

The first step in the analysis involved reviewing the many variables in the accident files and choosing the ones which appeared most useful for the task of developing a typology of the most common collision scenarios. A total of 60 variables were initially listed for consideration, but these were reduced to 17 variables of major interest. For the first runs it was decided to make use of four basic environmental variables: road type (limited access, other federal and state, other), rural or urban area (rural defined as a community under 5,000 in population or a township of any size), light condition (daylight, dark but lighted, dark and not lighted), and moisture condition (dry, wet, snowy/icy); and one accident severity variable (fatal or incapacitating injury, nonincapacitating or possible injury, no injury). These variables were chosen by team members based on previous research which had shown them to have an important effect on the probability of an accident, in the case of the environmental variables, or to identify very different accident subsets, in the case of the accident severity variable. A 14-level collision configuration variable was also constructed from a combination of variables describing the precrash situation for the involved traffic units (type and number of traffic units, type of movements of the involved vehicles, and relationship to an intersection or driveway). The runs were done separately for three vehicles types: passenger cars, light trucks including pickups, and heavy trucks.

After reviewing these initial tables it was decided to focus particularly on accidents which did not involve pedestrians or pedalcyclists. It was also decided to focus on "ordinary" drivers, and in all subsequent analyses drivers under 16, drivers who had been drinking, and drivers who were indicated to have been driving recklessly or carelessly were excluded whenever possible. Road moisture condition was dropped, and accident severity was reduced to casualty (death or injury) accidents versus property-damage-only accidents. The exclusions helped to sharpen the focus on the common accidents of ordinary drivers. Eliminating road moisture condition and collapsing the accident severity level served to help with sample size problems. Even with very large data sets, cell frequencies can become very small when the data are cross-classified by a large number of variables and code values. For the analysis to produce meaningful results, choices had to be made to preserve sample sizes.

At the same time, it was also decided to include driver age in the analysis. The perceptions and reaction times of drivers vary with age, as do the times of day they typically operate their vehicles, so it was felt that including driver age would capture important differences within the driver population. Since driver age is a vehicle-level rather than an accident-level variable, subsequent analyses used files of all accident-involved vehicles (one record per vehicle) rather than files of accidents as such (one record per accident). Consequently, percentages in these tables are based on accident-involved vehicles in the various categories. It should be noted that excluding a vehicle from the analysis because its driver was under age or had been drinking or had been driving recklessly did not remove from the analysis the vehicles of "ordinary" drivers that were involved in collisions with the "bad" drivers.

For this iteration, analyses were carried out with the 1988 Michigan vehicle file, the 1988 Washington vehicle file, the 1985 NASS vehicle file, and the 1984-86 CARDfile. In these analyses, two key environmental variables—road type and light condition—were examined (federal or state versus local roads; and daylight versus dusk/dark/dawn). Those two variables and rural/urban area were used separately and in combination (eight categories) as "control"[1] variables. Distributions of these variables were calculated for single-vehicle versus multi-vehicle crashes, driver age in three categories (16-25, 26-55, and 56 plus), and the combination of these two variables (six categories). Separate row-percent and total-percent tables were run for property damage only accidents, casualty accidents, and all accidents within three vehicle types: passenger cars, light trucks, and heavy trucks—making 18 tables from each data source.

It was noted that, in Michigan, less than one-quarter of cars with "ordinary" drivers in multi-vehicle collisions were involved in accidents during darkness, but well over half of the single-vehicle accidents took place after dark. Driver age was also shown to have a significant effect. Younger drivers, 16-25, were disproportionately involved in both single- and multiple-vehicle nighttime crashes, especially in rural areas, while drivers over 55 were disproportionately involved in daylight crashes and to a lesser extent in urban crashes.

A similar group of tables was produced from the 1985 NASS vehicle file looking at the interaction of rural or urban area, road type (interstate or other), and light condition with type of collision (single-vehicle, head-on, angle, rear-end, etc.). However, in the ensuing discussion it was decided that it was more useful to look at the intended precrash movements of the involved vehicles than whether the resulting collision involved an angle, head-on, rear-end, etc., impact. It was also suggested that for intersection collisions a major variable was the type of traffic control—a three-color traffic light or just a flashing light or stop or yield sign. Accordingly, it was decided to expand the original 14-category collision configuration variable to 18 categories by dividing each of the seven intersection categories into signalized and signed intersections. The two pedestrian categories had already been eliminated by the decision to exclude pedestrian accidents, and it was also decided to drop the small "other" category.

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[1]A "control variable" is one whose influence is "controlled for" by analyzing the cases for each level of the control variable. For example, when distributions are shown for each level of road type, the effects of the different levels of road type are said to be controlled for.

18 Level Collision Configuration

1. Single-vehicle, at a signalized intersection.

2. Single-vehicle, at a signed intersection.

3. Single-vehicle, not intersection-related.

4. Multi-vehicle, at a signalized intersection, vehicles crossing paths and both going straight.

5. Multi-vehicle, at a signed intersection, vehicles crossing paths and both going straight.

6. Multi-vehicle, at a signalized intersection, vehicles crossing paths and one or both turning.

7. Multi-vehicle, at a signed intersection, vehicles crossing paths and one or both turning.

8. Multi-vehicle, at a signalized intersection, vehicles in same direction and both going straight.

9. Multi-vehicle, at a signed intersection, vehicles in same direction and both going straight.

10. Multi-vehicle, at a signalized intersection, vehicles in same direction and one or both turning.

11. Multi-vehicle, at a signed intersection, vehicles in same direction and one or both turning.

12. Multi-vehicle, at a signalized intersection, vehicles in opposite directions and both going straight.

13. Multi-vehicle, at a signed intersection, vehicles in opposite directions and both going straight.

14. Multi-vehicle, at a signalized intersection, vehicles in opposite directions and one or both turning.

15. Multi-vehicle, at a signed intersection, vehicles in opposite directions and one or both turning.

16. Multi-vehicle, not intersection-related, one or both vehicles entering/leaving a driveway or parking place.

17. Multi-vehicle, not intersection-related, vehicles going in the same direction.

18. Multi-vehicle, not intersection-related, vehicles going in opposite directions.

The analysis using this revised collision configuration variable was carried out using all four data sources described previously. This time only passenger cars were used, but again separate row-percent and total-percent tables were created for property-damage-only accidents, for casualty accidents, and for all accidents. Control variables were again the two-level rural/urban, road type, and light condition variables; their 8-category combination; and the 3-category driver age variable. The only exceptions were that road type was not available in the CARDfile data, and in the Washington data only 16 of the 18 configuration categories could be created (when two vehicles were crossing paths "both going straight" could not be distinguished from "one or both turning"). Tables showing the results of all these splits for each of the data sets used are included in Appendix B.

The overall distribution of vehicles across the collision configuration variable is shown in figure 1 and table 1. Only the 16 categories available in the Washington data are shown for all four data sources. It should be remembered that these are percentages of all accident-involved vehicles, so the single-vehicle percentages are much smaller than they would be as percentages of all accidents (37.3 percent of all police-reported accidents in Michigan in 1988 were single-vehicle). Considering the somewhat disparate data collection and coding methods in the four data sources, these overall results are strikingly similar.

The figure also highlights five collision types which were selected for examination in greater detail. Driveway/parking related collisions accounted for a larger share of the vehicles involved in crashes than had been expected. Similarly, since drinking or reckless drivers had been excluded, the number of single-vehicle non-intersection collisions was still surprisingly high. The proportion of collisions involving vehicles traveling in the same direction, not at an intersection, was also intriguingly high. The other two collision types selected for a more detailed case study were the two crossing paths collision types, those at signalized intersections and those at non-signalized intersections. Moreover, in addition to the intrinsic interest of each of these collision types, the five selected collision type subsets cover a substantial fraction of all accidents. About two-thirds of all accidents fall into one of the five categories selected for further study. It was hoped that examining a sample of police reports from each would produce a more detailed understanding of the events which led to the collisions.

THE CASE STUDY ANALYSIS

As a final step in the project, hard copies of the accident reports were obtained for samples of accidents in each of these five major categories. It was hoped that study of these reports would provide additional useful information about what factors contributed to the reported crashes.

A total of 215 cases in the five categories were obtained from the Michigan State Police records, sampling randomly within a total of 32 strata. The strata were used in order to ensure that there would be adequate representation of various factors of interest (particularly driver age) in the case study sample. The numbers of selected cases in each stratum are shown in table 2.

Single-vehicle, non-intersection. Forty reports of single-vehicle, non-intersection accidents were examined. Fifteen involved hitting an animal—12 times it was a deer. An additional computer run showed that, overall, 44% of non-pedestrian single-vehicle accidents involved striking an animal. Three-quarters of these accidents were in rural areas after dark. Other major categories involved striking a fixed object (32.5%), overturning (7.7%), and striking a parked vehicle (12.1%). Snowy/icy roadways and younger drivers were over-represented in each of these latter three categories. Appendix C contains a table summarizing the computer runs for this accident category and also examples of accident reports from six different single-vehicle accident situations—backing into a parked car, sideswiping a parked car while avoiding another vehicle, hitting a deer, hitting a tree, losing control on a wet road, and losing control on a snowy road.

Crossing paths at a signalized intersection. In 18 cases where the vehicles were crossing paths at intersections with functioning 3-color traffic signals, the most common problem was one vehicle simply proceeding into the intersection when the signal was red. Only two of these involved a legal right turn on red. In 12 of the remaining 16 cases the at-fault driver was clear, while in four cases each of the colliding drivers claimed to have a green light. Older drivers were slightly over-represented among the at-fault drivers. Appendix D summarizes the results of the case study of this group of collisions and includes one example police report in which one driver failed to stop for a red light. It also includes a computer run on the various precrash movements of vehicles involved in this type of collision.

Crossing paths at a non-signalized intersection. Fifty of the 55 cases of vehicles crossing paths at a non-signalized intersection involved one vehicle failing to yield at a flashing red light, a stop sign, or a yield sign. Two of the collisions involved a right-turning vehicle striking a vehicle waiting at a stop sign, and three of the collisions were at uncontrolled intersections (one because the traffic signals were inoperative). The failure-to-yield collisions tended to fall into two major categories—cases where the driver told the police that he or she had stopped but then pulled out and collided with an oncoming vehicle and cases where no claim of having stopped was reported in the police narrative. Older drivers were substantially over-represented in the former group. Appendix E summarizes the results of the case study of this category of collisions and includes two sample police reports—one with an at-fault driver who said he stopped before pulling into the intersection and one with an at-fault driver who apparently did not stop at all. It also includes a computer run on the various precrash movements of vehicles involved in this type of collision.

Driveway/parking. Only one of the 59 accident cases which involved entering or leaving a driveway or parking place happened to take place at a parking spot. Of the 23 cases leaving a driveway, 12 involved turning left and four involved backing out. Of the 35 cases entering a driveway, 25 involved turning left and one involved backing in. Clearly, left turns are a particular problem in these collisions. Many of these collisions took place in driveways located adjacent to intersections which may have contributed to the confusion leading to the collision. Almost 17% of the cases involved rearends of a car stopped or slowing to turn into a driveway. Another large fraction of the cases involved an attempt to pass a vehicle turning into a driveway. Only 6 of the 59 cases were of the form that might be the most commonly expected: a vehicle backing from a driveway or parking spot into traffic. Appendix F summarizes the results of the case study of these collisions and includes three example police reports—turning left into a residential driveway, turning left from a residential driveway, and turning right into a commercial driveway. It also includes a new computer run indicating the precrash movements of all vehicles involved in these types of crashes in Michigan.

Same direction, non-intersection. Finally, of the 37 cases of vehicles colliding while traveling in the same direction away from intersections, 24 involved striking in the rear a vehicle in the same lane—usually one that was slowing down or stopped for a traffic light or to make a turn or due to general congestion. The remaining 13 cases involved sideswipe or angle collisions of vehicles passing, changing lanes, etc. Eight of the 24 rear-end collisions involved chains of three or four vehicles. Both younger and older drivers were over-represented among the at-fault drivers in this sample of cases. Appendix G summarizes the results of this case study and includes two example police reports—one of a rear-end collision in which one driver was following too closely and one of a sideswipe collision involving a lane change. Also included is a new computer run showing the precrash movements of the vehicles involved in this type of crash in Michigan.

OPPORTUNITIES FOR FURTHER RESEARCH

The authors feel that the process of developing the most useful typology of collision situations to assist in the development of vehicle or highway crash avoidance technologies is not yet complete. Areas for further research include:

1) The case studies of particular collision types showed that similar vehicle movements and relationships were involved in different collision types. For example, rearends of vehicles slowing in traffic occurred in both driveway-related and same-direction non-intersection collisions. From the point of view of technological interventions, developing a collision typology based on vehicle movements and relationships promises to be more directly applicable to crash avoidance research.

2) Cases involving opposite direction crashes both at and away from intersections are less frequent but generally more serious accident situations. Crash avoidance devices or techniques that prevent these would potentially have a larger payoff than those which affect less serious accidents. In general, accident severity should be included along with frequency in ranking collision scenarios.

3) A two-vehicle computer file should be produced with the Michigan data. In such a file, the data from both vehicles in a crash, such as the ages of the two drivers or the movements of the two vehicles, can be brought together in one record per accident. This will permit the calculation of percentages for each collision category based on all accidents rather than on all accident-involved vehicles. The two-vehicle file will also permit analysis of the interaction of drivers of different age groups in various collision situations and of the specific intended precrash movements of each vehicle involved in a crash.

4) The case studies suggest that older drivers tend to interact with signed intersections differently from younger drivers. The older drivers often stop and then pull out inappropriately, while the younger drivers more often fail to stop altogether. Further study is necessary to see if this pattern is real. If it is, it has important implications for the types of crash avoidance devices that would be effective. This research should include actually photographing the surrounding environment at a sample of stop sign intersections at which collisions have taken place.

5) Similar work could be done on single-vehicle accidents which take place at both signalized and non-signalized intersections to try to understand the factors contributing to these crashes.

Existing accident data lack sufficient detail particularly on pre-collision position and movement, to address many collision avoidance issues. However, information from the actual accident experience is essential if the developing collision avoidance technologies are to address real, as opposed to perceived, problems. This preliminary study has demonstrated the viability of developing collision typologies from existing data that focus on collision avoidance issues. These findings illustrate the potential for further development of such collision typologies.

A final area for further work is the development of viable coding systems for more accurately recording pre-collision information as part of the original accident report. Current coding of accident data is focussed on data elements which relate to crashworthiness. Collision type, for example, is coded for the first harmful event. Other important variables include most harmful event and accident severity. Information on the initiating events is often not recorded. Consideration should be given to changes in accident report forms that would record more pre-collision information. Collision avoidance holds the promise of major traffic safety gains in the coming decade, but the problems must be identified before they can be solved.

Figure 1

Collision Type Distribution
Comparison of Four Data Files

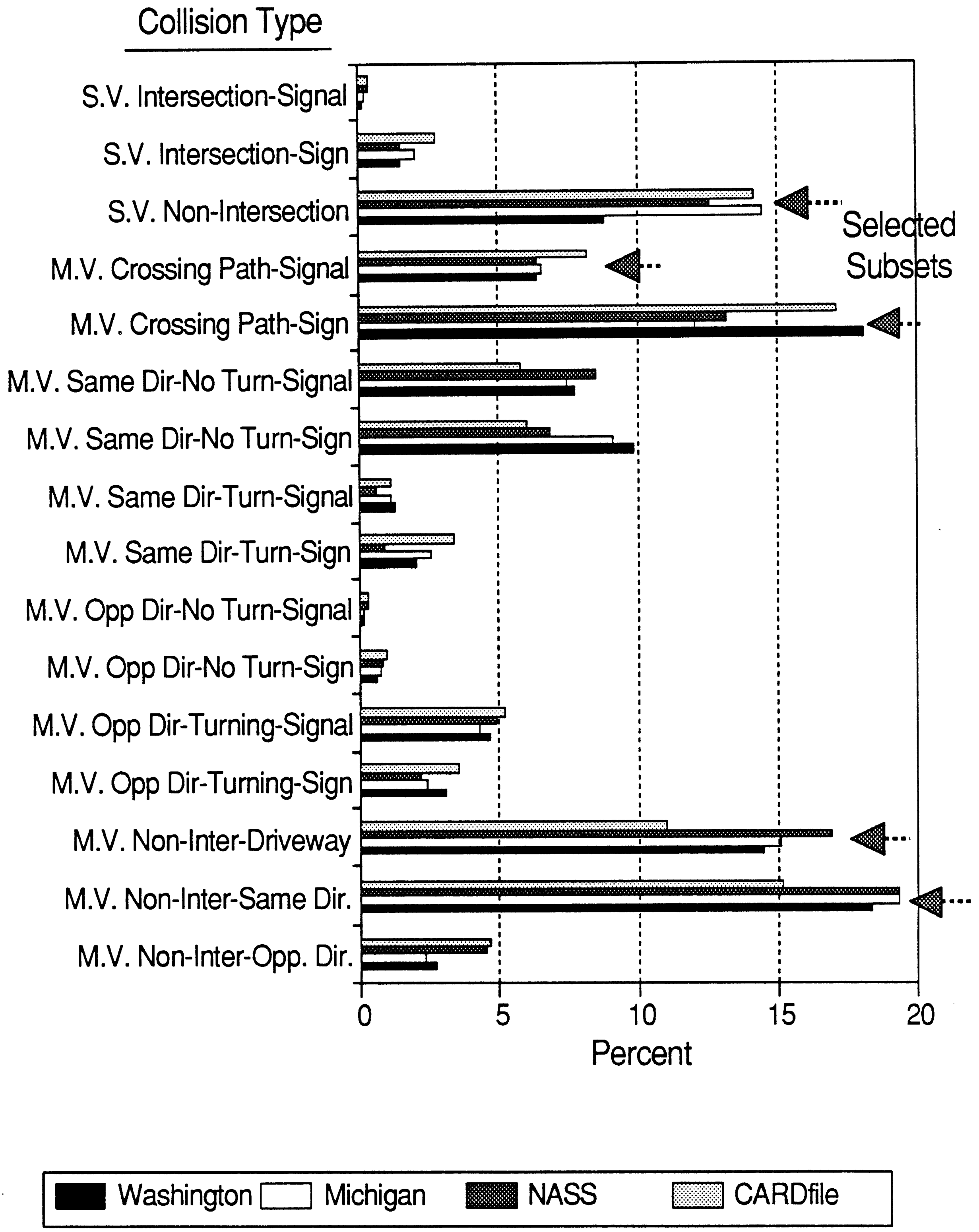


TABLE 1

Collision Type Distribution
Comparison of Four Data Files

Collision Type	Washington 1988	Michigan 1988	NASS 1985-86	CARDfile 1984-86
S.V. Intersection-Signal	0.18	0.24	0.40	0.38
S.V. Intersection-Sign	1.51	2.01	1.50	2.80
S.V. Non-Intersection	8.81	14.46	12.60	14.15
M.V. Crossing Path-Signal	6.39	6.59	6.40	8.23
M.V. Crossing Path-Sign	18.10	12.10	13.20	17.17
M.V. Same Dir-No Turn-Signal	7.78	7.43	8.50	5.81
M.V. Same Dir-No Turn-Sign	9.88	9.16	6.90	6.07
M.V. Same Dir-Turn-Signal	1.30	1.14	0.60	1.12
M.V. Same Dir-Turn-Sign	2.02	2.57	0.90	3.35
M.V. Opp Dir-No Turn-Signal	0.15	0.18	0.30	0.32
M.V. Opp Dir-No Turn-Sign	0.61	0.74	0.80	1.00
M.V. Opp Dir-Turning-Signal	4.70	4.27	4.90	5.20
M.V. Opp Dir-Turning-Sign	3.08	2.42	2.20	3.56
M.V. Non-Inter-Driveway	14.45	15.12	16.90	11.04
M.V. Non-Inter-Same Dir.	18.36	19.28	19.30	15.17
M.V. Non-Inter-Opp. Dir.	2.68	2.30	4.50	4.64
ALL	100.00	100.01	99.90	100.01
Sample Size	123,842	140,910	18,593	168,619
Sample Fraction	100%	30%	--	5%

Table 2

STRATA USED IN THE RANDOM SELECTION OF COPIES OF 1988 MICHIGAN ACCIDENT FORMS

NOTE: Cases were selected from a 25% sample of passenger cars involved in non-pedestrian accidents—excluding cars with drivers under 16, or with drivers who had been drinking, or with drivers who had been driving recklessly or carelessly. The numbers on the right of each stratum show the number of selections made and the number of cases available in the stratum in the sample analyzed.

1.	Single Veh Nonintersection	Light	Urban	16-25	4/1147
2.				26-55	2/1172
3.				56+	2/339
4.		Light	Rural	16-25	4/3300
5.				26-55	2/4577
6.				56+	2/950
7.		Dark	Urban	16-26	4/513
8.				26-55	2/479
9.				56+	2/95
10.		Light	Rural	16-25	8/1554
11.				26-55	4/2271
12.				56+	4/451
				Total = 40	
13.	Multi-Veh Driveway/Parking		Urban	16-25	10/3671
14.				26-55	10/4936
15.				56+	10/1695
16.			Rural	16-25	10/2928
17.				26-55	10/3373
18.				56+	10/1221
				Total = 60	
19.	Multi-Veh Nonintersection Same Dir.			16-25	10/7925
20.				26-55	10/11572
21.				56-65	10/1529
22.				66+	10/1223
				Total = 40	
23.	Multi-Veh Crossing Paths		Signs Only	16-25	10/5612
24.				26-55	10/7254
25.				56-65	10/1305
26.				66-75	10/978
27.				75+	10/524
28.			Signals	16-25	5/2106
29				26-55	5/2889
30				56-65	5/496
31.				66-75	5/350
32.				76+	5/200
				Total = 75	

Grand Total = 215

APPENDIX A
Literature Review

CRASH AVOIDANCE LITERATURE REVIEW
Art Wolfe

Treat John R. (and 7 associates).
Tri-Level Study of the Causes of Traffic Accidents: Executive Summary. Bloomington: Ind. U. Institute for Research in Public Safety, May 1979, 78 pages.

This report summarizes the major American study attempting to analyze the causes of traffic crashes. IRPS carried out on-site investigations of 2258 1972-75 Monroe County (Ind.) accidents (excluding heavy truck, motorcycle, and pedestrian accidents) and in-depth analyses of 420 of these accidents. For the on-site investigations they estimated the following types of (possibly overlapping) factors as definite or probable causal or severity-increasing factors:

Human 90%; Environment 35%; Vehicle 9%.

Non-overlapping combinations were:

Human Only 57%; Human and Environment 27%; Human and Vehicle 4%; Human, Environment, and Vehicle 3%; Environment Only 5%; Environment and Vehicle 1%; Vehicle Only 2%.

Human factors were classified in 3 ways:

1. Major Direct Cause Groups: Recognition Errors 51%; Decision Errors 47%; Performance Errors 9%; and Critical Non-Performance Errors (blackout, dozing) 1%.

2. Specific Direct Causes: Improper Lookout 20%; Excessive Speed 15%; Inattention 14%; False Assumption 12%; Improper Evasive Action 10%; Improper Maneuver 7%; Internal Distraction 6%; Inadequate Defensive Driving Technique 5%; Improper Driving Technique 4%; and Overcompensation 3%.

3. Major Condition or State Subgroups: Alcohol-Impairment 6%; Road/Area Unfamiliarity 2%; Other Drug Impairment 1%; Fatigue 1%; Driver Inexperience 1%; In-Hurry 1%; Emotional Upset 1%; Vehicle Unfamiliarity 1%; Pressure From Other Drivers 1%; and Reduced Vision .2%.

Environmental factors listed were: Slick Roads 14%; View Obstructions (half were trees and bushes) 11%; Special/Transient Hazards 5%; Inadequate Signs and Signals 3%; Control Hindrances (e.g., pavement edge drop-off) 3%; Design Problems 2%; Maintenance Problems 1%; Ambient Vision Limitations 1%; Avoidance Obstructions 1%; and Camouflage Effect .1%.

Vehicle factors listed were: Inadequate Tread Depth 3%; Gross Brake Failure 2%; Vehicle-Related Vision Obstruction 2%; Side-to-side Brake Imbalance 1%; Underinflation 1%; Excessive Steering Freeplay 1%; Inoperable Lights and Signals 1%; and Door Came Open 0% (but .5% in in-depth cases).

This study does not provide a classification of the scenarios in which the various accidents took place, but it is useful in providing a context for thinking about the various factors which must be addressed in attempting to reduce motor vehicle crashes in various driver/vehicle/environment situations.

Institute for Research in Public Safety, Indiana University.
An Analysis of Emergency Situations, Maneuvers, and Driver Behaviors in Accident Avoidance. Bloomington: IRPS, Feb. 1975, 115+ pages. (performed for URS/Matrix Company)

This is a very interesting attempt to classify 372 1971-1974 Monroe County accidents which had been studied indepth into an accident emergency conflict situation taxonomy and then to estimate the potential for optimal evasive maneuvers to have avoided the accident. No freeway accidents are included, and heavy truck, motorcycle, and some pedestrian accidents are also excluded. The general accident taxonomy is shown below with two percentages—first, the percentage of all 372 accidents in the category and, second, the percent of accidents in the category in which it was judged that at least one driver had time to attempt an additional or different evasive maneuver.

TOTAL ACCIDENTS—100.0%; 77.1%

Multi-Vehicle Accidents with All Drivers Facing Conflict—59.7%; 61.0%

1 vehicle traveling in intersection, second vehicle crossing in front of it from a stopped or slowed condition—13.7%; 98.0%

1 vehicle approaching from the rear another vehicle which has slowed or stopped ahead—12.9%; 79.2%

1 vehicle traveling in intersection, second vehicle approaching it from a stopped or slowed condition—7.5%; 57.1%

2 vehicles traveling in intersection, 1 crossing in front of the other, the other approaching the first—7.0%; 76.9%

2 vehicles traveling in opposite directions with one infringing on or in the lane of the other vehicle's path—4.8%; 88.2%

2 vehicles traveling in the same direction in adjacent lanes, one moving into path of the other (passing, turning, etc.)—4.3%; 62.5%

1 vehicle approaching from the rear 2 vehicles which have slowed or stopped ahead—1.9%; 71.4%

1 vehicle pulling into another vehicle's path from a curb lane or intersection—1.9%; 42.9%

1 vehicle traveling in an intersection and another vehicle stopped in its path—1.1%; 100%

1 vehicle traveling in an intersection and an approaching vehicle facing a traffic control device requiring a stop—0.8%; 66.7%

2 vehicles entering intersection from a stopped or slowed condition—0.8%; 33.3%

2 vehicles traveling in opposite directions each infringing upon or in the other's lane—0.8%; 100%

1 vehicle stopped in own lane and another vehicle backing into it from the curb lane or a driveway—0.8%; 100%

1 vehicle entering an intersection from a stopped or slowed condition and an approaching vehicle facing a traffic control device requiring a stop—0.5%; 100%

Other Multi-Vehicle Accidents—2.7%; 100%

1 vehicle traveling in its own lane encounters another vehicle in its path coming from the opposite direction and the other vehicle is attempting to negotiate an emergency situation created by the environment and/or the driver—1.1%; 75%

1 vehicle traveling in its own lane encounters another vehicle in its path coming from the opposite direction and the other vehicle brakes and has a brake imbalance which causes the vehicle to swerve out of control—0.8%; 33.3%

other multi-vehicle accidents in which not all drivers are facing conflict situations—0.8%; 33.3%

One-Vehicle Accidents Resulting from Conflict Situations—6.7%; 96.0%

1 vehicle traveling in its own lane encounters another vehicle in its path coming in the opposite direction—2.2%; 100%

1 vehicle traveling in its own lane with another vehicle stopped or slowed ahead—1.3%; 100%

1 vehicle infringing on or in opposing lane of travel and another vehicle is approaching in the opposite direction—1.1%; 100%

1 vehicle traveling in its own lane or passing and another vehicle traveling in the same direction is moving into its path—0.5%; 100%

1 vehicle traveling in its own lane and another vehicle pulling into its path from a curb or intersection—0.5%; 100%

other one-vehicle accidents with a conflict situation—1.1%; 75%

TOTAL CONFLICT SITUATION ACCIDENTS—69.1%; 79.4%

One-Vehicle Accidents Not From Conflict Situations—30.1%; 72.2%

Vehicle drifting off roadway through human error—7.5%; 60.7%

Vehicle rotating with respect to intended direction of travel due to environment and/or human error—6.7%; 92.0%

Vehicle encountering a stationary hazard or parked vehicle in its path—4.8%; 66.7%

Vehicle negotiating a curve at too high a rate of speed and losing control—3.2%; 100%

Vehicle out of control due to miscellaneous failure or gross performance degradation (steering wheel gear box stuck; left door opened and driver fell out (2 cases); hood flew open; rotational instability; wheel loss; vehicle stalled)—1.9%; 42.9%

Vehicle attempting to avoid a pedestrian in its path—1.6%; 83.3%

Braking vehicle finds brakes inoperative—1.3%; 100%

Vehicle encountering miscellaneous environmental problems (opening door on a parked car; slow moving train; unseen traffic control device beyond crest of hill; cresting a hill too fast)—1.1%; 75%

Braking vehicle has brake imbalance and swerves out of control—0.8%; 0%

Vehicle attempting to avoid an animal in its path—0.8%; 66.7%

Vehicle attempting to avoid a bicyclist crossing its path at an intersection—0.5%; 50%

Bizarre driver behavior (intoxicated driver opens door to scare passenger; drug reaction)—0.5%; 0%

TOTAL NON-CONFLICT SITUATION ACCIDENTS—30.9%; 72.2%

In the full situation taxonomy some categories are divided into further subcategories, but the percentages for these subcategories are not shown in the report. For example, a single vehicle drifting off the road is further categorized into drifting left and drifting right. And four types of intersection conflicts are further categorized as to whether the intersecting route was a path or a roadway (the distinction is not explained) and as to whether conflicting vehicles were coming from the left, from the right, or from ahead.

It should be noted that the situation taxonomy was applied separately to each of the 613 involved vehicles. Therefore the situation taxonomy for multi-vehicle accidents shown above is the result of combining the categories for each of the involved vehicles.

This study also developed a taxonomy of 32 possible emergency maneuvers which might have been attempted in these accident situations—combinations of steering direction, intent (stopping, continuing, reversing), use of brakes, and use of accelerator. The study staff then rated the probability of success in avoiding an accident for each of these maneuvers for each vehicle in its accident situation in the cases in which the driver was considered to have had enough time to perceive the danger and to attempt evasive action.

Overall, of the 488 drivers in emergency conflict situations 54% were considered to have had time to take evasive action. It was judged that if these 265 drivers had attempted the optimal avoidance maneuver (taking into account actual environmental constraints in each accident situation) 16.6% of them would have certainly been successful and another 37.7% would have probably been successful. Applied to the 257 conflict situation accidents 16.3% could have certainly been avoided, and 30.4% could probably have been avoided.

Analysis of the actual maneuvers of the 265 drivers who had time to do something showed that the most common maneuver (37.7%) was steering straight and braking with intent to stop. Of these 100 drivers 51 locked their brakes, as did 68 of the remaining 165 drivers. Also 7 made overcompensating steering errors and 3 panicked or froze.

An analysis of the value of using the car horn estimated certain success in avoiding an accident for 1.9% of the drivers who had time and probable success for another 13.6% of these drivers.

Tumbas, Nicholas S., John R. Treat, and Stephen T. McDonald.
"An Assessment of the Accident Avoidance and Severity Reduction Potential of Radar Warning, Radar Actuated, and Anti-Lock Braking Systems", SAE Paper 770266, Detroit, February 28-

March 4, 1977. [based on IRPS *Tri-Level Study: Interim Report II, Vol. II: Radar and Anti-Lock Braking Payoff Assessment*]

This was an interesting attempt to estimate the potential safety benefits of 6 safety systems by judging their certain, probable, or possible effects in 215 accident situations studied indepth in the IRPS tri-level accident study. These were: cooperative radar warning (requiring reflectors on other vehicles and roadside objects), non-cooperative radar warning (no special reflectors required), cooperative radar warning and brake actuation, non-cooperative radar warning and brake actuation, rear-wheel anti-lock brakes, and four-wheel anti-lock brakes. Four of these were evaluated separately plus six combinations were evaluated, making a total of 10 models. A 300-foot line-of-sight radar beam with an arc of 2.5 degrees was assumed, and it was also assumed that no spurious signals were given which caused other harm.

The authors found certain or probable benefits in accident avoidance or mitigation for the 10 models as follows:

Rear-Wheel Anti-Lock 2% (of accidents studied)
Four-Wheel Anti-Lock 8%
Cooperative Radar Warning (normal brakes) 12%
Cooperative Radar Warning and Rear-Wheel Anti-Lock 14%
Non-Cooperative Radar Warning (normal brakes) 17%
Cooperative Radar Warning and Four-Wheel Anti-Lock 17%
Non-Cooperative Radar Warning and Rear-Wheel Anti-Lock 19%
Cooperative Radar Warning/Actuation and Four-Wheel Anti-Lock 21%
Non-Cooperative Warning and Four-Wheel Anti-Lock 22%
Non-Cooperative Radar Warning/Actuation and Four-Wheel Anti-Lock 38%

Fontaine, Helene et al. (INRETS, Paris).
"Evaluation of the Potential Efficiency of Driving Aids", paper presented at the First Vehicle Navigation and Information Systems Conference, Toronto, Sept. 11-13, 1989, pp. 454-459 of *Conference Record* (D.H.M. Reekie et al. compilers and editors).

The authors report the preliminary analysis of 350 French police-reported accidents involving 621 vehicles, a 1:500 random sample. They classified the involved vehicles into 6 accident groupings roughly as follows (the descriptions of each group are somewhat vague, and I find it hard to believe that all the accidents fell into one of these 6 groups).

1. Urban, intersection, multi-vehicle (except 2-wheelers) 39%
2. Urban, intersection, multi-vehicle (with 1+ 2-wheelers) 17%
3. Rural, non-intersection, multi-vehicle 13%
4. Urban, involving a pedestrian 10%
5. Rural, non-intersection, single-vehicle, night-time 9%
6. Freeway, multi-vehicle 12%

The authors discuss 14 types of needs (assistance) which might be made available to drivers, and they estimate that about 59% of the 621 drivers had a need for assistance and that about 50% could have benefitted from one or more of the 14 devices they theorize about.

Joksch, Hans C.
Manual for Accident Causation Research. Hartford: Center for the Environment and Man, June 1983, 102 pages.

This "manual" discusses many theoretical and practical considerations in classifying, collecting, and analyzing accident and exposure data—with particular attention to sampling road segments and intersections in order to observe vehicle, driver, and environmental characteristics. It does not describe or recommend any specific exposure data collection plan.

Of particular interest is Section 3.2 Classification and Stratification of Accidents. It suggests the following (incomplete) accident classification schema.

1. Multi-vehicle Accidents at Intersections, Junctions, and Driveways
   [subcategories not provided]

2. Single-vehicle Accidents at Intersections etc.:
   No turning maneuver;
   Turning left;
   Turning right;
   Making a U-turn.

3. Atypical Intersection Collisions:
   Head-on collision or opposite direction sideswipe;
   Rear-end collision or same direction sideswipe with lead vehicle turning or stopping;
   Rear-end collision or same direction sideswipe with lead vehicle neither turning nor stopping.

4. Non-intersection Essential Two-vehicle Accidents:
   Head-on collision or opposite direction sideswipe, one or both vehicles passing;
   Head-on collision or opposite direction sideswipe, one or both traveling in opposing traffic lane;
   Rear-end collision;
   Same direction sideswipe with both vehicles in traffic stream;
   Same direction sideswipe with 1 vehicle merging from parking place.

5. Non-intersection Incidental Two-vehicle Accidents:
   Head-on collision or opposite direction sideswipe with 1 vehicle having prior "loss of control";
   Rear-end collision or same direction sideswipe with 1 vehicle having prior "loss of control".

6. Non-intersection Single-vehicle Accidents:
   Running off the road or colliding with a roadside object;
   Rolling over on the road;
   Collision with a parked vehicle on the road;
   Collision with a previously-involved accident vehicle on the road;
   Collision with some other object on the road;
   Collision with an animal on the road;
   Collision with a train at a railroad grade crossing;
   Collision with a pedestrian;
   Collision with a bicyclist;
   Collision with a horseback rider or an animal-drawn vehicle.

Joksch, Hans C. and Jim C. Kinoop.
Development of a Methodology for Accident Causation Research, Hartford, Center for the Environment and Man, 1983, 183 pp.

This reports the attempt to use roadside observation methods to obtain exposure data for a number of possible accident causation factors which were available in New York police-reported accidents. Both road segments and intersections were sampled on a variety of road types in Ulster

County (a NASS PSU, but the numbers of NASS cases were too few to use in the analysis), and a similar procedure limited to state highways was carried out in Schenectady County. The data observed were limited to passenger cars between 7:00 a.m. and 11:00 p.m. The data included estimated driver age and sex, vehicle occupancy, traffic control devices and driver compliance, number of traffic lanes, road alignment (straight or curved), road slope (level or grade), road surface condition, weather and light conditions, and traffic volume. In addition license plates were photographed in order to obtain car age and weight from state records, and car speed was obtained by radar. There were many sampling and data collection problems, particularly at night, which made the analysis of the data from this exploratory study less rigorous than had been planned. Nevertheless some of the findings of interest follow:

The unit of exposure for data collected at road segments was vehicle miles travelled (VMT) by passenger cars. In Ulster County the accident rates found per million VMT were: Single-vehicle 0.9; Head-on 0.9; Rear-end 0.5; and Other 1.8.

The unit of exposure for data collected at intersections was a count of maneuvers by passenger cars. The accident rates found per million maneuvers were: Going straight 0.32; Turning Left 1.25; Turning Right 0.20; and Other 0.30. Among the risk factors which the analysis found to be somewhat overinvolved in accidents were rural location, nighttime, wet road surface, driving an older vehicle, driving a heavier vehicle, being over 50, being female, traffic volume, and traffic speed.

Finklestein, Michael M.
"Future Motor Vehicle Safety Research Needs: Crash Avoidance", paper presented at the 12th International Technical Conference on Experimental Safety Vehicles, Gothenburg, Sweden, May 29 - June 1, 1989, 7 pages.

This paper points out that we have made great progress in occupant protection, but crash avoidance is a much more difficult problem because a variety of human factors are so prominent. He suggests that we have sufficient data in the FARS, NASS, and state accident files to be able to describe the relative importance of the various factors contributing to crashes. Thus the current challenge is to find the best methods for analyzing these data usefully and for determining priorities in developing crash avoidance countermeasures.

Council, Forrest R., J.R. Stewart, and E.A. Rodgeman.
Development of Exposure Measures for Highway Safety Analysis. Chapel Hill: Highway Safety Research Center, 1987, 108+ pages.

This interesting report describes an extensive attempt to develop appropriate formulas for measuring exposure ("the opportunity to be involved in a crash") for various kinds of accidents at signalized intersections. In an earlier study HSRC had developed exposure formulas for 5 types of accidents (head-on, angle, rear-end, sideswipe (same direction), and single-vehicle) as relevant to 5 types of locations or research questions (intersections, interchanges, nonintersection roadway segments, fixed object collisions, and accidents involving specific vehicle types). In this study the accident types are expanded to distinguish left-turning accidents in each situation, and 3 types of left-turning signalization are analyzed—unprotected (no special left-turn phase), protected (special left-turn phase and lane), and protected/permissive (like protected but also permitting left turns on the thru-green phase). The 7 exposure types analyzed were:

1. Head-on for through and right-turning flows.
2. Head-on for left-turning flows.
3. Sideswipe (same direction)

4. Rear-end for through and right-turning flows.
5. Rear-end for left-turning flows.
6. Angle for through and right-turning vehicles.
7. Left-turning [distinction from 2 & 5 not clear—p. 61].

In order to test their theoretical formulas with empirical data the project staff collected 60 hours of videotapes at 29 intersections in 4 North Carolina cities. It required about 10 hours to code each hour of tape into the various needed flow counts by 15-minute segments. In addition to the flow data the formulas took into account such variables as intersection width, signal cycle length and phasing, number of approach lanes, speed limit, etc. They also developed formulas using only the flow data, but in general they did not find these as satisfactory as the formulas using other variables also. In some cases the formulas were specific to the type of left-turn signalization. They discuss the problems of relating their formulas to accident probabilities and of aggregating the exposure measures for an entire intersection in order to compare the hazardousness of various intersections, but they admit to not having satisfactory solutions to these problems.

Nwanko, Adiele and Ravi Goli.
Southeast Michigan Traffic Crash Profile. Detroit: Southeast Michigan Council of Governments, November 1989, 41 pages.

This report provides univariate 1985-1987 crash distributions (mostly in percents) for the 7-county southeast Michigan region (sometimes separately for property damage only, injury, and fatal accidents or for alcohol-related accidents, and sometimes separately for each county). Independent variables presented include month, day of week, weekend/weekday, day/night, 3-hour time periods, freeway/other, on/off road surface, driver age, pedestrian age, and bicyclist age. Comparisons with exposure data are provided for freeway/other (by county), day/night, and driver age, but the source is not mentioned. The concluding section uses FHWA accident cost analysis studies to estimate a $1,700,000,000 cost in 1987 for traffic crashes in southeast Michigan.

Haight, Frank A., Hans C. Joksch, James O'Day, Patricia F. Waller, Jane C. Stutts, and Donald W. Reinfurt. *Review of Methods for Studying Pre-Crash Factors.* Chapel Hill: Highway Safety Research Center, May 1976, 95 pages.

This is a report by a panel of experts who provide critical reviews of previous accident causation studies, with particular attention to 4 IRPS studies and 2 Calspan studies. Thirteen other studies are also reviewed briefly. The authors strongly endorse the general plans for implementing a National Accident Sampling System (NASS) which would collect mainly Level II-type accident data, although they add some cogent suggestions for improving the NASS plans. They do not suggest any particular accident type taxonomies, but they do suggest that the IRPS accident causation taxonomy would be a good starting point for developing the NASS data collection forms.

Andreassend, D.C.
"The Need For, and Use Of, Classified Accident Types in Safety Investigations". Vermont South, Victoria: Australian Road Research Board Internal Report 819-1, July 1986, 10 pages.

The author discusses the value of using a clear well-defined accident typology, utilizing accident diagram data on maneuvers and intentions if necessary. Then if one applies a countermeasure treatment, one should analyze how these various types of accidents are affected, not just accidents in general. He gives one example of a useful accident typology from 1981 accidents in Victoria. The listing below is in order by the frequency [or fraction—not clear] of persons killed or admitted to the hospital per accident in each type of accident.

1. Head-on 0.70
2. Ran off road at bend 0.61
3. Pedestrian accident 0.54
4. Ran off road on straight section 0.46
5. Pedacycle accident 0.37
6. Vehicles from 2 streets 0.34
7. Right turn/opposing vehicle 0.34

Strandberg, Lennart
"Skidding Accidents and Their Avoidance with Different Cars", Paper No. 89-48-0-011 presented at the 12th Experimental Safety Vehicle Conference, June 1989.

The author presents some dramatic statistics on the overrepresentation of snowy/icy roads in head-on injury-producing multi-vehicle collisions in Sweden—the collision type accounting for more than one half of the multi-vehicle fatalities. Unfortunately, the supporting data in Figure 1 don't agree with the numbers presented in the text, but they do still indicate a substantial overrepresentation of snowy/icy roads.

Strandberg cites a study by Aschenbrenner et al. (1988) which found no real-world improvement in safety from anti-lock brakes and a study by Glad (1988) that found an increased risk of accident in drivers with skidpad training. He suggests that improvements in controllability (steering and brakes) may not be as important to crash avoidance as improvements in stability. He says that stability is improved when the cornering performance of the front tires is inferior to that of the rear wheels and when the front wheels are overpowered or overbraked compared to the rear wheels. He suggests that there may be particular problems with stability in front-wheel-drive cars, in cars with studs protruding more on the front tires, and in cars with cruise control. He also suggests that the common driver education recommendation to depress the clutch pedal before countersteering in a rear-wheel skid may be counterproductive.

Kramer, F., N. Shakeri-Nejad, G. Schockenhoff, A. Fandre, K.-D.Schlichting, H. Appel, and W. Hauschild. "Study in Avoidance of Road Accidents with the Aid of Computer Simulation of Characteristic Driving Manoeuvres", paper presented at the 11th International Technical Conference on Experimental Safety Vehicles, May 12-15, 1987, Arlington, Virginia, USA.

This paper reports the distribution of traffic injury costs among seven types of accidents in West Germany for 1984, separately for inside and outside city limits. The seven types are: driving traffic, turn off traffic, junction/crossing, going across (pedestrian), traffic in rest, longitudinal traffic, and other. A similar distribution is shown for 646 injuries from a detailed accident study. This study provided data for the generation of models varying different types of accident-relevant driving maneuvers and road-building and automotive parameters in a mathematical simulation program. Some examples of the simulations results for driving on a left-hand curve are presented. Experimental tests will be necessary to validate the results of these simulation findings.

APPENDIX B
Tables from Washington, Michigan, NASS, and CARDfile

ANALYSIS OF 1988 WASHINGTON ACCIDENT DATA

DATA FILE: all passenger cars involved in non-pedestrian/bicyclist accidents

EXCLUSIONS:

1. Vehicles with drivers under 16

2. Vehicles with drivers who had been drinking (about 7.7%)

TOTAL CASES IN ANALYSIS: 123,842

TABLES: Separate tables for property damage only accidents (59% of total), casualty accidents, and all accidents—each with row and total percentages

SPREAD VARIABLE: 16 Collision Configurations based on

1. Single-Vehicle/Multi-Vehicle

2. Intersection or Not

3. Vehicle Movements—crossing paths, same direction, opposite directions, entering or leaving a driveway or parking place, turning or going straight

4. Intersection Signalized or Signed

CONTROL VARIABLES:

1. Urban (defined as cities over 5,000 or other urbanized areas—about 79%) or Rural

2. Major Road (defined as U.S. or state route—about 33%) or Local Road

3. Daylight (about 65%) or Dark (including dawn and dusk)

4. Driver Age—16-25, 26-55, 56

TABLE 1. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 WASHINGTON (STATE) PASSENGER CARS IN NON-PEDESTRIAN PROPERTY DAMAGE ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE AT AN INTERSECTION SIGNAL	SINGLE-VEHICLE AT AN INTERSECTION SIGNS	SINGLE-VEHICLE NON-INTER SECT	MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS: CROSS PATHS ALL MOVES SIGNAL	CROSS PATHS ALL MOVES SIGNS	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNAL	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNS	VEHICLES SAME DIRECTION ONE+ TURNING SIGNAL	VEHICLES SAME DIRECTION ONE+ TURNING SIGNS	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNAL	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNS	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNAL	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNS	MULTI-VEHICLE NON-INTERSECTION DRIVWY PARKNG	NON-INTERSECTION SAME DIR.	NON-INTERSECTION OPP. DIR.	TOTAL N	TOTAL COL %
URMJDY R%	0.15	0.97	5.11	6.25	8.31	9.25	13.57	1.68	1.64	0.18	0.20	3.32	1.96	10.90	35.64	0.86	12473	16.94
URMJDK R%	0.15	1.07	3.35	7.07	24.99	6.17	7.92	2.25	2.69	0.16	0.56	5.34	3.91	21.59	11.13	1.66	34570	46.95
URLCDY R%	0.50	1.87	11.04	6.20	6.02	8.75	11.16	1.02	1.28	0.22	0.60	4.94	1.87	9.51	33.65	1.36	5016	6.81
URLCDK R%	0.31	2.64	9.36	8.57	20.29	6.75	6.19	2.44	2.36	0.28	0.68	8.68	3.11	15.01	10.99	2.35	11616	15.78
RUMJDY R%	0.03	1.21	28.17	1.73	11.96	2.17	8.55	0.20	4.36	----	0.69	0.64	1.82	11.70	22.02	4.74	3461	4.70
RUMJDK R%	0.06	2.49	21.41	0.77	22.27	1.45	7.01	0.18	3.24	----	0.86	0.50	2.76	21.38	7.87	7.75	3368	4.57
RULCDY R%	0.19	2.79	55.02	0.93	6.51	1.18	3.97	0.06	2.60	0.06	0.19	0.99	1.24	6.20	14.06	4.03	1614	2.19
RULCDK R%	----	7.02	51.52	0.46	11.72	0.60	4.44	0.13	1.32	----	0.40	0.53	1.39	10.60	5.36	4.50	1510	2.05
URMJDY T%	0.03	0.16	0.87	1.06	1.41	1.57	2.30	0.28	0.28	0.03	0.03	0.56	0.33	1.85	6.04	0.15	12473	16.94
URMJDK T%	0.07	0.50	1.57	3.32	11.73	2.90	3.72	1.06	1.26	0.07	0.26	2.51	1.84	10.14	5.22	0.78	34570	46.95
URLCDY T%	0.03	0.13	0.75	0.42	0.41	0.60	0.76	0.07	0.09	0.01	0.04	0.34	0.13	0.65	2.29	0.09	5016	6.81
URLCDK T%	0.05	0.42	1.48	1.35	3.20	1.06	0.98	0.38	0.37	0.04	0.11	1.37	0.49	2.37	1.73	0.37	11616	15.78
RUMJDY T%	0.00	0.06	1.32	0.08	0.56	0.10	0.40	0.01	0.21	----	0.03	0.03	0.09	0.55	1.03	0.22	3461	4.70
RUMJDK T%	0.00	0.11	0.98	0.04	1.02	0.07	0.32	0.01	0.15	----	0.04	0.02	0.13	0.98	0.36	0.35	3368	4.57
RULCDY T%	0.00	0.06	1.21	0.02	0.14	0.03	0.09	0.00	0.06	0.00	0.00	0.02	0.03	0.14	0.31	0.09	1614	2.19
RULCDK T%	----	0.14	1.06	0.01	0.24	0.01	0.09	0.00	0.03	----	0.01	0.01	0.03	0.22	0.11	0.09	1510	2.05
URBAN R%	0.21	1.40	5.39	7.12	19.37	7.08	8.97	2.07	2.31	0.19	0.52	5.52	3.22	17.34	17.68	1.60	63675	86.48
RURAL R%	0.06	2.78	33.78	1.09	14.53	1.53	6.66	0.16	3.24	0.01	0.62	0.63	1.98	13.92	13.41	5.61	9953	13.52
URBAN T%	0.18	1.21	4.67	6.15	16.75	6.13	7.76	1.79	2.00	0.16	0.45	4.77	2.79	15.00	15.29	1.39	63675	86.48
RURAL T%	0.01	0.38	4.57	0.15	1.96	0.21	0.90	0.02	0.44	0.00	0.08	0.09	0.27	1.88	1.81	0.76	9953	13.52
MAJOR R%	0.21	1.34	13.53	5.17	8.23	7.48	11.58	1.19	2.04	0.15	0.36	3.10	1.87	10.38	31.57	1.79	22564	30.65
LOCAL R%	0.17	1.70	7.33	6.80	23.35	5.83	7.36	2.09	2.61	0.17	0.60	5.64	3.58	19.75	10.71	2.30	51064	69.35
MAJOR T%	0.07	0.41	4.15	1.58	2.52	2.29	3.55	0.36	0.63	0.05	0.11	0.95	0.57	3.18	9.67	0.55	22564	30.65
LOCAL T%	0.12	1.18	5.08	4.72	16.19	4.04	5.11	1.45	1.81	0.12	0.42	3.91	2.48	13.70	7.43	1.60	51064	69.35
LIGHT R%	0.14	1.15	6.48	6.15	20.12	6.33	9.21	1.85	2.59	0.14	0.50	4.27	3.25	18.47	17.30	2.05	53872	73.17
DARK R%	0.32	2.79	16.74	6.72	14.89	6.33	7.14	1.71	2.02	0.22	0.60	6.48	2.51	12.56	16.57	2.40	19756	26.83
LIGHT T%	0.10	0.84	4.74	4.50	14.72	4.63	6.74	1.36	1.89	0.10	0.37	3.12	2.38	13.51	12.66	1.50	53872	73.17
DARK T%	0.09	0.75	4.49	1.80	3.99	1.70	1.92	0.46	0.54	0.06	0.16	1.74	0.67	3.77	4.45	0.64	19756	26.83
16TO25 R%	0.29	2.59	12.18	5.43	18.16	5.94	8.54	1.44	2.47	0.19	0.51	4.92	2.71	15.86	16.51	2.26	26865	36.49
26TO55 R%	0.13	1.07	7.82	6.37	18.11	6.84	9.27	1.97	2.33	0.15	0.55	4.69	3.09	16.97	18.45	2.18	35538	48.27
56PLUS R%	0.11	0.83	6.63	8.19	21.98	5.67	6.98	2.22	2.70	0.12	0.51	5.24	3.77	19.04	14.26	1.76	11225	15.25
16TO25 T%	0.11	0.95	4.45	1.98	6.63	2.17	3.12	0.52	0.90	0.07	0.19	1.80	0.99	5.79	6.02	0.82	26865	36.49
26TO55 T%	0.06	0.52	3.78	3.07	8.74	3.30	4.47	0.95	1.12	0.07	0.27	2.27	1.49	8.19	8.90	1.05	35538	48.27
56PLUS T%	0.02	0.13	1.01	1.25	3.35	0.86	1.06	0.34	0.41	0.02	0.08	0.80	0.57	2.90	2.17	0.27	11225	15.25
TOTAL N	137	1170	6797	4639	13781	4663	6373	1336	1795	120	390	3578	2249	12429	12592	1579	73628	100.00
TOTAL R%	0.19	1.59	9.23	6.30	18.72	6.33	8.66	1.81	2.44	0.16	0.53	4.86	3.05	16.88	17.10	2.14	73628	100.00

*Excluding drivers under 16 and drivers who had been drinking.

TABLE 2. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 WASHINGTON (STATE) PASSENGER CARS IN NON-PEDESTRIAN FATAL AND INJURY ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE AT AN INTERSECTION SIGNAL	SINGLE-VEHICLE AT AN INTERSECTION SIGNS	SINGLE-VEHICLE NON-INTER SECT	MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS: CROSS PATHS ALL MOVES SIGNAL	CROSS PATHS ALL MOVES SIGNS	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNAL	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNS	VEHICLES SAME DIRECTION ONE+ TURNING SIGNAL	VEHICLES SAME DIRECTION ONE+ TURNING SIGNS	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNAL	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNS	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNAL	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNS	MULTI-VEHICLE NON-INTERSECTION DRIVWY PARKNG	NON-INTERSECTION SAME DIR.	NON-INTERSECTION OPP. DIR.	TOTAL N	TOTAL COL %
URMJDY R%	0.19	0.79	4.72	4.64	5.73	13.00	14.73	0.49	0.82	0.08	0.40	2.72	1.83	7.67	40.93	1.28	10269	20.45
URMJDK R%	0.15	0.89	2.80	8.61	25.34	10.26	11.94	0.67	1.37	0.12	0.66	5.45	3.88	13.52	12.00	2.32	20715	41.25
URLCDY R%	0.35	1.28	8.73	5.18	4.92	12.37	11.26	0.64	0.83	0.19	0.52	4.16	2.06	6.20	38.22	3.10	4228	8.42
URLCDK R%	0.26	2.12	7.33	9.27	19.71	10.59	9.71	0.63	1.70	0.24	0.97	7.82	3.33	11.80	10.98	3.56	7651	15.24
RUMJDY R%	0.07	1.48	24.34	1.38	12.03	3.45	11.66	0.17	2.59	0.07	1.03	0.86	3.59	9.21	18.38	9.69	2900	5.78
RUMJDK R%	0.09	2.54	23.68	0.71	22.61	1.65	8.74	0.04	2.50	----	1.43	0.54	3.08	13.56	9.55	9.28	2242	4.46
RULCDY R%	0.18	3.20	38.93	1.87	8.44	1.87	5.51	0.27	2.22	0.09	0.89	1.69	2.49	6.04	14.84	11.47	1125	2.24
RULCDK R%	----	7.10	41.05	0.46	12.36	1.85	5.81	----	2.03	----	1.38	0.37	2.40	6.83	8.30	10.06	1084	2.16
URMJDY T%	0.04	0.16	0.97	0.95	1.17	2.66	3.01	0.10	0.17	0.02	0.08	0.56	0.37	1.57	8.37	0.26	10269	20.45
URMJDK T%	0.06	0.37	1.16	3.55	10.46	4.23	4.93	0.28	0.56	0.05	0.27	2.25	1.60	5.58	4.95	0.96	20715	41.25
URLCDY T%	0.03	0.11	0.73	0.44	0.41	1.04	0.95	0.05	0.07	0.02	0.04	0.35	0.17	0.52	3.22	0.26	4228	8.42
URLCDK T%	0.04	0.32	1.12	1.41	3.00	1.61	1.48	0.10	0.26	0.04	0.15	1.19	0.51	1.80	1.67	0.54	7651	15.24
RUMJDY T%	0.00	0.09	1.41	0.08	0.70	0.20	0.67	0.01	0.15	0.00	0.06	0.05	0.21	0.53	1.06	0.56	2900	5.78
RUMJDK T%	0.00	0.11	1.06	0.03	1.01	0.07	0.39	0.00	0.11	----	0.06	0.02	0.14	0.61	0.43	0.41	2242	4.46
RULCDY T%	0.00	0.07	0.87	0.04	0.19	0.04	0.12	0.01	0.05	0.00	0.02	0.04	0.06	0.14	0.33	0.26	1125	2.24
RULCDK T%	----	0.15	0.89	0.01	0.27	0.04	0.13	----	0.04	----	0.03	0.01	0.05	0.15	0.18	0.22	1084	2.16
URBAN R%	0.20	1.12	4.66	7.44	17.62	11.18	12.15	0.62	1.24	0.14	0.64	5.09	3.11	11.09	21.33	2.37	42863	85.36
RURAL R%	0.08	2.90	28.84	1.12	14.76	2.42	8.96	0.12	2.42	0.04	1.18	0.82	3.09	9.70	13.66	9.89	7351	14.64
URBAN T%	0.17	0.96	3.97	6.35	15.04	9.55	10.37	0.53	1.06	0.12	0.55	4.35	2.66	9.47	18.21	2.02	42863	85.36
RURAL T%	0.01	0.42	4.22	0.16	2.16	0.35	1.31	0.02	0.35	0.01	0.17	0.12	0.45	1.42	2.00	1.45	7351	14.64
MAJOR R%	0.21	1.16	10.79	4.08	6.69	10.68	12.90	0.46	1.18	0.10	0.56	2.69	2.20	7.48	35.20	3.63	18522	36.89
LOCAL R%	0.17	1.52	6.68	7.93	23.35	9.44	10.97	0.59	1.55	0.13	0.81	5.50	3.64	12.88	11.45	3.37	31692	63.11
MAJOR T%	0.08	0.43	3.98	1.51	2.47	3.94	4.76	0.17	0.44	0.04	0.21	0.99	0.81	2.76	12.98	1.34	18522	36.89
LOCAL T%	0.11	0.96	4.22	5.01	14.73	5.96	6.92	0.37	0.98	0.08	0.51	3.47	2.30	8.13	7.23	2.13	31692	63.11
LIGHT R%	0.15	1.01	6.37	6.41	18.53	9.96	12.51	0.54	1.38	0.09	0.66	4.00	3.22	11.52	20.58	3.04	36126	71.94
DARK R%	0.26	2.34	12.87	6.77	13.81	9.75	9.54	0.55	1.50	0.19	0.86	5.66	2.81	9.28	19.26	4.55	14088	28.06
LIGHT T%	0.11	0.73	4.59	4.61	13.33	7.17	9.00	0.39	0.99	0.07	0.48	2.88	2.32	8.28	14.81	2.19	36126	71.94
DARK T%	0.07	0.66	3.61	1.90	3.87	2.74	2.68	0.16	0.42	0.05	0.24	1.59	0.79	2.60	5.40	1.28	14088	28.06
16TO25 R%	0.19	2.12	11.85	5.79	17.32	8.28	11.29	0.48	1.51	0.11	0.73	4.73	2.77	10.83	18.60	3.41	18040	35.93
26TO55 R%	0.15	0.97	6.13	6.51	15.98	11.21	12.30	0.60	1.40	0.14	0.75	4.15	3.13	10.74	22.18	3.66	25375	50.53
56PLUS R%	0.28	0.97	6.22	8.46	21.46	9.34	10.43	0.50	1.19	0.09	0.56	4.96	3.93	11.60	17.12	2.90	6799	13.54
16TO25 T%	0.07	0.76	4.26	2.08	6.22	2.97	4.05	0.17	0.54	0.04	0.26	1.70	0.99	3.89	6.68	1.23	18040	35.93
26TO55 T%	0.08	0.49	3.10	3.29	8.08	5.66	6.21	0.30	0.71	0.07	0.38	2.10	1.58	5.43	11.21	1.85	25375	50.53
56PLUS T%	0.04	0.13	0.84	1.15	2.91	1.26	1.41	0.07	0.16	0.01	0.08	0.67	0.53	1.57	2.32	0.39	6799	13.54
TOTAL N	92	695	4116	3270	8639	4972	5865	273	710	61	361	2243	1561	5467	10148	1741	50214	100.00
TOTAL R%	0.18	1.38	8.20	6.51	17.20	9.90	11.68	0.54	1.41	0.12	0.72	4.47	3.11	10.89	20.21	3.47	50214	100.00

*Excluding drivers under 16 and drivers who had been drinking.

TABLE 3. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 WASHINGTON (STATE) PASSENGER CARS IN ALL NON-PEDESTRIAN ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE			MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS												MULTI-VEHICLE			TOTAL N	TOTAL COL %
	AT AN INTERSECTION		NON-INTER SECT	CROSS PATHS		VEHICLES SAME DIRECTION				VEHICLES OPP. DIRECTIONS				NON-INTERSECTION				
				ALL MOVES		TWO STRAIGHT		ONE+ TURNING		TWO STRAIGHT		ONE+ TURNING		DRIVWY	SAME	OPP.		
	SIGNAL	SIGNS		SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	PARKNG	DIR.	DIR.		
URMJDY R%	0.17	0.89	4.93	5.52	7.15	10.94	14.10	1.14	1.27	0.13	0.29	3.05	1.90	9.45	38.03	1.05	22742	18.36
URMJDK R%	0.15	1.01	3.14	7.65	25.12	7.71	9.43	1.66	2.20	0.14	0.60	5.38	3.90	18.57	11.45	1.90	55285	44.64
URLCDY R%	0.43	1.60	9.98	5.73	5.52	10.41	11.21	0.84	1.07	0.21	0.56	4.59	1.96	7.99	35.74	2.15	9244	7.46
URLCDK R%	0.29	2.43	8.55	8.84	20.06	8.27	7.59	1.72	2.10	0.26	0.79	8.34	3.20	13.74	10.99	2.83	19267	15.56
RUMJDY R%	0.05	1.34	26.43	1.57	11.99	2.75	9.97	0.19	3.55	0.03	0.85	0.74	2.63	10.56	20.36	7.00	6361	5.14
RUMJDK R%	0.07	2.51	22.32	0.75	22.41	1.53	7.70	0.12	2.94	----	1.09	0.52	2.89	18.25	8.54	8.36	5610	4.53
RULCDY R%	0.18	2.96	48.41	1.31	7.30	1.46	4.60	0.15	2.45	0.07	0.47	1.28	1.75	6.13	14.38	7.08	2739	2.21
RULCDK R%	----	7.05	47.15	0.46	11.99	1.12	5.01	0.08	1.62	----	0.81	0.46	1.81	9.02	6.59	6.82	2594	2.09
URMJDY T%	0.03	0.16	0.91	1.01	1.31	2.01	2.59	0.21	0.23	0.02	0.05	0.56	0.35	1.73	6.98	0.19	22742	18.36
URMJDK T%	0.07	0.45	1.40	3.41	11.22	3.44	4.21	0.74	0.98	0.06	0.27	2.40	1.74	8.29	5.11	0.85	55285	44.64
URLCDY T%	0.03	0.12	0.75	0.43	0.41	0.78	0.84	0.06	0.08	0.02	0.04	0.34	0.15	0.60	2.67	0.16	9244	7.46
URLCDK T%	0.05	0.38	1.33	1.38	3.12	1.29	1.18	0.27	0.33	0.04	0.12	1.30	0.50	2.14	1.71	0.44	19267	15.56
RUMJDY T%	0.00	0.07	1.36	0.08	0.62	0.14	0.51	0.01	0.18	0.00	0.04	0.04	0.13	0.54	1.05	0.36	6361	5.14
RUMJDK T%	0.00	0.11	1.01	0.03	1.02	0.07	0.35	0.01	0.13	----	0.05	0.02	0.13	0.83	0.39	0.38	5610	4.53
RULCDY T%	0.00	0.07	1.07	0.03	0.16	0.03	0.10	0.00	0.05	0.00	0.01	0.03	0.04	0.14	0.32	0.16	2739	2.21
RULCDK T%	----	0.15	0.99	0.01	0.25	0.02	0.10	0.00	0.03	----	0.02	0.01	0.04	0.19	0.14	0.14	2594	2.09
URBAN R%	0.20	1.29	5.10	7.25	18.67	8.73	10.25	1.49	1.88	0.17	0.57	5.35	3.18	14.83	19.15	1.91	06538	86.03
RURAL R%	0.07	2.83	31.68	1.10	14.63	1.91	7.64	0.14	2.89	0.02	0.86	0.71	2.45	12.12	13.52	7.43	17304	13.97
URBAN T%	0.18	1.11	4.39	6.23	16.06	7.51	8.81	1.28	1.62	0.14	0.49	4.60	2.73	12.76	16.47	1.64	106538	86.03
RURAL T%	0.01	0.40	4.43	0.15	2.04	0.27	1.07	0.02	0.40	0.00	0.12	0.10	0.34	1.69	1.89	1.04	17304	13.97
MAJOR R%	0.21	1.26	12.30	4.68	7.54	8.92	12.17	0.86	1.66	0.13	0.45	2.92	2.02	9.07	33.20	2.62	41086	33.18
LOCAL R%	0.17	1.63	7.08	7.23	23.35	7.21	8.74	1.52	2.21	0.15	0.68	5.59	3.60	17.12	10.99	2.71	82756	66.82
MAJOR T%	0.07	0.42	4.08	1.55	2.50	2.96	4.04	0.29	0.55	0.04	0.15	0.97	0.67	3.01	11.02	0.87	41086	33.18
LOCAL T%	0.12	1.09	4.73	4.83	15.60	4.82	5.84	1.01	1.47	0.10	0.46	3.73	2.41	11.44	7.35	1.81	82756	66.82
LIGHT R%	0.14	1.09	6.44	6.25	19.48	7.79	10.54	1.33	2.10	0.12	0.57	4.16	3.24	15.68	18.62	2.45	89998	72.67
DARK R%	0.30	2.60	15.13	6.74	14.44	7.76	8.14	1.23	1.81	0.21	0.71	6.14	2.64	11.19	17.69	3.29	33844	27.33
LIGHT T%	0.10	0.79	4.68	4.54	14.16	5.66	7.66	0.96	1.53	0.09	0.41	3.02	2.36	11.39	13.53	1.78	89998	72.67
DARK T%	0.08	0.71	4.13	1.84	3.95	2.12	2.22	0.34	0.49	0.06	0.19	1.68	0.72	3.06	4.83	0.90	33844	27.33
16TO25 R%	0.25	2.40	12.05	5.57	17.82	6.88	9.64	1.05	2.09	0.16	0.60	4.84	2.73	13.84	17.35	2.72	44905	36.26
26TO55 R%	0.14	1.03	7.12	6.42	17.22	8.66	10.53	1.40	1.94	0.15	0.64	4.47	3.11	14.38	20.00	2.80	60913	49.19
56PLUS R%	0.17	0.88	6.47	8.29	21.78	7.05	8.28	1.57	2.13	0.11	0.53	5.13	3.83	16.23	15.34	2.19	18024	14.55
16TO25 T%	0.09	0.87	4.37	2.02	6.46	2.50	3.50	0.38	0.76	0.06	0.22	1.76	0.99	5.02	6.29	0.99	44905	36.26
26TO55 T%	0.07	0.51	3.50	3.16	8.47	4.26	5.18	0.69	0.96	0.07	0.31	2.20	1.53	7.07	9.84	1.38	60913	49.19
56PLUS T%	0.03	0.13	0.94	1.21	3.17	1.03	1.21	0.23	0.31	0.02	0.08	0.75	0.56	2.36	2.23	0.32	18024	14.55
TOTAL N	229	1865	10913	7909	22420	9635	12238	1609	2505	181	751	5821	3810	17896	22740	3320	23842	100.00
TOTAL R%	0.18	1.51	8.81	6.39	18.10	7.78	9.88	1.30	2.02	0.15	0.61	4.70	3.08	14.45	18.36	2.68	23842	100.00

*Excluding drivers under 16 and drivers who had been drinking.

ANALYSIS OF 1988 MICHIGAN ACCIDENT DATA

DATA FILE: 30% sample of passenger cars involved in non-pedestrian/bicyclist accidents

EXCLUSIONS:

1. Vehicles with drivers under 16
2. Vehicles with drivers who had been driving recklessly or carelessly (about 1.3%)
3. Vehicles with drivers who had taken alcohol or drugs (about 5.2%)

TOTAL CASES IN ANALYSIS: 140,910

TABLES: Separate tables for property damage only accidents (73% of total), casualty accidents, and all accidents—each with row and total percentages

SPREAD VARIABLE: 18 Collision Configurations based on

1. Single-Vehicle/Multi-Vehicle
2. Intersection or Not
3. Vehicle Movements—crossing paths, same direction, opposite directions, entering or leaving a driveway or parking place, turning or going straight
4. Intersection Signalized or Signed

CONTROL VARIABLES:

1. Urban (defined as cities over 5,000—about 56%) or Rural
2. Major Road (defined as U.S. or state route—about 37%) or Local Road
3. Daylight (about 62%) or Dark (including dawn and dusk)
4. Driver Age—16-25, 26-55, 56+

TABLE 1. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 MICHIGAN 30% SAMPLE OF PASSENGER CARS IN NON-PEDESTRIAN PROPERTY DAMAGE ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE AT AN INTERSECTION SIGNAL	SINGLE-VEHICLE AT AN INTERSECTION SIGNS	SINGLE-VEHICLE NOT AT INTER SECT	MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS: VEHICLES CROSSING PATHS TWO STRAIGHT SIGNAL	VEHICLES CROSSING PATHS TWO STRAIGHT SIGNS	VEHICLES CROSSING PATHS ONE+ TURNING SIGNAL	VEHICLES CROSSING PATHS ONE+ TURNING SIGNS	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNAL	VEHICLES SAME DIRECTION TWO STRAIGHT SIGNS	VEHICLES SAME DIRECTION ONE+ TURNING SIGNAL	VEHICLES SAME DIRECTION ONE+ TURNING SIGNS	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNAL	VEHICLES OPP. DIRECTIONS TWO STRAIGHT SIGNS	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNAL	VEHICLES OPP. DIRECTIONS ONE+ TURNING SIGNS	MULTI-VEHICLE NON-INTERSECTION DRIVWY PARKNG	MULTI-VEHICLE NON-INTERSECTION SAME DIR.	MULTI-VEHICLE NON-INTERSECTION OPP. DIR.	TOTAL N	TOTAL COL %
URMJDY R%	0.24	0.82	3.58	5.84	3.40	2.46	3.21	12.36	11.57	2.52	2.69	0.15	0.23	3.78	2.00	12.32	32.12	0.73	16129	15.73
URMJDK R%	0.25	1.74	4.55	4.65	11.73	1.96	5.64	8.36	10.62	1.70	3.64	0.17	0.75	4.85	2.94	20.49	14.73	1.24	29191	28.46
URLCDY R%	0.36	1.72	9.70	6.79	3.11	2.65	2.19	11.50	9.30	2.20	2.15	0.25	0.36	4.39	1.24	9.14	31.83	1.12	5626	5.49
URLCDK R%	0.68	4.57	11.56	6.28	8.65	2.31	5.07	8.89	9.54	1.89	2.88	0.33	1.27	5.24	2.38	13.18	12.89	2.39	9153	8.92
RUMJDY R%	0.15	1.28	14.23	2.28	4.72	1.51	4.51	5.90	10.48	0.64	3.37	0.08	0.38	2.62	2.27	16.65	26.76	2.15	11433	11.15
RUMJDK R%	0.11	2.52	18.40	1.30	8.18	0.87	6.61	3.95	8.86	0.40	2.81	0.09	0.92	2.25	2.13	22.90	13.86	3.72	15096	14.72
RULCDY R%	0.23	2.33	53.38	1.79	1.85	1.01	1.86	2.91	4.52	0.38	1.19	0.15	0.32	1.52	1.08	8.61	15.32	1.59	6665	6.50
RULCDK R%	0.11	3.95	61.15	1.00	2.94	0.61	2.61	1.93	2.96	0.30	1.56	0.08	0.63	1.39	0.86	8.19	7.22	2.51	9272	9.04
URMJDY T%	0.04	0.13	0.56	0.92	0.54	0.39	0.50	1.94	1.82	0.40	0.42	0.02	0.04	0.59	0.31	1.94	5.05	0.11	16129	15.73
URMJDK T%	0.07	0.50	1.30	1.32	3.34	0.56	1.61	2.38	3.02	0.48	1.04	0.05	0.21	1.38	0.84	5.83	4.19	0.35	29191	28.46
URLCDY T%	0.02	0.09	0.53	0.37	0.17	0.15	0.12	0.63	0.51	0.12	0.12	0.01	0.02	0.24	0.07	0.50	1.75	0.06	5626	5.49
URLCDK T%	0.06	0.41	1.03	0.56	0.77	0.21	0.45	0.79	0.85	0.17	0.26	0.03	0.11	0.47	0.21	1.18	1.15	0.21	9153	8.92
RUMJDY T%	0.02	0.14	1.59	0.25	0.53	0.17	0.50	0.66	1.17	0.07	0.38	0.01	0.04	0.29	0.25	1.86	2.98	0.24	11433	11.15
RUMJDK T%	0.02	0.37	2.71	0.19	1.21	0.13	0.97	0.58	1.30	0.06	0.43	0.01	0.14	0.33	0.31	3.37	2.04	0.55	15096	14.72
RULCDY T%	0.01	0.15	3.47	0.12	0.12	0.07	0.12	0.19	0.29	0.02	0.08	0.01	0.02	0.10	0.07	0.56	1.00	0.10	6665	6.50
RULCDK T%	0.01	0.36	5.53	0.09	0.27	0.06	0.24	0.17	0.27	0.03	0.14	0.01	0.06	0.13	0.08	0.74	0.65	0.23	9272	9.04
URBAN R%	0.32	1.92	5.84	5.41	8.22	2.21	4.57	9.81	10.60	2.00	3.13	0.20	0.66	4.57	2.44	16.11	20.72	1.26	60238	58.61
RURAL R%	0.14	2.47	32.11	1.58	5.11	1.01	4.42	3.88	7.32	0.44	2.48	0.09	0.62	2.04	1.73	15.76	16.10	2.70	42542	41.39
URBAN T%	0.19	1.13	3.42	3.17	4.82	1.30	2.68	5.75	6.21	1.17	1.83	0.12	0.39	2.68	1.43	9.44	12.14	0.74	60238	58.61
RURAL T%	0.06	1.02	13.29	0.65	2.12	0.42	1.83	1.60	3.03	0.18	1.03	0.04	0.25	0.85	0.72	6.52	6.66	1.12	42542	41.39
MAJOR R%	0.23	1.33	15.81	4.28	3.47	1.97	3.21	8.81	9.78	1.57	2.57	0.14	0.31	3.15	1.82	12.50	27.72	1.33	39936	38.86
LOCAL R%	0.26	2.67	17.29	3.54	9.14	1.55	5.34	6.43	8.91	1.21	3.04	0.16	0.85	3.76	2.35	18.17	13.14	2.19	62844	61.14
MAJOR T%	0.09	0.52	6.14	1.66	1.35	0.77	1.25	3.42	3.80	0.61	1.00	0.06	0.12	1.22	0.71	4.86	10.77	0.52	39936	38.86
LOCAL T%	0.16	1.63	10.57	2.16	5.59	0.95	3.27	3.93	5.45	0.74	1.86	0.10	0.52	2.30	1.44	11.11	8.03	1.34	62844	61.14
LIGHT R%	0.20	1.63	8.78	3.84	8.00	1.77	5.12	7.94	10.44	1.44	3.23	0.14	0.61	3.70	2.45	18.55	20.36	1.79	71849	70.05
DARK R%	0.35	3.37	35.27	3.81	4.44	1.58	3.10	5.97	6.42	1.14	1.98	0.20	0.70	3.12	1.43	9.94	15.17	2.02	30716	29.95
LIGHT T%	0.14	1.14	6.15	2.69	5.61	1.24	3.59	5.56	7.31	1.01	2.26	0.09	0.43	2.60	1.72	12.99	14.27	1.25	71849	70.05
DARK T%	0.10	1.01	10.56	1.14	1.33	0.47	0.93	1.79	1.92	0.34	0.59	0.06	0.21	0.93	0.43	2.98	4.54	0.61	30716	29.95
16TO25 R%	0.30	2.80	16.58	3.52	6.82	1.64	4.69	6.99	9.46	1.16	2.85	0.17	0.63	3.69	1.96	16.10	18.69	1.94	37573	36.56
26TO55 R%	0.23	1.78	17.81	3.64	6.50	1.58	4.19	7.76	9.35	1.40	2.84	0.15	0.64	3.29	2.08	15.12	19.72	1.92	50966	49.59
56PLUS R%	0.17	1.74	13.14	5.29	8.81	2.38	5.18	6.84	8.30	1.69	2.94	0.11	0.68	3.93	2.90	18.66	15.84	1.40	14241	13.86
16TO25 T%	0.11	1.02	6.06	1.29	2.49	0.60	1.71	2.56	3.46	0.43	1.04	0.06	0.23	1.35	0.72	5.89	6.83	0.71	37573	36.56
26TO55 T%	0.11	0.88	8.83	1.81	3.22	0.78	2.08	3.85	4.64	0.69	1.41	0.08	0.32	1.63	1.03	7.50	9.78	0.95	50966	49.59
56PLUS T%	0.02	0.24	1.82	0.73	1.22	0.33	0.72	0.95	1.15	0.23	0.41	0.02	0.09	0.54	0.40	2.59	2.19	0.19	14241	13.86
TOTAL N	253	2210	17179	3931	7129	1761	4636	7557	9501	1388	2939	158	658	3622	2206	16412	19330	1910	102780	100.00
TOTAL R%	0.25	2.15	16.71	3.82	6.94	1.71	4.51	7.35	9.24	1.35	2.86	0.15	0.64	3.52	2.15	15.97	18.81	1.86	102780	100.00

*Excluding drivers who were under 16, or who had been drinking/drugging, or who were cited for reckless driving

TABLE 2. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 MICHIGAN 30% SAMPLE OF PASSENGER CARS IN NON-PEDESTRIAN FATAL AND INJURY ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE			MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS												MULTI-VEHICLE NON-INTERSECTION			TOTAL N	TOTA COL
	AT AN INTERSECTION		NOT AT INTER SECT	VEHICLES CROSSING PATHS				VEHICLES SAME DIRECTION				VEHICLES OPP. DIRECTIONS								
				TWO STRAIGHT		ONE+ TURNING		TWO STRAIGHT		ONE+ TURNING		TWO STRAIGHT		ONE+ TURNING						
	SIGNAL	SIGNS		SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	SIGNAL	SIGNS	DRIVWY PARKNG	SAME DIR.	OPP. DIR.		
URMJDY R%	0.21	0.48	4.07	10.92	3.85	1.71	2.00	12.12	10.52	0.97	0.97	0.21	0.44	5.28	2.55	8.44	34.20	1.05	6188	16.2
URMJDK R%	0.23	1.09	1.97	9.78	15.74	1.61	4.19	8.44	10.11	0.65	1.89	0.27	1.04	8.69	4.05	13.03	15.60	1.62	10854	28.5
URLCDY R%	0.38	1.73	8.71	12.17	2.73	1.73	1.92	11.98	7.72	1.04	1.11	0.38	0.69	5.22	1.11	6.87	32.86	1.65	2605	6.8
URLCDK R%	0.72	3.28	6.42	11.91	10.63	1.63	3.25	8.85	9.12	0.80	2.27	0.77	1.73	8.72	3.52	11.09	11.41	3.89	3752	9.8
RUMJDY R%	0.15	1.12	8.43	4.63	8.49	1.02	3.30	5.50	8.74	0.37	1.91	0.02	0.69	4.77	3.38	17.69	25.35	4.44	4817	12.6
RUMJDK R%	0.05	1.89	13.74	2.89	14.68	0.69	4.96	3.19	7.97	0.23	2.41	0.02	1.25	4.26	3.55	17.66	14.30	6.26	5770	15.1
RULCDY R%	0.11	1.89	17.36	5.88	5.71	1.22	3.44	4.66	6.05	0.11	1.89	0.44	1.33	4.33	2.00	13.14	23.41	7.04	1803	4.7
RULCDK R%	0.09	4.93	32.17	2.88	7.32	1.18	3.44	2.35	5.45	0.17	1.39	0.31	1.44	4.62	1.83	10.77	11.16	8.50	2294	6.0
URMJDY T%	0.03	0.08	0.66	1.78	0.62	0.28	0.33	1.97	1.71	0.16	0.16	0.03	0.07	0.86	0.41	1.37	5.56	0.17	6188	16.2
URMJDK T%	0.07	0.31	0.56	2.79	4.48	0.46	1.19	2.41	2.88	0.19	0.54	0.08	0.30	2.48	1.16	3.71	4.45	0.46	10854	28.5
URLCDY T%	0.03	0.12	0.60	0.83	0.19	0.12	0.13	0.82	0.53	0.07	0.08	0.03	0.05	0.36	0.08	0.47	2.25	0.11	2605	6.8
URLCDK T%	0.07	0.32	0.63	1.17	1.05	0.16	0.32	0.87	0.90	0.08	0.22	0.08	0.17	0.86	0.35	1.09	1.12	0.38	3752	9.8
RUMJDY T%	0.02	0.14	1.07	0.59	1.07	0.13	0.42	0.70	1.11	0.05	0.24	0.00	0.09	0.60	0.43	2.24	3.21	0.56	4817	12.6
RUMJDK T%	0.01	0.29	2.08	0.44	2.22	0.11	0.75	0.48	1.21	0.03	0.36	0.00	0.19	0.65	0.54	2.68	2.17	0.95	5770	15.1
RULCDY T%	0.01	0.09	0.82	0.28	0.27	0.06	0.16	0.22	0.29	0.01	0.09	0.02	0.06	0.20	0.09	0.62	1.11	0.33	1803	4.7
RULCDK T%	0.01	0.30	1.94	0.17	0.44	0.07	0.21	0.14	0.33	0.01	0.08	0.02	0.09	0.28	0.11	0.65	0.67	0.51	2294	6.0
URBAN R%	0.32	1.35	4.00	10.68	10.31	1.65	3.21	9.90	9.79	0.80	1.62	0.35	0.95	7.39	3.24	10.82	21.78	1.84	23435	61.4
RURAL R%	0.10	2.11	15.34	3.82	10.40	0.94	3.99	3.99	7.60	0.25	2.02	0.12	1.10	4.50	3.04	16.03	18.55	6.10	14695	38.5
URBAN T%	0.20	0.83	2.46	6.56	6.34	1.01	1.97	6.08	6.02	0.49	1.00	0.21	0.58	4.54	1.99	6.65	13.39	1.13	23435	61.4
RURAL T%	0.04	0.81	5.91	1.47	4.01	0.36	1.54	1.54	2.93	0.10	0.78	0.04	0.42	1.73	1.17	6.18	7.15	2.35	14695	38.5
MAJOR R%	0.21	1.06	7.77	8.57	5.32	1.44	2.56	9.17	8.97	0.69	1.40	0.21	0.66	4.99	2.50	11.61	29.95	2.91	15438	40.4
LOCAL R%	0.25	2.04	8.77	7.68	13.76	1.34	4.16	6.57	8.93	0.52	2.03	0.29	1.25	7.15	3.61	13.65	14.13	3.87	22692	59.5
MAJOR T%	0.08	0.43	3.15	3.47	2.16	0.58	1.04	3.71	3.63	0.28	0.57	0.08	0.27	2.02	1.01	4.70	12.13	1.18	15438	40.4
LOCAL T%	0.15	1.21	5.22	4.57	8.19	0.79	2.48	3.91	5.31	0.31	1.21	0.17	0.74	4.26	2.15	8.12	8.41	2.30	22692	59.5
LIGHT R%	0.17	1.13	6.03	7.70	11.59	1.34	3.71	7.66	9.52	0.59	1.80	0.16	0.89	6.32	3.50	13.78	21.19	2.95	27629	72.5
DARK R%	0.39	3.01	14.53	8.95	7.09	1.48	2.99	7.48	7.43	0.60	1.72	0.52	1.34	6.19	2.29	10.32	18.77	4.89	10454	27.4
LIGHT T%	0.13	0.82	4.37	5.59	8.41	0.97	2.69	5.55	6.90	0.43	1.30	0.12	0.64	4.58	2.54	10.00	15.37	2.14	27629	72.5
DARK T%	0.11	0.83	3.99	2.46	1.95	0.41	0.82	2.05	2.04	0.17	0.47	0.14	0.37	1.70	0.63	2.83	5.15	1.34	10454	27.4
16TO25 R%	0.30	2.17	11.70	7.32	10.40	1.22	3.33	6.18	8.91	0.53	1.88	0.29	0.92	6.71	2.89	12.86	18.92	3.48	13956	36.6
26TO55 R%	0.18	1.35	6.89	8.07	9.76	1.34	3.38	8.43	9.23	0.62	1.83	0.22	1.09	5.77	3.17	12.61	22.43	3.62	18663	48.9
56PLUS R%	0.25	1.29	4.94	9.74	12.21	1.91	4.41	8.51	8.07	0.64	1.34	0.29	0.96	6.91	3.81	13.45	18.22	3.05	5511	14.45
16TO25 T%	0.11	0.79	4.28	2.68	3.81	0.45	1.22	2.26	3.26	0.19	0.69	0.11	0.34	2.45	1.06	4.71	6.92	1.27	13956	36.6
26TO55 T%	0.09	0.66	3.37	3.95	4.78	0.66	1.65	4.13	4.52	0.30	0.89	0.11	0.53	2.82	1.55	6.17	10.98	1.77	18663	48.9
56PLUS T%	0.04	0.19	0.71	1.41	1.77	0.28	0.64	1.23	1.17	0.09	0.19	0.04	0.14	1.00	0.55	1.94	2.63	0.44	5511	14.45
TOTAL N	89	626	3191	3065	3945	525	1339	2906	3411	225	677	98	385	2394	1205	4890	7831	1328	38130	100.00
TOTAL R%	0.23	1.64	8.37	8.04	10.35	1.38	3.51	7.62	8.95	0.59	1.78	0.26	1.01	6.28	3.16	12.82	20.54	3.48	38130	100.00

*Excluding drivers who were under 16, or who had been drinking/drugging, or who were cited for reckless driving.

TABLE 3. ACCIDENT CONFIGURATION (VEHICLE MOVEMENTS AND LOCATIONS--SIGNALIZED OR NOT) BY URBANICITY, ROAD TYPE, LIGHT, AND DRIVER AGE
1988 MICHIGAN 30% SAMPLE OF PASSENGER CARS IN ALL NON-PEDESTRIAN ACCIDENTS*, IN ROW PERCENTAGES AND TOTAL PERCENTAGES

CONTROL CATEG	SINGLE-VEHICLE			MULTI-VEHICLE ACCIDENTS AT INTERSECTIONS												MULTI-VEHICLE NON-INTERSECTION			TOTAL N	TOTAL COL %
	AT AN INTERSECTION		NOT AT INTER SECT	VEHICLES CROSSING PATHS				VEHICLES SAME DIRECTION				VEHICLES OPP. DIRECTIONS				DRIVWY PARKNG	SAME DIR.	OPP. DIR.		
	SIGNAL	SIGNS		TWO STRAIGHT SIGNAL	TWO STRAIGHT SIGNS	ONE+ TURNING SIGNAL	ONE+ TURNING SIGNS	TWO STRAIGHT SIGNAL	TWO STRAIGHT SIGNS	ONE+ TURNING SIGNAL	ONE+ TURNING SIGNS	TWO STRAIGHT SIGNAL	TWO STRAIGHT SIGNS	ONE+ TURNING SIGNAL	ONE+ TURNING SIGNS					
URMJDY R%	0.23	0.73	3.71	7.25	3.53	2.25	2.87	12.29	11.28	2.09	2.21	0.17	0.29	4.19	2.16	11.24	32.69	0.82	22317	15.8
URMJDK R%	0.25	1.56	3.85	6.04	12.82	1.86	5.25	8.38	10.48	1.41	3.16	0.20	0.83	5.89	3.24	18.46	14.97	1.34	40045	28.4
URLCDY R%	0.36	1.73	9.39	8.49	2.99	2.36	2.10	11.65	8.80	1.83	1.82	0.29	0.46	4.65	1.20	8.42	32.16	1.29	8231	5.8
URLCDK R%	0.69	4.19	10.07	7.92	9.23	2.11	4.54	8.88	9.41	1.57	2.70	0.46	1.40	6.25	2.71	12.57	12.46	2.83	12905	9.1
RUMJDY R%	0.15	1.23	12.51	2.98	5.84	1.37	4.15	5.78	9.96	0.56	2.94	0.06	0.47	3.26	2.60	16.96	26.34	2.83	16250	11.5
RUMJDK R%	0.09	2.35	17.11	1.74	9.99	0.82	6.15	3.74	8.61	0.35	2.77	0.07	1.01	2.80	2.53	21.45	13.98	4.42	20866	14.8
RULCDY R%	0.20	2.23	45.71	2.66	2.67	1.05	2.20	3.28	4.84	0.32	1.33	0.21	0.53	2.11	1.28	9.58	17.04	2.75	8468	6.0
RULCDK R%	0.10	4.14	55.40	1.37	3.81	0.73	2.78	2.01	3.45	0.28	1.53	0.12	0.79	2.03	1.05	8.70	8.00	3.70	11566	8.2
URMJDY T%	0.04	0.12	0.59	1.15	0.56	0.36	0.46	1.95	1.79	0.33	0.35	0.03	0.05	0.67	0.34	1.78	5.19	0.13	22317	15.8
URMJDK T%	0.07	0.45	1.10	1.72	3.65	0.53	1.49	2.39	2.98	0.40	0.90	0.06	0.24	1.68	0.92	5.26	4.26	0.38	40045	28.47
URLCDY T%	0.02	0.10	0.55	0.50	0.17	0.14	0.12	0.68	0.51	0.11	0.11	0.02	0.03	0.27	0.07	0.49	1.88	0.08	8231	5.8
URLCDK T%	0.06	0.38	0.92	0.73	0.85	0.19	0.42	0.81	0.86	0.14	0.25	0.04	0.13	0.57	0.25	1.15	1.14	0.26	12905	9.1
RUMJDY T%	0.02	0.14	1.45	0.34	0.67	0.16	0.48	0.67	1.15	0.06	0.34	0.01	0.05	0.38	0.30	1.96	3.04	0.33	16250	11.5
RUMJDK T%	0.01	0.35	2.54	0.26	1.48	0.12	0.91	0.56	1.28	0.05	0.41	0.01	0.15	0.42	0.37	3.18	2.07	0.66	20866	14.84
RULCDY T%	0.01	0.13	2.75	0.16	0.16	0.06	0.13	0.20	0.29	0.02	0.08	0.01	0.03	0.13	0.08	0.58	1.03	0.17	8468	6.0
RULCDK T%	0.01	0.34	4.56	0.11	0.31	0.06	0.23	0.17	0.28	0.02	0.13	0.01	0.06	0.17	0.09	0.72	0.66	0.30	11566	8.2
URBAN R%	0.32	1.76	5.32	6.89	8.81	2.05	4.19	9.83	10.37	1.66	2.71	0.24	0.74	5.36	2.67	14.63	21.02	1.43	83673	59.3
RURAL R%	0.13	2.38	27.81	2.16	6.47	0.99	4.31	3.91	7.39	0.39	2.36	0.10	0.74	2.67	2.06	15.83	16.73	3.57	57237	40.6
URBAN T%	0.19	1.05	3.16	4.09	5.23	1.22	2.49	5.84	6.16	0.99	1.61	0.14	0.44	3.18	1.58	8.69	12.48	0.85	83673	59.3
RURAL T%	0.05	0.97	11.29	0.88	2.63	0.40	1.75	1.59	3.00	0.16	0.96	0.04	0.30	1.09	0.84	6.43	6.80	1.45	57237	40.6
MAJOR R%	0.22	1.26	13.57	5.47	3.99	1.82	3.02	8.91	9.55	1.33	2.24	0.16	0.41	3.66	2.01	12.25	28.35	1.78	55374	39.3
LOCAL R%	0.26	2.50	15.03	4.64	10.36	1.49	5.03	6.46	8.91	1.03	2.78	0.20	0.96	4.66	2.69	16.97	13.40	2.64	85536	60.7
MAJOR T%	0.09	0.49	5.33	2.15	1.57	0.72	1.19	3.50	3.75	0.52	0.88	0.06	0.16	1.44	0.79	4.81	11.14	0.70	55374	39.3
LOCAL T%	0.16	1.52	9.12	2.81	6.29	0.91	3.05	3.92	5.41	0.62	1.68	0.12	0.58	2.83	1.63	10.30	8.14	1.60	85536	60.7
LIGHT R%	0.19	1.49	8.02	4.91	9.00	1.65	4.73	7.86	10.18	1.20	2.83	0.14	0.69	4.43	2.74	17.22	20.59	2.11	99478	70.7
DARK R%	0.36	3.28	30.00	5.11	5.11	1.55	3.08	6.35	6.67	1.00	1.92	0.28	0.86	3.90	1.65	10.04	16.09	2.75	41170	29.2
LIGHT T%	0.14	1.05	5.67	3.47	6.36	1.17	3.34	5.56	7.20	0.85	2.00	0.10	0.49	3.13	1.94	12.18	14.57	1.49	99478	70.7
DARK T%	0.11	0.96	8.78	1.50	1.50	0.45	0.90	1.86	1.95	0.29	0.56	0.08	0.25	1.14	0.48	2.94	4.71	0.80	41170	29.2
16TO25 R%	0.30	2.63	15.26	4.55	7.79	1.53	4.32	6.77	9.31	0.99	2.59	0.20	0.71	4.51	2.21	15.22	18.75	2.36	51529	36.5
26TO55 R%	0.21	1.67	14.88	4.83	7.37	1.51	3.98	7.94	9.32	1.19	2.57	0.17	0.76	3.96	2.37	14.45	20.45	2.38	69629	49.4
56PLUS R%	0.19	1.62	10.85	6.54	9.76	2.25	4.96	7.31	8.24	1.39	2.50	0.16	0.76	4.76	3.15	17.21	16.50	1.86	19752	14.0
16TO25 T%	0.11	0.96	5.58	1.66	2.85	0.56	1.58	2.48	3.40	0.36	0.95	0.07	0.26	1.65	0.81	5.57	6.86	0.86	51529	36.5
26TO55 T%	0.11	0.82	7.36	2.39	3.64	0.75	1.96	3.92	4.61	0.59	1.27	0.08	0.37	1.95	1.17	7.14	10.11	1.17	69629	49.4
56PLUS T%	0.03	0.23	1.52	0.92	1.37	0.32	0.70	1.02	1.15	0.20	0.35	0.02	0.11	0.67	0.44	2.41	2.31	0.26	19752	14.0
TOTAL N	342	2836	20370	6996	11074	2286	5975	10463	12912	1613	3616	256	1043	6016	3411	21302	27161	3238	140910	100.0
TOTAL R%	0.24	2.01	14.46	4.96	7.86	1.62	4.24	7.43	9.16	1.14	2.57	0.18	0.74	4.27	2.42	15.12	19.28	2.30	140910	100.0

*Excluding drivers who were under 16, or who had been drinking/drugging, or who were cited for reckless driving.

1985-1986 NASS TABLES

The tables in this set were generated from the combined 1985 and 1986 NASS files.

Vehicle Type:	Passenger cars
Sample Size:	18,593
Excluded Cases:	1. Accidents involving pedestrians or bicylists. 2. Alcohol involved drivers. 3. Drivers identified as reckless. 4. Drivers under 16.
Variables Used:	1. Driver Age. 2. Accident Type. 3. Relation to Junction. 4. Class Trafficway. 5. Traffic Control Device. 6. Roadway Function Class. 7. Light Condition. 8. Maximum Known AIS.

Missing data has been excluded from the analysis. About 28% of the cases had missing data on at least one of the variables used—age, accident type, intersection type, or traffic controls. The sample size reported above is the sample that remained after missing data was excluded.

PASSENGER CARS ONLY

1985-86 NASS ROW PERCENTS

PROPERTY DAMAGE ONLY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS											---------------->	MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turr		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.8	2.5	15.1	2.4	6.6	1.4	3.8	6.5	7.5	0.6	0.9	0.2	1.0	4.4	1.3	20.8	20.5	3.7	100.0
26-55	0.2	1.5	13.1	4.1	5.3	1.1	4.5	9.6	6.1	0.7	1.3	0.4	0.6	4.1	1.8	19.2	22.2	4.1	100.0
56+	0.6	0.6	7.8	4.6	11.6	1.7	5.5	11.0	7.3	1.2	0.5	0.2	0.0	2.9	2.2	20.5	18.5	3.3	100.0
Total	0.5	1.8	13.1	3.5	6.7	1.3	4.4	8.6	6.8	0.7	1.1	0.3	0.7	4.0	1.6	20.0	21.0	3.8	100.0

CASUALTY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS----											---------------->	MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turr		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.2	1.8	16.4	6.0	9.4	1.7	4.7	6.7	7.0	0.1	0.9	0.5	0.8	6.7	3.1	12.4	16.5	5.0	100.0
26-55	0.2	1.1	10.5	7.0	11.0	1.9	5.2	10.2	7.6	0.3	0.8	0.4	1.0	5.9	2.9	11.8	17.3	5.0	100.0
56+	0.2	0.2	7.9	9.8	16.6	1.5	5.9	6.9	5.9	0.6	0.5	0.4	1.0	6.7	3.5	14.7	11.5	6.2	100.0
Total	0.2	1.2	12.4	7.0	11.1	1.8	5.1	8.4	7.2	0.3	0.8	0.4	0.9	6.3	3.1	12.4	16.2	5.2	100.0

ALL ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS----											---------------->	MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turr		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.5	2.2	15.6	3.9	7.6	1.5	4.2	6.5	7.3	0.4	0.9	0.3	0.9	5.3	2.0	17.4	19.2	4.2	100.0
26-55	0.2	1.3	11.8	5.3	7.8	1.4	4.7	10.0	6.7	0.6	1.1	0.4	0.8	4.7	2.2	16.1	20.4	4.6	100.0
56+	0.4	0.4	7.6	6.4	13.1	1.6	5.9	9.3	6.8	1.1	0.5	0.3	0.4	4.3	2.6	18.4	16.2	4.7	100.0
Total	0.4	1.5	12.6	4.9	8.5	1.5	4.7	8.5	6.9	0.6	0.9	0.3	0.8	4.9	2.2	16.9	19.3	4.5	100.0

PASSENGER CARS ONLY

1985-86 NASS TOTAL PERCENTS WITHIN ACCIDENT SEVERITY

PROPERTY DAMAGE ONLY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS ------------------>														MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnin		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.3	1.0	5.8	0.9	2.6	0.5	1.5	2.5	2.9	0.2	0.4	0.1	0.4	1.7	0.5	8.1	8.0	1.4	38.7
26-55	0.1	0.7	6.1	1.9	2.5	0.5	2.1	4.5	2.8	0.3	0.6	0.2	0.3	1.9	0.8	8.9	10.3	1.9	46.3
56+	0.1	0.1	1.2	0.7	1.7	0.3	0.8	1.6	1.1	0.2	0.1	0.0	0.0	0.4	0.3	3.1	2.8	0.5	15.0
Total	0.5	1.8	13.1	3.5	6.7	1.3	4.4	8.6	6.8	0.7	1.1	0.3	0.7	4.0	1.6	20.0	21.0	3.8	100.0

CASUALTY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS--- ------------------>														MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnin		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.1	0.7	6.3	2.3	3.6	0.7	1.8	2.6	2.7	0.1	0.3	0.2	0.3	2.6	1.2	4.7	6.3	1.9	38.4
26-55	0.1	0.5	5.0	3.4	5.3	0.9	2.5	4.9	3.7	0.1	0.4	0.2	0.5	2.8	1.4	5.7	8.3	2.4	48.1
56+	0.0	0.0	1.1	1.3	2.2	0.2	0.8	0.9	0.8	0.1	0.1	0.1	0.1	0.9	0.5	2.0	1.6	0.8	13.5
Total	0.2	1.2	12.4	7.0	11.1	1.8	5.1	8.4	7.2	0.3	0.8	0.4	0.9	6.3	3.1	12.4	16.2	5.2	100.0

ALL ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS--- ------------------>														MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnin		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning					
AGE	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
16-25	0.2	0.8	6.0	1.5	2.9	0.6	1.6	2.5	2.8	0.2	0.4	0.1	0.4	2.0	0.8	6.7	7.4	1.6	38.5
26-55	0.1	0.6	5.5	2.5	3.7	0.7	2.2	4.7	3.1	0.3	0.5	0.2	0.4	2.2	1.0	7.5	9.6	2.2	47.0
56+	0.1	0.1	1.1	0.9	1.9	0.2	0.9	1.4	1.0	0.2	0.1	0.0	0.1	0.6	0.4	2.7	2.3	0.7	14.5
Total	0.4	1.5	12.6	4.9	8.5	1.5	4.7	8.5	6.9	0.6	0.9	0.3	0.8	4.9	2.2	16.9	19.3	4.5	100.0

1985-86 NASS
ROW PERCENTS

PROPERTY DAMAGE ONLY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS										-------------------->		MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turn		OppDir/Both Strt		OppDir/Turning					
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.0	0.5	5.4	3.8	2.5	1.0	1.4	13.7	9.4	1.2	0.4	0.8	0.0	4.4	0.8	15.0	37.1	2.5	100.0
UrbMajDark	2.0	0.9	17.3	3.8	0.4	1.2	3.9	12.8	4.8	0.8	0.4	0.1	0.1	8.4	2.6	11.9	27.2	1.4	100.0
UrbOthDay	0.6	1.7	6.3	4.0	12.3	1.0	6.3	7.4	6.5	0.6	1.7	0.1	0.7	4.1	1.9	26.0	15.5	3.3	100.0
UrbOthDark	0.8	2.3	15.8	5.8	5.1	3.0	3.8	12.1	4.2	0.8	1.3	0.4	1.6	4.5	2.6	17.3	15.0	3.7	100.0
RurMajDay	0.3	2.0	19.8	0.0	2.0	0.0	6.7	2.5	12.2	0.0	1.3	0.0	0.0	2.0	2.1	17.6	25.6	5.9	100.0
RurMajDark	0.0	3.6	59.0	0.0	0.1	5.1	1.1	0.0	3.4	2.5	0.0	0.0	0.0	2.6	0.0	5.6	11.7	5.4	100.0
RurOthDay	0.0	3.4	12.8	0.6	8.0	0.0	5.2	0.6	2.9	0.0	0.6	0.0	2.4	0.2	0.7	34.9	14.7	13.0	100.0
RurOthDark	0.0	5.8	62.0	0.0	4.6	0.9	1.9	3.5	6.0	0.0	0.0	0.0	0.7	0.4	0.0	6.2	4.8	3.2	100.0
Urban	0.6	1.4	8.7	4.3	7.4	1.4	4.3	10.4	6.7	0.8	1.2	0.4	0.7	4.6	1.8	20.3	22.1	3.0	100.0
Rural	0.1	3.4	32.3	0.2	3.9	1.0	4.4	1.7	7.0	0.4	0.6	0.0	0.8	1.3	0.9	18.3	16.3	7.3	100.0
Major	0.4	1.1	14.7	2.8	1.8	1.2	2.8	10.4	8.6	1.0	0.5	0.5	0.0	4.6	1.3	14.1	31.1	3.2	100.0
Other	0.6	2.2	12.4	3.9	9.7	1.4	5.3	7.7	5.6	0.6	1.4	0.2	1.1	3.6	1.8	23.6	14.6	4.2	100.0
Daylight	0.3	1.5	7.8	3.3	8.0	0.8	4.8	8.3	7.7	0.7	1.2	0.3	0.6	3.7	1.5	22.6	22.8	4.0	100.0
Dark	0.9	2.5	26.9	3.9	3.3	2.5	3.3	9.8	4.5	0.9	0.7	0.2	0.9	4.7	2.0	13.3	16.3	3.3	100.0
Total	0.5	1.8	13.3	3.5	6.7	1.3	4.3	8.7	6.8	0.7	1.1	0.3	0.7	4.0	1.6	19.9	21.0	3.8	100.0

1985-86 NASS

TOTAL PERCENTS FOR THE ENVIRONMENT BY ACCIDENT TYPE, AND THEN WITHIN EACH OF THE MARGINALS

PROPERTY DAMAGE ONLY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS										------------------->		MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning					
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.0	0.1	1.1	0.8	0.5	0.2	0.3	2.9	2.0	0.2	0.1	0.2	0.0	0.9	0.2	3.2	7.9	0.5	21.2
UrbMajDark	0.1	0.1	1.2	0.3	0.0	0.1	0.3	0.9	0.3	0.1	0.0	0.0	0.0	0.6	0.2	0.8	1.9	0.1	7.0
UrbOthDay	0.2	0.6	2.4	1.5	4.6	0.4	2.4	2.8	2.5	0.2	0.6	0.0	0.3	1.5	0.7	9.8	5.8	1.2	37.8
UrbOthDark	0.1	0.3	2.3	0.9	0.7	0.4	0.6	1.8	0.6	0.1	0.2	0.1	0.2	0.7	0.4	2.6	2.2	0.5	14.8
RurMajDay	0.0	0.1	1.4	0.0	0.1	0.0	0.5	0.2	0.9	0.0	0.1	0.0	0.0	0.1	0.1	1.2	1.8	0.4	7.0
RurMajDark	0.0	0.1	1.9	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.4	0.2	3.2
RurOthDay	0.0	0.2	0.7	0.0	0.4	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	1.9	0.8	0.7	5.4
RurOthDark	0.0	0.2	2.2	0.0	0.2	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	3.6
Urban	0.5	1.2	7.1	3.5	5.9	1.1	3.5	8.4	5.4	0.7	0.9	0.3	0.5	3.7	1.4	16.4	17.8	2.4	80.7
Rural	0.0	0.6	6.2	0.0	0.7	0.2	0.9	0.3	1.3	0.1	0.1	0.0	0.2	0.2	0.2	3.5	3.1	1.4	19.3
Major	0.2	0.4	5.6	1.1	0.7	0.4	1.1	4.0	3.3	0.4	0.2	0.2	0.0	1.8	0.5	5.4	11.9	1.2	38.4
Other	0.3	1.4	7.6	2.4	6.0	0.9	3.3	4.7	3.5	0.3	0.8	0.1	0.7	2.2	1.1	14.5	9.0	2.6	61.6
Daylight	0.2	1.1	5.6	2.4	5.7	0.6	3.4	5.9	5.5	0.5	0.8	0.2	0.4	2.6	1.1	16.1	16.3	2.9	71.4
Dark	0.3	0.7	7.7	1.1	0.9	0.7	0.9	2.8	1.3	0.3	0.2	0.1	0.3	1.4	0.6	3.8	4.7	0.9	28.6
Total	0.5	1.8	13.3	3.5	6.7	1.3	4.3	8.7	6.8	0.7	1.1	0.3	0.7	4.0	1.6	19.9	21.0	3.8	100.0

1985-86 NASS
ROW PERCENTS

CASUALTY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS										------------------>		MULTIPLE VEHICLE			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turn		OppDir/Both Strt		OppDir/Turning		NOT AT INTERSECTION			
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.3	0.5	4.7	4.3	3.1	1.9	5.1	15.0	6.0	0.3	0.6	0.4	0.2	7.4	3.1	12.0	32.7	2.4	100.0
UrbMajDark	0.3	0.5	14.1	6.0	2.1	2.5	1.8	12.2	3.5	0.1	0.2	0.1	0.6	10.5	1.9	10.5	28.3	4.6	100.0
UrbOthDay	0.1	0.6	4.6	10.2	19.3	1.7	6.6	8.0	8.8	0.4	0.9	0.6	1.1	6.4	3.4	13.1	10.1	3.9	100.0
UrbOthDark	0.4	3.5	15.5	10.5	11.1	2.6	3.6	9.5	6.5	0.4	0.4	0.7	1.2	8.4	2.7	12.2	6.3	4.4	100.0
RurMajDay	0.1	0.6	21.1	1.9	6.9	0.6	4.5	1.3	12.6	0.0	1.5	0.1	1.0	1.6	3.3	16.3	17.6	9.1	100.0
RurMajDark	0.0	1.5	41.4	1.2	3.8	0.2	0.8	0.4	2.7	0.0	0.5	0.0	0.7	3.3	3.7	10.0	20.6	9.2	100.0
RurOthDay	0.0	0.8	29.0	1.1	14.4	2.2	8.4	0.3	3.3	0.0	1.5	0.0	2.8	0.5	2.7	11.4	7.5	14.2	100.0
RurOthDark	0.0	7.2	48.6	0.4	3.2	0.0	6.2	0.0	6.2	0.0	0.0	0.0	0.2	0.4	1.6	8.0	4.4	13.6	100.0
Urban	0.3	1.1	7.6	8.3	11.9	2.0	5.2	10.5	7.1	0.3	0.7	0.5	0.8	7.5	3.1	12.4	17.1	3.7	100.0
Rural	0.0	1.9	31.5	1.3	7.7	0.9	5.1	0.7	7.2	0.0	1.1	0.0	1.3	1.5	2.9	12.4	13.5	11.2	100.0
Major	0.2	0.6	13.3	3.9	3.6	1.6	3.9	10.4	6.4	0.2	0.7	0.3	0.5	6.6	2.9	12.3	27.8	4.8	100.0
Other	0.2	1.7	11.6	9.0	16.1	1.9	6.0	7.3	7.6	0.3	0.8	0.5	1.2	6.1	3.1	12.5	8.7	5.4	100.0
Daylight	0.2	0.6	8.2	6.9	12.9	1.7	6.1	8.7	8.0	0.3	0.9	0.4	1.0	5.7	3.3	13.0	17.2	4.8	100.0
Dark	0.3	2.7	21.8	6.9	6.7	2.0	3.0	8.1	5.1	0.2	0.3	0.4	0.9	7.5	2.5	11.0	14.5	6.0	100.0
Total	0.2	1.2	12.3	6.9	11.1	1.8	5.2	8.5	7.1	0.3	0.7	0.4	0.9	6.3	3.0	12.4	16.4	5.2	100.0

1985-86 NASS

TOTAL PERCENTS FOR THE ENVIRONMENT BY ACCIDENT TYPE, AND THEN WITHIN EACH OF THE MARGINALS

CASUALTY ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS										------------------>		MULTIPLE VEHICLE			
	Intersection		Not	Cross/Both Strt		Cross/Turnin		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning		NOT AT INTERSECTION			
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.1	0.1	0.9	0.9	0.6	0.4	1.0	3.0	1.2	0.1	0.1	0.1	0.0	1.5	0.6	2.4	6.6	0.5	20.1
UrbMajDark	0.0	0.0	1.3	0.5	0.2	0.2	0.2	1.1	0.3	0.0	0.0	0.0	0.1	0.9	0.2	0.9	2.5	0.4	8.9
UrbOthDay	0.1	0.2	1.7	3.8	7.2	0.6	2.5	3.0	3.3	0.1	0.3	0.2	0.4	2.4	1.3	4.9	3.8	1.4	37.0
UrbOthDark	0.1	0.5	2.2	1.5	1.6	0.4	0.5	1.4	0.9	0.1	0.1	0.1	0.2	1.2	0.4	1.7	0.9	0.6	14.2
RurMajDay	0.0	0.0	1.6	0.1	0.5	0.0	0.3	0.1	0.9	0.0	0.1	0.0	0.1	0.1	0.2	1.2	1.3	0.7	7.5
RurMajDark	0.0	0.1	1.6	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.8	0.4	3.9
RurOthDay	0.0	0.0	1.5	0.1	0.7	0.1	0.4	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.6	0.4	0.7	5.2
RurOthDark	0.0	0.2	1.5	0.0	0.1	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.4	3.1
Urban	0.2	0.9	6.1	6.7	9.5	1.6	4.2	8.4	5.7	0.3	0.5	0.4	0.7	6.0	2.5	10.0	13.8	3.0	80.3
Rural	0.0	0.4	6.2	0.3	1.5	0.2	1.0	0.1	1.4	0.0	0.2	0.0	0.3	0.3	0.6	2.5	2.6	2.2	19.7
Major	0.1	0.2	5.4	1.6	1.5	0.7	1.6	4.2	2.6	0.1	0.3	0.1	0.2	2.7	1.2	5.0	11.2	1.9	40.5
Other	0.1	1.0	6.9	5.3	9.6	1.1	3.6	4.3	4.5	0.2	0.5	0.3	0.7	3.6	1.9	7.4	5.2	3.2	59.5
Daylight	0.1	0.4	5.7	4.8	9.0	1.2	4.3	6.1	5.6	0.2	0.6	0.3	0.7	4.0	2.3	9.1	12.1	3.3	69.9
Dark	0.1	0.8	6.6	2.1	2.0	0.6	0.9	2.5	1.5	0.1	0.1	0.1	0.3	2.3	0.7	3.3	4.4	1.8	30.1
Total	0.2	1.2	12.3	6.9	11.1	1.8	5.2	8.5	7.1	0.3	0.7	0.4	0.9	6.3	3.0	12.4	16.4	5.2	100.0

1985-86 NASS
ROW PERCENTS

ALL ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS										---------------->		MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnir		SameDir/Both St		SameDir/Turr		OppDir/Both Strt		OppDir/Turning					
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.1	0.5	5.1	4.0	2.7	1.3	2.9	14.1	7.9	0.9	0.5	0.6	0.2	5.6	1.8	13.7	35.7	2.4	100.0
UrbMajDark	1.1	0.7	14.9	4.6	1.1	1.7	2.7	12.5	3.9	0.4	0.3	0.1	0.3	9.4	2.1	10.5	30.5	2.9	100.0
UrbOthDay	0.4	1.2	5.9	6.5	15.1	1.3	6.6	7.5	7.3	0.5	1.3	0.3	0.9	4.9	2.4	21.0	13.3	3.6	100.0
UrbOthDark	0.6	2.7	16.5	7.5	7.2	2.6	3.7	11.3	6.1	0.8	1.0	0.5	1.3	5.5	2.4	15.1	11.3	3.8	100.0
RurMajDay	0.2	1.4	20.2	0.8	4.1	0.3	5.7	2.0	12.3	0.0	1.3	0.0	0.4	1.8	2.6	16.8	22.4	7.7	100.0
RurMajDark	0.0	2.7	50.0	0.6	1.8	2.7	1.0	0.2	3.0	1.3	0.2	0.0	0.3	2.9	1.7	7.5	16.2	7.9	100.0
RurOthDay	0.0	2.3	19.4	0.8	10.6	0.9	6.5	0.5	3.1	0.0	1.0	0.0	2.5	0.3	1.5	25.2	11.7	13.5	100.0
RurOthDark	0.0	6.2	57.6	0.1	3.9	0.6	3.4	2.1	6.4	0.0	0.0	0.0	0.5	0.4	0.6	6.7	4.5	7.0	100.0
Urban	0.4	1.3	8.6	5.9	9.1	1.6	4.7	10.4	6.9	0.7	1.0	0.4	0.7	5.7	2.2	17.0	20.2	3.3	100.0
Rural	0.1	2.7	32.0	0.7	5.4	0.9	4.7	1.3	7.1	0.2	0.8	0.0	1.0	1.3	1.8	15.6	15.2	9.2	100.0
Major	0.3	0.9	13.8	3.2	2.5	1.3	3.2	10.3	7.5	0.7	0.6	0.4	0.3	5.5	2.0	13.0	30.5	4.0	100.0
Other	0.4	2.0	12.5	5.9	12.1	1.5	5.7	7.6	6.6	0.5	1.1	0.3	1.1	4.5	2.3	19.1	12.2	4.7	100.0
Daylight	0.3	1.1	8.1	4.7	10.0	1.2	5.4	8.3	7.7	0.5	1.1	0.4	0.8	4.5	2.2	18.8	20.6	4.4	100.0
Dark	0.6	2.5	24.4	5.1	4.6	2.2	3.1	9.4	5.2	0.7	0.6	0.3	0.8	5.7	2.0	12.1	16.2	4.4	100.0
Total	0.4	1.5	13.0	4.9	8.4	1.5	4.7	8.6	6.9	0.6	0.9	0.3	0.8	4.8	2.1	16.7	19.3	4.4	100.0

1985-86 NASS

TOTAL PERCENTS FOR THE ENVIRONMENT BY ACCIDENT TYPE, AND THEN WITHIN EACH OF THE MARGINALS

ALL ACCIDENTS

	<-SINGLE VEHICLE->			<-MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS								------------------>				MULTIPLE VEHICLE NOT AT INTERSECTION			
	Intersection		Not	Cross/Both Strt		Cross/Turnin		SameDir/Both		SameDir/Turning		OppDir/Both Strt		OppDir/Turning					
	Signal	Sign	Intersec	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Drv/Prk	SameDir	OppDir	Total
UrbMajDay	0.0	0.1	1.0	0.8	0.5	0.3	0.6	2.9	1.6	0.2	0.1	0.1	0.0	1.1	0.4	2.8	7.2	0.5	20.3
UrbMajDark	0.1	0.1	1.2	0.4	0.1	0.1	0.2	1.0	0.3	0.0	0.0	0.0	0.0	0.8	0.2	0.8	2.5	0.2	8.1
UrbOthDay	0.1	0.5	2.2	2.4	5.6	0.5	2.5	2.8	2.7	0.2	0.5	0.1	0.3	1.8	0.9	7.8	4.9	1.4	37.2
UrbOthDark	0.1	0.4	2.6	1.2	1.1	0.4	0.6	1.8	0.9	0.1	0.2	0.1	0.2	0.9	0.4	2.3	1.7	0.6	15.5
RurMajDay	0.0	0.1	1.4	0.1	0.3	0.0	0.4	0.1	0.9	0.0	0.1	0.0	0.0	0.1	0.2	1.2	1.6	0.5	7.0
RurMajDark	0.0	0.1	1.7	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	0.3	3.4
RurOthDay	0.0	0.1	1.0	0.0	0.5	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.1	1.3	0.6	0.7	5.2
RurOthDark	0.0	0.2	1.9	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	3.4
Urban	0.4	1.0	7.0	4.7	7.4	1.3	3.8	8.4	5.6	0.5	0.8	0.3	0.6	4.6	1.8	13.8	16.4	2.7	81.0
Rural	0.0	0.5	6.1	0.1	1.0	0.2	0.9	0.2	1.3	0.0	0.2	0.0	0.2	0.3	0.3	3.0	2.9	1.7	19.0
Major	0.1	0.3	5.4	1.3	1.0	0.5	1.2	4.0	2.9	0.3	0.2	0.1	0.1	2.1	0.8	5.1	11.8	1.5	38.8
Other	0.2	1.2	7.7	3.6	7.4	0.9	3.5	4.6	4.0	0.3	0.7	0.2	0.7	2.7	1.4	11.7	7.5	2.9	61.2
Daylight	0.2	0.8	5.6	3.3	7.0	0.8	3.8	5.8	5.3	0.4	0.7	0.2	0.5	3.1	1.5	13.1	14.4	3.1	69.6
Dark	0.2	0.8	7.4	1.6	1.4	0.7	0.9	2.8	1.6	0.2	0.2	0.1	0.3	1.7	0.6	3.7	4.9	1.3	30.4
Total	0.4	1.5	13.0	4.9	8.4	1.5	4.7	8.6	6.9	0.6	0.9	0.3	0.8	4.8	2.1	16.7	19.3	4.4	100.0

PASSENGER CARS 1985-86 NASS
ALL ACCIDENTS--ROW PERCENTS

AGE	Signal	Signed	Not Int.	Total
16-25	25.12	18.10	56.78	100.00
26-55	24.34	22.50	53.16	100.00
56-65	28.89	22.14	48.97	100.00
65-75	31.62	23.73	44.65	100.00
76+	30.00	19.05	50.95	100.00
Total	25.47	20.78	53.75	100.00

Sample sizes

16-25	2106	1602	4202	7910
26-55	2466	2343	4818	9627
56-65	433	361	733	1527
65-75	316	255	447	1018
76+	186	106	197	489
Total	5507	4667	10397	20571

MULTIPLE VEHICLE ACCIDENTS AT INTERSECTIONS
PASSENGER CARS 1985-86 NASS
ALL ACCIDENTS--ROW PERCENTS

AGE	Crossing	SameDir	OppDir	Total
16-25	41.48	38.20	20.32	100.00
26-55	43.64	39.36	17.00	100.00
56-65	52.06	35.16	12.78	100.00
65-75	46.55	36.18	17.27	100.00
76+	58.31	22.28	19.41	100.00
Total	44.14	37.95	17.91	100.00

Sample sizes

16-25	1859	1082	986	3927
26-55	2469	1447	1100	5016
56-65	459	232	177	868
65-75	339	143	139	621
76+	206	48	78	332
Total	5332	2952	2480	10764

CARDfile TABLES

The tables in this set were generated from a random 5% sample of the CARDfile. The version of the CARDfile used covered the years 1984 through 1986. These are the most recent years available. The CARDfile is a data file which combines all police-reported accidents from Indiana, Michigan, Maryland, Pennsylvania, Texas, and Washington.

Vehicle Type:	Passenger cars
Sample Size:	168,619
Excluded Cases:	1. Accidents involving pedestrians or bicylists. 2. Alcohol involved drivers. 3. Drivers under 16. Note: Reckless driving could *not* be excluded.
Variables Used:	1. Driver Age. 2. Accident Type. 3. Relation to Intersection. 4. Intersection Signalization. 5. Land Use. 6. Light Conditions. 7. Accident Severity.

Missing data has been excluded from the analysis. About 30% of the cases had missing data on at least one of the variables used—age, accident type, intersection type, or traffic controls. The sample size reported above is the sample that remained after missing data was excluded.

The analyses that include land use (urban/rural) as part of a variable exclude cases from Pennsylvania and Texas, since that information is unavailable in the police reports of those states. Together, Texas and Pennsylvania form about 40% of the CARDfile cases. Similarly, no useful road type variable exists in the CARDfile dataset. The only road type variable at all divides roadways into those have some sort of roadway separation and those that do not. This variable is available only for Washington State cases, which is about 8% of the dataset.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
PROPERTY DAMAGE ONLY ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Inter-section	Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning		Driveway/ Parking	Same Dir.	Opp. Dir.	
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
16–25	0.40%	3.85%	17.35%	5.08%	10.52%	1.60%	5.76%	5.17%	6.21%	1.18%	3.74%	0.27%	0.91%	4.49%	2.85%	10.78%	15.99%	3.85%	100.00%
26–55	0.30	2.35	13.45	5.95	10.77	1.75	5.82	6.03	6.33	1.53	3.67	0.27	1.03	4.51	3.34	12.07	16.81	4.01	100.00
56+	0.33	2.23	10.03	7.28	13.80	2.37	6.54	5.05	5.57	1.49	3.54	0.32	0.94	5.15	4.01	14.56	13.54	3.26	100.00
TOTAL	0.34%	2.92%	14.50%	5.79%	11.09%	1.78%	5.90%	5.56%	6.18%	1.38%	3.68%	0.28%	0.97%	4.59%	3.24%	11.91%	16.03%	3.84%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
PROPERTY DAMAGE ONLY ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles															TOTAL
	Intersection		Non-Inter-section	Intersection												Non-Intersection			
				Angle				Same Direction				Opposite Direction				Driveway/ Parking	Same Dir.	Opp. Dir.	
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
16–25	0.16%	1.51%	6.79%	1.99%	4.12%	0.63%	2.25%	2.02%	2.43%	0.46%	1.46%	0.10%	0.35%	1.76%	1.12%	4.22%	6.26%	1.51%	39.13%
26–55	0.14	1.11	6.32	2.80	5.06	0.82	2.74	2.84	2.98	0.72	1.72	0.13	0.49	2.12	1.57	5.67	7.90	1.88	47.00
56+	0.05	0.31	1.39	1.01	1.91	0.33	0.91	0.70	0.77	0.21	0.49	0.04	0.13	0.71	0.56	2.02	1.88	0.45	13.87
TOTAL	0.34%	2.92%	14.50%	5.79%	11.09%	1.78%	5.90%	5.56%	6.18%	1.38%	3.68%	0.28%	0.97%	4.59%	3.24%	11.91%	16.03%	3.84%	100.00%

NOTE: All figures are total percents.   Missing data have been excluded from this table.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
CASUALTY ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles															TOTAL
	Intersection		Non-Intersection	Intersection												Non-Intersection			
				Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Driveway/ Parking	Same Dir.	Opp. Dir.	
16–25	0.53%	3.50%	18.10%	6.98%	11.88%	1.17%	4.67%	5.14%	5.49%	0.55%	2.63%	0.38%	1.13%	6.55%	3.67%	8.84%	12.65%	6.13%	100.00%
26–55	0.41	2.04	11.00	8.44	12.57	1.35	4.48	7.22	6.38	0.75	2.79	0.38	1.01	6.12	4.21	9.80	14.77	6.27	100.00
56+	0.46	1.87	9.27	10.24	16.15	1.51	5.31	6.11	5.18	0.53	2.79	0.43	1.04	6.47	5.19	9.85	12.12	5.48	100.00
TOTAL	0.46%	2.58%	13.46%	8.15%	12.83%	1.31%	4.67%	6.26%	5.86%	0.64%	2.73%	0.39%	1.06%	6.34%	4.15%	9.44%	13.57%	6.10%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
CASUALTY ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles																TOTAL
				Intersection												Non-Intersection				
	Intersection		Non-Inter-section	Angle				Same Direction				Opposite Direction								
				Straight		Turning		Straight		Turning		Straight		Turning		Driveway/ Parking	Same Dir.	Opp. Dir.		
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign					
16–25	0.20%	1.34%	6.93%	2.67%	4.55%	0.45%	1.79%	1.97%	2.10%	0.21%	1.01%	0.15%	0.43%	2.51%	1.41%	3.38%	4.84%	2.35%		38.28%
26–55	0.19	0.96	5.18	3.97	5.92	0.64	2.11	3.40	3.00	0.35	1.32	0.18	0.48	2.88	1.98	4.62	6.96	2.95		47.09
56+	0.07	0.27	1.36	1.50	2.36	0.22	0.78	0.89	0.76	0.08	0.41	0.06	0.15	0.95	0.76	1.44	1.77	0.80		14.63
TOTAL	0.46%	2.58%	13.46%	8.15%	12.83%	1.31%	4.67%	6.26%	5.86%	0.64%	2.73%	0.39%	1.06%	6.34%	4.15%	9.44%	13.57%	6.10%		100.00%

NOTE: All figures are total percents. Missing data have been excluded from this table.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
ALL ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Inter-section	Angle				Same Direction				Opposite Direction				Driveway/ Parking	Same Dir.	Opp. Dir.	
	Signal	Sign		Straight		Turning		Straight		Turning		Straight		Turning					
				Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
16–25	0.44%	3.73%	17.62%	5.74%	10.99%	1.45%	5.38%	5.16%	5.96%	0.96%	3.36%	0.31%	0.98%	5.20%	3.13%	10.11%	14.83%	4.64%	100.00%
26–55	0.34	2.25	12.60	6.82	11.40	1.61	5.35	6.45	6.35	1.25	3.36	0.31	1.03	5.07	3.64	11.27	16.09	4.80	100.00
56+	0.38	2.10	9.77	8.35	14.65	2.06	6.09	5.44	5.42	1.14	3.27	0.36	0.98	5.63	4.44	12.85	13.02	4.06	100.00
TOTAL	0.38%	2.80%	14.15%	6.62%	11.70%	1.61%	5.47%	5.81%	6.07%	1.12%	3.35%	0.32%	1.00%	5.20%	3.56%	11.04%	15.17%	4.64%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.

DRIVER AGE BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
ALL ACCIDENTS

Driver Age	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Intersection	Angle				Same Direction				Opposite Direction				Driveway/ Parking	Same Dir.	Opp. Dir.	
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
16–25	0.17%	1.45%	6.84%	2.23%	4.27%	0.56%	2.09%	2.00%	2.32%	0.37%	1.30%	0.12%	0.38%	2.02%	1.22%	3.92%	5.76%	1.80%	38.83%
26–55	0.16	1.06	5.93	3.21	5.36	0.76	2.52	3.03	2.99	0.59	1.58	0.15	0.48	2.39	1.71	5.30	7.57	2.26	47.03
56+	0.05	0.30	1.38	1.18	2.07	0.29	0.86	0.77	0.77	0.16	0.46	0.05	0.14	0.80	0.63	1.82	1.84	0.57	14.14
TOTAL	0.38%	2.80%	14.15%	6.62%	11.70%	1.61%	5.47%	5.81%	6.07%	1.12%	3.35%	0.32%	1.00%	5.20%	3.56%	11.04%	15.17%	4.64%	100.00%

NOTE: All figures are total percents. Missing data have been excluded from this table.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984-1986 CARDfile
PROPERTY DAMAGE ONLY ACCIDENTS

Condition	Single Vehicle			Two Vehicles															TOTAL
	Intersection		Non-Intersection	Intersection												Non-Intersection			
				Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Driveway/ Parking	Same Dir.	Opp. Dir.	
Urb/Day	0.44%	3.14%	10.10%	6.01%	12.57%	1.75%	5.05%	7.22%	8.14%	1.81%	3.61%	0.35%	1.18%	4.75%	3.47%	10.12%	17.58%	2.70%	100.00%
Urb/Dark	0.61	5.78	24.55	5.62	7.51	1.52	3.08	6.33	6.34	1.43	2.89	0.43	1.42	4.50	2.13	6.56	15.93	3.36	100.00
Rur/Day	0.19	3.14	24.44	2.63	8.25	1.14	5.04	3.35	6.01	0.58	3.58	0.18	1.64	2.39	2.44	5.14	22.20	7.64	100.00
Rur/Dark	0.20	5.66	58.55	1.48	2.88	0.55	1.93	1.69	2.75	0.34	1.38	0.15	0.86	1.54	1.08	2.25	11.78	4.91	100.00
Urban	0.49%	3.92%	14.36%	5.90%	11.08%	1.68%	4.47%	6.96%	7.61%	1.70%	3.39%	0.37%	1.25%	4.68%	3.07%	9.07%	17.10%	2.90%	100.00%
Rural	0.19	4.16	38.22	2.16	6.08	0.91	3.78	2.68	4.69	0.48	2.69	0.17	1.33	2.05	1.89	3.97	17.99	6.54	100.00
Daylight	0.38%	3.14%	13.61%	5.19%	11.51%	1.60%	5.05%	6.27%	7.62%	1.51%	3.60%	0.31%	1.29%	4.17%	3.22%	8.90%	18.71%	3.91%	100.00%
Dark	0.47	5.74	36.25	4.19	5.92	1.19	2.69	4.73	5.10	1.06	2.37	0.33	1.23	3.48	1.77	5.08	14.50	3.89	100.00
TOTAL	0.41%	3.99%	20.97%	4.86%	9.69%	1.47%	4.28%	5.77%	6.80%	1.36%	3.20%	0.32%	1.27%	3.95%	2.75%	7.66%	17.34%	3.91%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
PROPERTY DAMAGE ONLY ACCIDENTS

Condi-tion	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Inter-section	Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning		Driveway/ Parking	Same Dir.	Opp. Dir.	
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
Urb/Day	0.22%	1.60%	5.15%	3.07%	6.41%	0.89%	2.58%	3.68%	4.15%	0.92%	1.84%	0.18%	0.60%	2.42%	1.77%	5.16%	8.96%	1.38%	50.97%
Urb/Dark	0.13	1.23	5.24	1.20	1.60	0.33	0.66	1.35	1.35	0.31	0.62	0.09	0.30	0.96	0.45	1.40	3.40	0.72	21.33
Rur/Day	0.03	0.52	4.04	0.43	1.36	0.19	0.83	0.55	0.99	0.10	0.59	0.03	0.27	0.40	0.40	0.85	3.67	1.26	16.51
Rur/Dark	0.02	0.63	6.55	0.17	0.32	0.06	0.22	0.19	0.31	0.04	0.15	0.02	0.10	0.17	0.12	0.25	1.32	0.55	11.19
Urban	0.36%	2.83%	10.38%	4.26%	8.01%	1.22%	3.23%	5.03%	5.50%	1.23%	2.45%	0.27%	0.90%	3.38%	2.22%	6.56%	12.36%	2.09%	72.30%
Rural	0.05	1.15	10.59	0.60	1.68	0.25	1.05	0.74	1.30	0.13	0.75	0.05	0.37	0.57	0.52	1.10	4.98	1.81	27.70
Daylight	0.26%	2.12%	9.18%	3.50%	7.77%	1.08%	3.41%	4.23%	5.14%	1.02%	2.43%	0.21%	0.87%	2.82%	2.17%	6.00%	12.63%	2.64%	67.48%
Dark	0.15	1.87	11.79	1.36	1.92	0.39	0.87	1.54	1.66	0.34	0.77	0.11	0.40	1.13	0.57	1.65	4.72	1.27	32.52
TOTAL	0.41%	3.99%	20.97%	4.86%	9.69%	1.47%	4.28%	5.77%	6.80%	1.36%	3.20%	0.32%	1.27%	3.95%	2.75%	7.66%	17.34%	3.91%	100.00%

NOTE: All figures are total percents within the respective boxes. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
CASUALTY ACCIDENTS

Condition	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Intersection	Angle				Same Direction				Opposite Direction				Driveway/ Parking	Same Dir.	Opp. Dir.	
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
Urb/Day	0.33%	1.65%	5.80%	9.66%	14.99%	1.30%	3.96%	8.74%	8.66%	1.00%	3.43%	0.36%	1.24%	7.56%	4.95%	7.43%	15.02%	3.92%	100.00%
Urb/Dark	0.63	3.33	13.08	10.03	10.48	1.34	2.56	7.78	6.47	0.86	2.82	0.64	1.44	9.01	3.94	6.00	14.39	5.22	100.00
Rur/Day	0.17	2.81	20.40	3.86	13.09	0.77	3.53	3.21	4.65	0.36	3.81	0.21	1.39	3.64	3.62	4.94	18.79	10.74	100.00
Rur/Dark	0.13	4.24	38.04	3.74	6.71	0.40	2.20	2.44	3.37	0.23	2.40	0.30	2.10	3.34	1.90	2.71	15.10	10.62	100.00
Urban	0.42%	2.18%	8.10%	9.77%	13.57%	1.31%	3.52%	8.44%	7.96%	0.96%	3.24%	0.45%	1.31%	8.02%	4.63%	6.98%	14.82%	4.33%	100.00%
Rural	0.16	3.30	26.39	3.82	10.93	0.65	3.08	2.95	4.22	0.32	3.33	0.24	1.63	3.54	3.04	4.18	17.54	10.70	100.00
Daylight	0.28%	1.98%	9.91%	8.03%	14.46%	1.15%	3.84%	7.19%	7.53%	0.82%	3.54%	0.31%	1.28%	6.46%	4.57%	6.73%	16.08%	5.84%	100.00%
Dark	0.48	3.61	20.65	8.12	9.34	1.05	2.45	6.16	5.53	0.67	2.69	0.54	1.64	7.29	3.32	5.00	14.60	6.86	100.00
TOTAL	0.35%	2.50%	13.38%	8.06%	12.80%	1.12%	3.39%	6.85%	6.88%	0.77%	3.27%	0.39%	1.40%	6.73%	4.17%	6.17%	15.60%	6.17%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
CASUALTY ACCIDENTS

Condition	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Intersection	Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning		Driveway/ Parking	Same Dir.	Opp. Dir.	
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign				
Urb/Day	0.16%	0.80%	2.82%	4.70%	7.30%	0.63%	1.93%	4.25%	4.21%	0.49%	1.67%	0.17%	0.60%	3.68%	2.41%	3.61%	7.31%	1.91%	48.66%
Urb/Dark	0.14	0.75	2.94	2.26	2.36	0.30	0.58	1.75	1.46	0.19	0.63	0.14	0.32	2.03	0.89	1.35	3.24	1.17	22.50
Rur/Day	0.03	0.54	3.89	0.74	2.49	0.15	0.67	0.61	0.89	0.07	0.73	0.04	0.26	0.69	0.69	0.94	3.58	2.05	19.06
Rur/Dark	0.01	0.42	3.72	0.37	0.66	0.04	0.22	0.24	0.33	0.02	0.24	0.03	0.21	0.33	0.19	0.26	1.48	1.04	9.79
Urban	0.30%	1.55%	5.76%	6.96%	9.65%	0.93%	2.50%	6.00%	5.67%	0.68%	2.31%	0.32%	0.93%	5.71%	3.29%	4.96%	10.55%	3.08%	71.15%
Rural	0.05	0.95	7.61	1.10	3.15	0.19	0.89	0.85	1.22	0.09	0.96	0.07	0.47	1.02	0.88	1.21	5.06	3.09	28.85
Daylight	0.19%	1.34%	6.71%	5.43%	9.79%	0.78%	2.60%	4.87%	5.10%	0.56%	2.40%	0.21%	0.87%	4.37%	3.10%	4.55%	10.89%	3.96%	67.71%
Dark	0.15	1.16	6.67	2.62	3.01	0.34	0.79	1.99	1.79	0.22	0.87	0.17	0.53	2.35	1.07	1.62	4.72	2.21	32.29
TOTAL	0.35%	2.50%	13.38%	8.06%	12.80%	1.12%	3.39%	6.85%	6.88%	0.77%	3.27%	0.39%	1.40%	6.73%	4.17%	6.17%	15.60%	6.17%	100.00%

NOTE: All figures are total percents within the respective boxes. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
ALL ACCIDENTS

Condition	Single Vehicle			Two Vehicles															TOTAL
	Intersection		Non-Intersection	Intersection												Non-Intersection			
				Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Driveway/ Parking	Same Dir.	Opp. Dir.	
Urb/Day	0.41%	2.71%	8.87%	7.06%	13.26%	1.62%	4.74%	7.66%	8.29%	1.58%	3.56%	0.35%	1.20%	5.56%	3.89%	9.34%	16.85%	3.05%	100.00%
Urb/Dark	0.62	5.03	21.02	6.98	8.43	1.47	2.92	6.77	6.38	1.26	2.87	0.50	1.43	5.89	2.68	6.39	15.45	3.93	100.00
Rur/Day	0.19	3.03	23.12	3.03	9.84	1.02	4.55	3.31	5.56	0.51	3.65	0.19	1.56	2.80	2.83	5.07	21.09	8.66	100.00
Rur/Dark	0.18	5.28	53.03	2.09	3.91	0.51	2.01	1.89	2.91	0.31	1.66	0.19	1.20	2.02	1.30	2.38	12.68	6.45	100.00
Urban	0.47%	3.41%	12.53%	7.03%	11.81%	1.57%	4.19%	7.39%	7.71%	1.48%	3.35%	0.39%	1.27%	5.66%	3.53%	8.45%	16.43%	3.32%	100.00%
Rural	0.18	3.90	34.61	2.67	7.56	0.83	3.57	2.76	4.55	0.43	2.89	0.19	1.42	2.50	2.24	4.04	17.85	7.81	100.00
Daylight	0.35%	2.80%	12.51%	6.03%	12.39%	1.47%	4.69%	6.54%	7.59%	1.30%	3.58%	0.31%	1.29%	4.85%	3.62%	8.25%	17.93%	4.49%	100.00%
Dark	0.47	5.11	31.65	5.35	6.93	1.15	2.62	5.15	5.23	0.94	2.46	0.39	1.35	4.61	2.23	5.06	14.53	4.77	100.00
TOTAL	0.39%	3.55%	18.72%	5.81%	10.62%	1.36%	4.02%	6.09%	6.83%	1.19%	3.22%	0.34%	1.31%	4.77%	3.17%	7.22%	16.83%	4.58%	100.00%

NOTE: All figures are row percents. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

ENVIRONMENTAL CONDITION BY ACCIDENT TYPE
PASSENGER CARS 1984–1986 CARDfile
ALL ACCIDENTS

Condition	Single Vehicle			Two Vehicles															TOTAL
				Intersection												Non-Intersection			
	Intersection		Non-Inter-section	Angle				Same Direction				Opposite Direction							
				Straight		Turning		Straight		Turning		Straight		Turning					
	Signal	Sign		Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Signal	Sign	Driveway/ Parking	Same Dir.	Opp. Dir.	
Urb/Day	0.21%	1.36%	4.46%	3.55%	6.67%	0.82%	2.38%	3.85%	4.17%	0.79%	1.79%	0.18%	0.60%	2.79%	1.96%	4.70%	8.47%	1.54%	50.28%
Urb/Dark	0.13	1.09	4.56	1.51	1.83	0.32	0.63	1.47	1.38	0.27	0.62	0.11	0.31	1.28	0.58	1.39	3.35	0.85	21.68
Rur/Day	0.03	0.52	3.99	0.52	1.70	0.18	0.79	0.57	0.96	0.09	0.63	0.03	0.27	0.48	0.49	0.88	3.64	1.49	17.27
Rur/Dark	0.02	0.57	5.71	0.22	0.42	0.06	0.22	0.20	0.31	0.03	0.18	0.02	0.13	0.22	0.14	0.26	1.37	0.70	10.77
Urban	0.34%	2.45%	9.01%	5.06%	8.50%	1.13%	3.02%	5.32%	5.55%	1.07%	2.41%	0.28%	0.91%	4.07%	2.54%	6.08%	11.82%	2.39%	71.96%
Rural	0.05	1.09	9.70	0.75	2.12	0.23	1.00	0.77	1.27	0.12	0.81	0.05	0.40	0.70	0.63	1.13	5.01	2.19	28.04
Daylight	0.24%	1.89%	8.45%	4.07%	8.37%	0.99%	3.17%	4.42%	5.13%	0.88%	2.42%	0.21%	0.87%	3.28%	2.45%	5.57%	12.11%	3.03%	67.55%
Dark	0.15	1.66	10.27	1.74	2.25	0.37	0.85	1.67	1.70	0.31	0.80	0.13	0.44	1.49	0.72	1.64	4.72	1.55	32.45
TOTAL	0.39%	3.55%	18.72%	5.81%	10.62%	1.36%	4.02%	6.09%	6.83%	1.19%	3.22%	0.34%	1.31%	4.77%	3.17%	7.22%	16.83%	4.58%	100.00%

NOTE: All figures are total percents within the respective boxes. Missing data have been excluded from this table.
All cases from Pennsylvania and Texas were lost since the Land Use variable is not available for either state.

APPENDIX C
Single Vehicle, Non-Intersection Cases

Single Vehicle, Non-Intersection

14.5% of the case vehicles in 1988 Michigan accidents (7.1% at night in rural areas)

Percent All Veh.	Percent of S.V.	Most Common Situations
6.5%	44%	Hit an animal (97% deer*) 76% rural dark
4.7%	32%	Hit fixed object 52% Age 16-25, 41% snow/ice
1.1%	8%	Overturn 53% Age 16-25, 38% snow/ice
1.7%	12%	Hit parked car 43% Age 16-25, 24% snow/ice

*Deer were involved in 42,868 traffic accidents (10%) in Michigan in 1988.

1988 SINGLE-VEHICLE NON-INTERSECTION ACCIDENTS IN MICHIGAN

1. This category composed **14.46%** of all **accident-involved passenger cars** in which the driver was over 15 and was not considered to have been drinking or driving recklessly.
2. An additional **2.25%** of the above-defined vehicles were in single-vehicle accidents at or adjacent to intersections.
3. Looking at all reported **accidents** without any driver exclusions, **37.1%** involved just a single vehicle.
4. The different types of single-vehicle non-intersection accidents and their associated maneuvers and some of their associated factors are shown below with percentages.

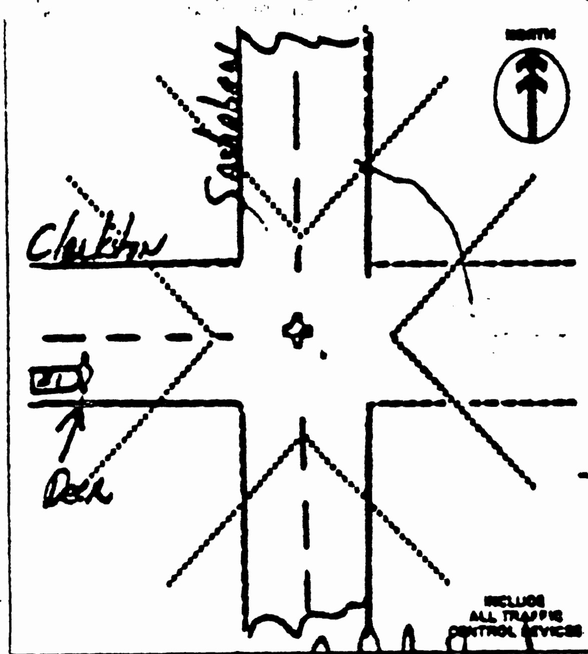
A. **Struck animal(43.0% Deer)**	**44.2%**	Urban Day 0.9%	Straight Rd 98.9%
a. Going straight	43.2%	Urban Dark 2.3%	Curved Road 1.1%
b. Avoiding an animal	1.0%	Rural Day 20.9%	
		Rural Dark 75.9%	Ages 16-25 25.9%
			Ages 26-55 61.1%
		Dry 77.4% Wet 15.3%	Ages 56+ 13.0%
		Snowy/Icy 7.3%	
B. **Struck a fixed object**	**32.5%**	Urban Day 15.1%	Straight Rd 82.4%
a. Going straight	23.2%	Urban Dark 13.5%	**Curved Road 17.6%**
b. Turning	0.7%	Rural Day 36.5%	
c. Passing/changing lanes	0.5%	Rural Dark 35.0%	**Ages 16-25 51.6%**
d. Avoiding a vehicle	5.4%		Ages 26-55 39.8%
e. Avoiding an animal or pedestrian (1.3% Deer)	1.9%	Dry 41.2% Wet 17.4%	Ages 56+ 8.5%
f. Avoiding an object	0.2%	**Snowy/Icy 41.4%**	
g. Pursuing/being pursued	0.2%		
C. **Overturned on or off road**	**7.7%**	Urban Day 5.1%	Straight Rd 78.5%
a. Going straight	5.8%	Urban Dark 2.7%	**Curved Road 21.5%**
b. Avoiding an animal or pedestrian	0.9%	Rural Day 47.5%	
		Rural Dark 44.7%	**Ages 16-25 53.5%**
c. Avoiding a vehicle	0.6%		Ages 26-55 41.0%
d. Passing/changing lanes	0.2%	Dry 46.2% Wet 15.4%	Ages 56+ 5.5%
e. Turning	0.1%	**Snowy/Icy 38.3%**	
D. **Struck a parked vehicle**	**12.1%**	Urban Day 47.1%	Straight Rd 94.5%
a. Going straight	5.5%	Urban Dark 28.2%	Curved Road 5.5%
b. Backing up	5.1%	Rural Day 16.7%	
c. Turning	0.5%	Rural Dark 8.0%	**Ages 16-25 43.5%**
d. Entering/leaving parking	0.5%		Ages 26-55 40.5%
e. Avoiding a vehicle, animal, or pedestrian	0.4%	Dry 64.0% Wet 11.5%	Ages 56+ 15.9%
		Snowy/Icy 24.5%	
E. **Struck other object or other/unknown accident**	**3.2%**	Urban Day 22.4%	Straight Rd 98.1%
		Urban Dark 23.4%	Curved Road 1.9%
a. Going straight	2.9%	Rural Day 32.7%	
b. Avoiding a vehicle	0.2%	Rural Dark 21.5%	Ages 16-25 27.1%
			Ages 26-55 64.5%
		Dry 72.6% Wet 17.0%	Ages 56+ 8.4%
		Snowy/Icy 10.4%	
F. **Struck a railroad train**	**0.3%**		

CASE# 244

Striking a deer

V1:CASE SEQUENCE NUMBER	= 758637
V2:ACCIDENT MONTH	= September
V5:TIME OF DAY	= 7 pm- 8 pm
V8:DAY OF WEEK	= Wednesday
V17:HIGHWAY AREA TYPE	= Other area
V19:ACCIDENT LOCATION	= On regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Local road or MD
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Dry
V25:TRAFFIC CONTROL	= None
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Dawn or dusk
V29:POPULATION	= Township
V30:ACCIDENT TYPE	= Col w animal
V31:ACC ANALYSIS - WHERE	= Same dir -nonint
V32:ACC ANALYSIS - HOW	= 10
V33:ACC ANALYSIS SUBSCRIPT	= 38
V34:SPECIAL ACCIDENT TAG	= Deer involved
V36:NSC ACC CIRCUMSTANCE	= Other/not stated
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= No violation
V48:WORST INJURY IN ACC	= No injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Going straight
V118:VEHICLE DAMAGE SEVERITY	= 2
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= None
V125:HAZARDOUS ACTION	= No violation
V126:POLICE ACTION	= No citation
V128:LF RESTRAINT USAGE	= Belt used
V147:DRIVER/PED AGE	= 22
V150:DRIVER/PED SEX	= Female

No Passengers



ACCIDENT DESCRIPTION AND REMARKS

Vehicle 1 was E/B on Clarkston when a deer ran out of some woods into the vehicle. Driver unable to avoid collision.

9-28-88 720 — 170 Deer Killed

FORWARD COPY TO Michigan Department of State Police, Traffic Services Division, 7150 Harris Drive, Lansing, MI 48913

Vehicle-Related Suggestions in Deer-Vehicle Accidents in Michigan: A Task Force Report
DNR Wildlife Division Report No. 3072, Oct. 198?

Vehicle Design and Accessories

Vehicle manufacturers and companies that produce automotive accessories should continue their research and make feasible engineering improvements to reduce both the number and severity of deer-vehicle collisions.

The automotive industry has emphasized reduced vehicle weights and aerodynamic designs to improve overall fuel economy. The severity of deer-vehicle accidents may be greater with vehicles of lighter weight. Aeronautic designs that lower a vehicle's front end below the center of gravity of a deer may cause deer to be thrown through the vehicle's windshield. People driving in areas with high deer numbers might be advised that heavier and higher vehicles may be safer.

Some vehicle accessories might be useful in reducing deer-vehicle accidents, although research data is not sufficient to allow endorsement of a specific product at this time. Ultrasonic warning devices (whistles) are reported to emit sound from 16,000 to 20,000 hertz to frighten deer off the roadways. Manufacturers claim the signal starts working at about 30 mph and may affect animals up to 400 yards away. Although many drivers who use these devices feel they are effective in alerting deer, there have been no definitive research studies that prove ultrasonic devices reduce deer-vehicle accidents. Several corporations have placed ultrasonic devices on their company vehicles. Many of the companies, such as K-mart, Meijer, Inc., Sullivan Trucking Company, Southwestern Bell, Spartan Stores, Inc., Super-Valu, and the Kansas State Highway Police, report a reduction in deer-vehicle accidents up to 80%. But the causes of the reduction may not be due to the ultrasonic generators, but to other factors. These devices may reduce accidents by making drivers more aware of deer, rather than by affecting the animal itself. No studies have been done to adequately control for driver awareness. In addition, a number of severe deer-vehicle accidents have occurred to drivers whose vehicles were equipped with ultrasonic warning devices. There is no conclusive evidence that an audible signal will prevent deer from crossing the path of a vehicle. Given the conflicting information on the effectiveness of this product, continuing research by manufacturers is recommended.

The intensity and direction of vehicle headlights may be related to accident rates. Halogen headlights, which provide about 25% more light than conventional headlights, may reduce accident risks by increasing deer visibility. New types of headlights might be designed to shine sideways towards roadway edges and ditches. Research is needed to evaluate the effectiveness of existing and potential headlight options. Perhaps an entire package of automotive options involving whistles, lights, bumpers, and grills might be considered for drivers who live in deer country.

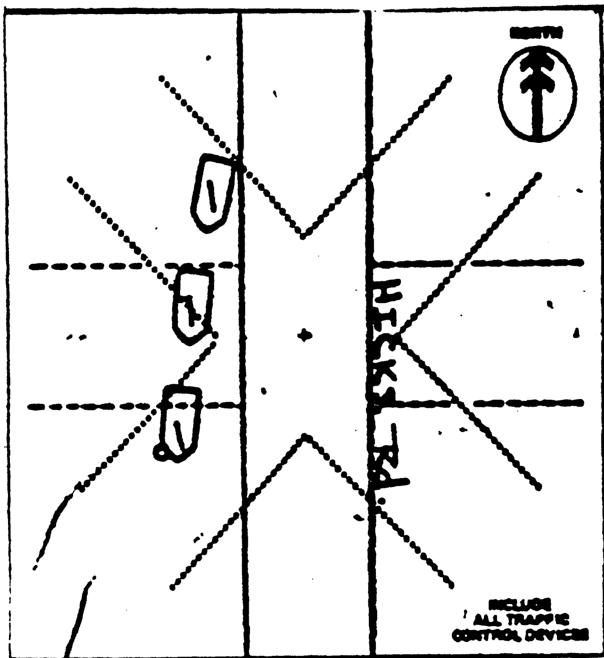
The use of seat belts may make the difference between an injury and a fatality in a deer-vehicle accident. Seat belts were not used in more than half of the fatalities from 1984 to 1986 in accidents involving a deer.

We encourage the auto industry to continue their commitment to quality and design. Future technologies hopefully will include devices to improve night-time driving vision and sensors that will alert drivers if they are in danger of hitting an object.

CASE# 338

Hitting a tree

V1:CASE SEQUENCE NUMBER	=	668974
V2:ACCIDENT MONTH	=	December
V5:TIME OF DAY	=	4 am- 5 am
V8:DAY OF WEEK	=	Tuesday
V17:HIGHWAY AREA TYPE	=	Other area
V19:ACCIDENT LOCATION	=	Off regular road
V21:HIGHWAY CLASS SUBSCRIPT	=	Local road or MD
V22:ROAD ALIGNMENT	=	Straight
V23:ROAD SURFACE	=	Dry
V25:TRAFFIC CONTROL	=	None
V26:CONSTRUCTION ZONE	=	Non const zone
V27:WEATHER	=	Clear/cloudy
V28:LIGHT	=	Dawn or dusk
V29:POPULATION	=	Township
V30:ACCIDENT TYPE	=	Overturn/off rd
V31:ACC ANALYSIS - WHERE	=	Same dir -nonint
V32:ACC ANALYSIS - HOW	=	2
V33:ACC ANALYSIS SUBSCRIPT	=	39
V34:SPECIAL ACCIDENT TAG	=	None of above
V36:NSC ACC CIRCUMSTANCE	=	Speed too fast
V40:DRINKING IN ACCIDENT	=	No drinking
V44:ENFORCEMENT IN ACCIDENT	=	No violation
V48:WORST INJURY IN ACC	=	A-injury
V107:VEHICLE CONDITION	=	No defect
V112:DRIVER INTENT	=	Going straight
V118:VEHICLE DAMAGE SEVERITY	=	6
V123:VISUAL OBSTRUCTION	=	No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	=	Other/unknown
V125:HAZARDOUS ACTION	=	Speed too fast
V126:POLICE ACTION	=	No citation
V128:LF RESTRAINT USAGE	=	Belt used
V147:DRIVER/PED AGE	=	70
V150:DRIVER/PED SEX	=	Male *No Passengers*



ACCIDENT DESCRIPTION AND REMARKS

DRIVER WAS HEADED S BOUND ON HICKS WHEN HE LOST THE ROAD & STRUCK A TREE

* DRIVER SITED FOR RE-EXAM FOR MEDICAL REASONS

12-6-88 9300-1 88-110909

Reported: Mo/Da/Yr 12-6-88 Time 616 Investigator ALVORD Badge No. 3058 Damaged Property Other Than Vehicle NONE

Photos by N/A

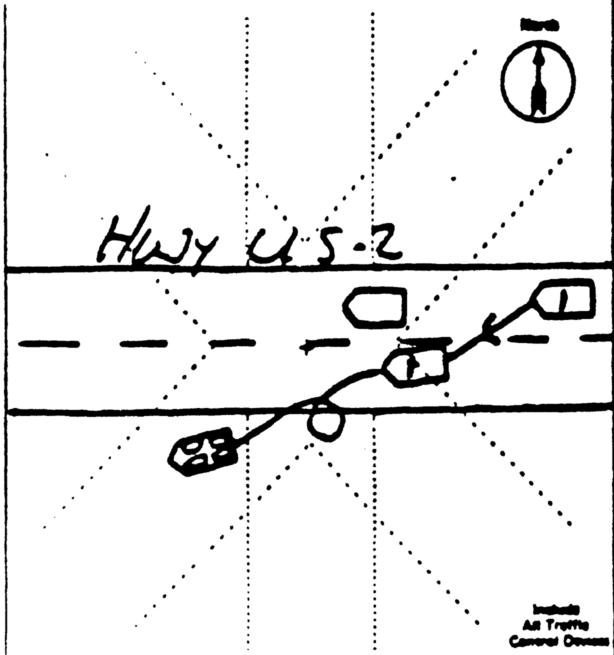
FORWARD COPY TO: Michigan Department of State Police, Traffic Services Division, 7150 Harris Drive, Lansing, MI 48913

CASE# 19

Lose control passing on icy road and overturning

V1:CASE SEQUENCE NUMBER	= 979774
V2:ACCIDENT MONTH	= January
V5:TIME OF DAY	= 2 pm- 3 pm
V8:DAY OF WEEK	= Sunday
V17:HIGHWAY AREA TYPE	= Other area
V19:ACCIDENT LOCATION	= Off regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Nonlim acc US rt
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Snowy/icy
V25:TRAFFIC CONTROL	= None
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Daylight
V29:POPULATION	= Township
V30:ACCIDENT TYPE	= Overturn/off rd
V31:ACC ANALYSIS - WHERE	= Same dir -nonint
V32:ACC ANALYSIS - HOW	= 1 Left
V33:ACC ANALYSIS SUBSCRIPT	= 39 not I
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Speed too fast
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= No violation
V48:WORST INJURY IN ACC	= No injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Overtake/pass
V118:VEHICLE DAMAGE SEVERITY	= 4
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown
V125:HAZARDOUS ACTION	= Speed too fast
V126:POLICE ACTION	= No citation
V128:LF RESTRAINT USAGE	= Belt used
V147:DRIVER/PED AGE	= 20
V150:DRIVER/PED SEX	= Female

3 Passengers: Male 20, Male 20, Male 22



ACCIDENT DESCRIPTION AND REMARKS

#1 STATES SHE WAS TRAVELING AT 50 MPH WHEN SHE ATTEMPTED TO PASS ANOTHER VEHICLE. ADVISED SHE LOST CONTROL AND ROLLED HER VEHICLE OVER.

1-3-88 4:30 TPR URCH 660

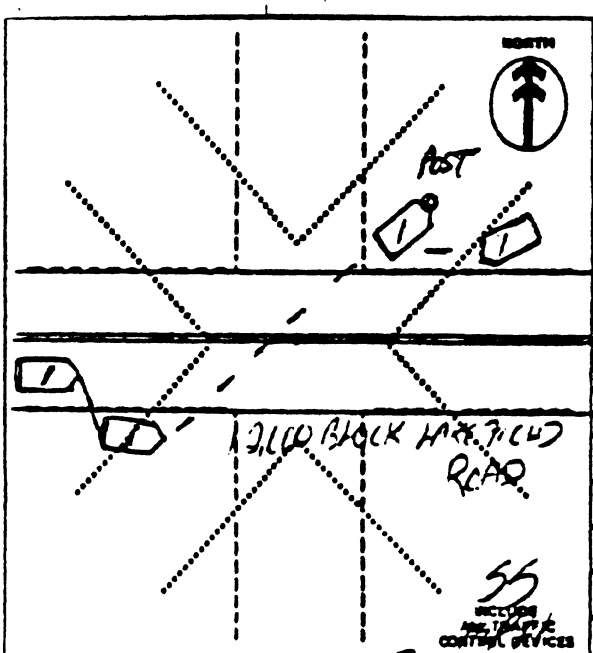
FORWARD COPY TO: Michigan Department of State Police, Traffic Services Division, 7150 Harris Drive, Lansing, Michigan 48913

CASE# 189

V1:CASE SEQUENCE NUMBER	=	803157
V2:ACCIDENT MONTH	=	August
V6:TIME OF DAY	=	8 am- 9 am
V8:DAY OF WEEK	=	Tuesday
V17:HIGHWAY AREA TYPE	=	Intersection
V19:ACCIDENT LOCATION	=	Off regular road
V21:HIGHWAY CLASS SUBSCRIPT	=	Local road or MD
V22:ROAD ALIGNMENT	=	Straight
V23:ROAD SURFACE	=	Wet
V25:TRAFFIC CONTROL	=	None
V26:CONSTRUCTION ZONE	=	Non const zone
V27:WEATHER	=	Raining
V28:LIGHT	=	Daylight
V29:POPULATION	=	Township
V30:ACCIDENT TYPE	=	Overturn/off rd
V31:ACC ANALYSIS - WHERE	=	Same dir -nonint
V32:ACC ANALYSIS - HOW	=	1
V33:ACC ANALYSIS SUBSCRIPT	=	39
V34:SPECIAL ACCIDENT TAG	=	None of above
V36:NSC ACC CIRCUMSTANCE	=	Follow too close
V40:DRINKING IN ACCIDENT	=	No drinking
V44:ENFORCEMENT IN ACCIDENT	=	No violation
V48:WORST INJURY IN ACC	=	No injury
V107:VEHICLE CONDITION	=	No defect
V112:DRIVER INTENT	=	Going straight
V118:VEHICLE DAMAGE SEVERITY	=	4
V123:VISUAL OBSTRUCTION	=	No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	=	Other/unknown
V125:HAZARDOUS ACTION	=	Follow too close
V126:POLICE ACTION	=	No citation
V128:LF RESTRAINT USAGE	=	Belt used
V147:DRIVER/PED AGE	=	17
V150:DRIVER/PED SEX	=	Male

Lose control on water hole and overturning

Passengers: 0



ACCIDENT DESCRIPTION AND REMARKS

DRIVER STATED HE WAS EASTBOUND ON LAKEFIELD ROAD. HE HIT A WATER HOLE, LOST CONTROL & WENT OFF THE ROAD TO THE RIGHT, VERED OFF ACROSS THE ROAD TO THE NORTH SIDE OF LAKEFIELD, HIT A CORNER POST, FLIPPED OVER & CAME TO REST ON THE LEFT SIDE OF THE VEHICLE. DRIVER SAID HE WAS GOING APPROX. 50 MPH.

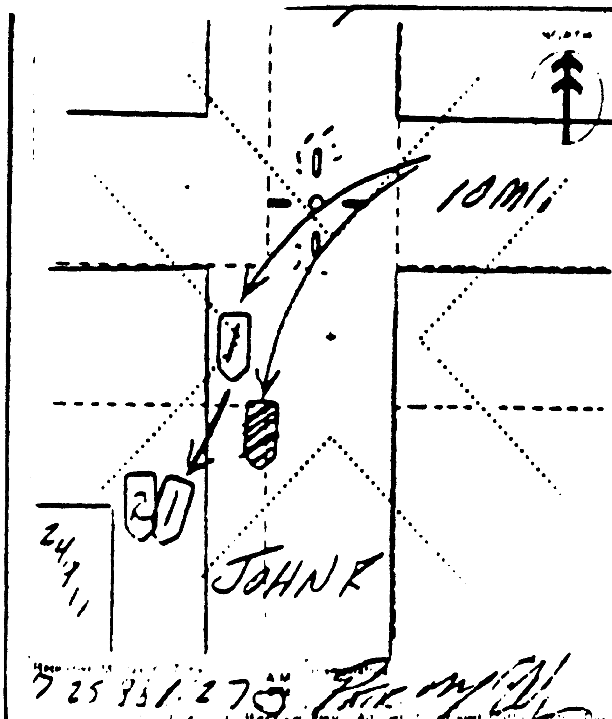
FORWARD COPY TO Michigan Department of State Police Traffic Services Division 7150 Harris Drive Lansing, MI 48913

CASE# 188

Hit a parked vehicle avoiding another vehicle

V1:CASE SEQUENCE NUMBER	= 803553
V2:ACCIDENT MONTH	= July
V5:TIME OF DAY	= 1 pm- 2 pm
V8:DAY OF WEEK	= Monday
V17:HIGHWAY AREA TYPE	= Intersection
V19:ACCIDENT LOCATION	= Off regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Local road or MD
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Wet
V25:TRAFFIC CONTROL	= Stop & go signal
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Raining
V28:LIGHT	= Daylight
V29:POPULATION	= 10000 to 25000
V30:ACCIDENT TYPE	= Col w parked veh
V31:ACC ANALYSIS - WHERE	= Same dir -nonint
V32:ACC ANALYSIS - HOW	= 10
V33:ACC ANALYSIS SUBSCRIPT	= 12
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Follow too close
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= Hazrdous violatn
V48:WORST INJURY IN ACC	= No injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Turning left
V118:VEHICLE DAMAGE SEVERITY	= 5
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown
V125:HAZARDOUS ACTION	= Follow too close
V126:POLICE ACTION	= Hazard violation
V128:LF RESTRAINT USAGE	= Belt not used
V147:DRIVER/PED AGE	= 16
V150:DRIVER/PED SEX	= Male

1 Passenger: Male 16



#1 - TURNED S/ON JOHN R. from W/B 10 MILE BEHIND ANOTHER CAR, WAS GOING TO PASS IN RIGHT LANE WHEN OTHER CAR CHANGED TO RIGHT LN. #1 BRAKED & CUT RIGHT & WENT OVER CURB STRIKING #2

#2 - LEGALLY PARKED, HIT BY #1 & PUSHED INTO BUILDING AT 24911 JOHN R.

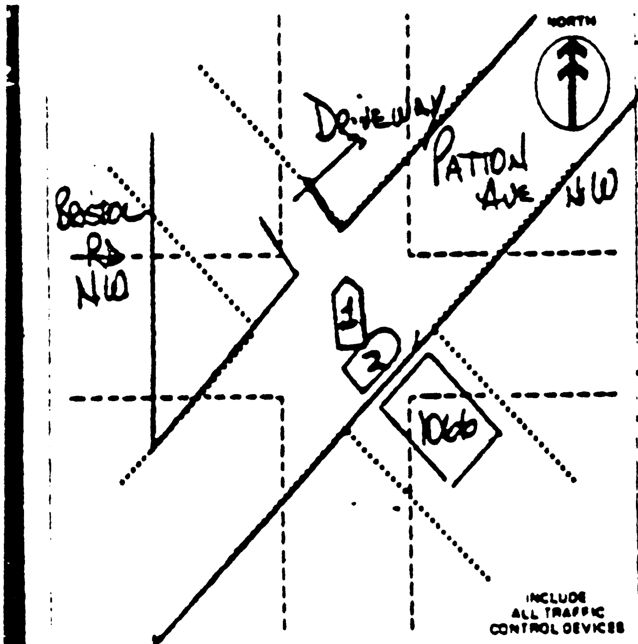
#1 & MOTHER CAME TO SCENE & ADV. OF ACCIDENT

CASE# 175

Backing into parked car

V1:CASE SEQUENCE NUMBER	= 813928
V2:ACCIDENT MONTH	= July
V5:TIME OF DAY	= 1 pm- 2 pm
V8:DAY OF WEEK	= Wednesday
V17:HIGHWAY AREA TYPE	= Intersection
V19:ACCIDENT LOCATION	= Off regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Local road or MD
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Dry
V25:TRAFFIC CONTROL	= None
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Daylight
V29:POPULATION	= 100000 to 250000
V30:ACCIDENT TYPE	= Col w parked veh
V31:ACC ANALYSIS - WHERE	= Driveway access
V32:ACC ANALYSIS - HOW	= 10
V33:ACC ANALYSIS SUBSCRIPT	= 12
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Othr improp drvg
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= No violation
V48:WORST INJURY IN ACC	= No injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Backing
V118:VEHICLE DAMAGE SEVERITY	= None
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown
V125:HAZARDOUS ACTION	= Imprp back/start
V126:POLICE ACTION	= No citation
V128:LF RESTRAINT USAGE	= Belt used
V147:DRIVER/PED AGE	= 60
V150:DRIVER/PED SEX	= Male

1 Passenger: Age & Sex missing



#2 - legally parked without occupants - in front of 1066 Patton Ave NW. #1 backed into #2 and left scene. #2 discovered accident. Later, witness - resident of 1066 Patton NW - contacted #1 who admitted striking #2.

#1 states he was backing out of 1033 Patton & did not see #2 who was parked across the street from the drive & struck #2.

8-28-83 1140 [illegible] A Hurst 144 [illegible] NONE.

NONE

APPENDIX D
Multi-Vehicle, Crossing Paths, Signalized Intersection Cases

Multiple Vehicle, Crossing Paths
Signalized Intersection

6.6% of the case vehicles in 1988 Michigan accidents

Percent All Veh.	Percent Signals	Most Common Situations
4.6%	70%	Pulled out in front of approaching vehicle
0.8%	12%	Turned left into approaching vehicle

Associated factors: clear, dry, and daylight

Some over-involvement of older drivers

Basic error is driving through a red light

Multi-Vehicle, Vehicle Crossing Paths, Signalized Intersection

Summary/Highlights

1). This category accounts for 6.59 percent of crash-involved passenger cars in 1988 Michigan crashes, or approximately 30,950 such vehicles.

2). Most of these multi-vehicle crashes occurring at signalled intersections were attributable to one of the drivers running through a red light or a flashing red light.

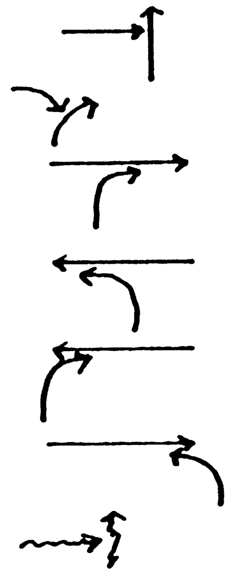
3). In most instances conditions were Clear, Daylight, Dry.

4). In a few instances a collision occurred when a driver was turning right on red. In all these cases the driver turning was age 75 or older. Whether age would prove to be a factor if this crash type were investigated more extensively is not known.

Possible Contributing Factors

This crash type appears difficult to analyze in that a clear signal is apparently present but a driver is not responding appropriately. While older drivers are over-represented in this crash type, all ages are involved.

Crossing Path Crashes at Signed and Signalized Intersections
Michigan 1986 Cases from CARDfile

Accident Configuration	SIGNED		SIGNALIZED		Diagram
	Number	Percent	Number	Percent	
Both Straight	28,588	64.1%	19,593	69.5%	
Both Curving/Turning	1,227	2.7	563	2.0	
Resulting Same Dir. Turn Right	1,857	4.2	1,819	6.5	
Resulting Same Dir. Turn Left	2,859	6.4	1,755	6.2	
Resulting Opp. Dir. Turn Right	1,898	4.3	918	3.3	
Resulting Opp. Dir. Turn Left	7,869	17.6	3,342	11.9	
Other/Unknown	323	0.7	207	0.7	
TOTAL	44,621	100.0%	28,197	100.0%	

NOTE: In each case, one of the vehicles may be stopped.

CASE# 390

Fail to stop for red light

V1:CASE SEQUENCE NUMBER	= 611570
V2:ACCIDENT MONTH	= January
V5:TIME OF DAY	= 2 pm- 3 pm
V8:DAY OF WEEK	= Friday
V17:HIGHWAY AREA TYPE	= Intersection
V19:ACCIDENT LOCATION	= On regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Local road or MD
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Dry
V25:TRAFFIC CONTROL	= Stop & go signal
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Daylight
V29:POPULATION	= More than 250000
V30:ACCIDENT TYPE	= Col w other veh
V31:ACC ANALYSIS - WHERE	= Angle -at int
V32:ACC ANALYSIS - HOW	= 1
V33:ACC ANALYSIS SUBSCRIPT	= 1
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Failed to yield
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= Hazrdous violatn
V48:WORST INJURY IN ACC	= No injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Going straight
V118:VEHICLE DAMAGE SEVERITY	= Unk
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown
V125:HAZARDOUS ACTION	= Failed to yield
V126:POLICE ACTION	= Hazard violation
V128:LF RESTRAINT USAGE	= Rstraint use unk
V147:DRIVER/PED AGE	= 44
V150:DRIVER/PED SEX	= Female

ULD

Vehicle 2

Going straight

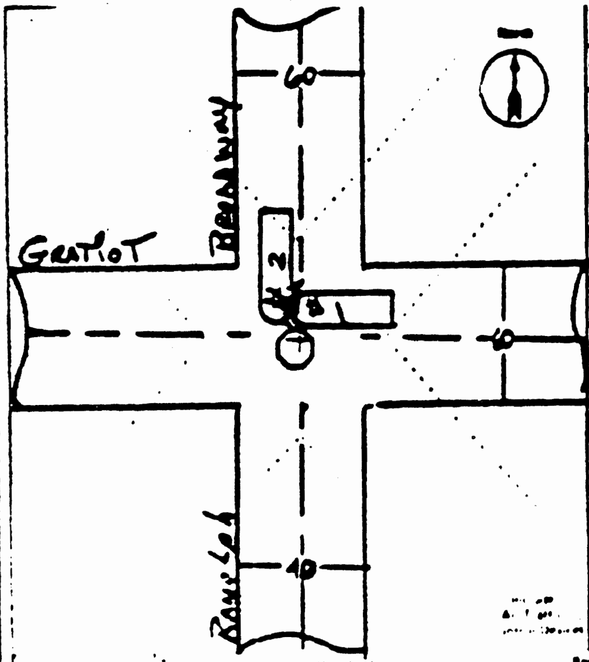
2

No violation

Belt used

70

Male



ACCIDENT DESCRIPTION AND REMARKS

Veh #2 was traveling S/B on Broad-way with the green traffic signal when Veh #1 traveling W/B on Gratiot disregard the red traffic signal and struck Veh #2

1-9-88 5:20 Leo Blakely 1916 1 Rpt

Auto/Auto

APPENDIX E
Multi-Vehicle, Crossing Paths, Signed Intersection Cases

Multiple Vehicle, Crossing Paths
Signed Intersection

12.1% of the case vehicles in 1988 Michigan accidents

Percent All Veh.	Percent Signed	Most Common Situations
5.4%	45%	Ran through a stop or yield sign 45% under the age of 25
5.0%	41%	Stopped at sign, and then proceeded into approaching traffic 69% over 60

The association with driver age is striking.

Multi-Vehicle, Vehicle Crossing Paths, Signed Intersection

Summary/Highlights

1. This category accounts for 12.1 percent of crash-involved passenger cars in 1988 Michigan crashes, or approximately 56,800 such vehicles.

2. Two dominant crash types occur in this category:

    a. Ran Sign: A driver simply ran through a stop or yield sign, apparently without stopping first.

    b. Stopped at Sign, Pulled Out: In these crashes one driver stopped at a sign, then pulled out and hit another vehicle.

3. Less frequently occurring crashes involved the following:

    a. Driver's View Blocked: In several cases another vehicle blocked the driver's view, and the driver committed a driving error, e.g., pulled out behind another vehicle when it went through the intersection.

    b. Slippery Road Conditions: In a significant minority of cases the road was snowy/icy and a driver could not control the car adequately.

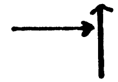
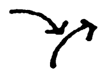
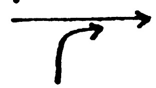
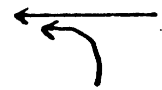
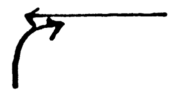
    c. Environmental Factors: In a few instances the intersection did not have any right-of-way control or an existing light was not operating.

Possible Contributing Factors

The most remarkable characteristic of this crash type concerns the two predominant situations, (1) running through a sign, and, (2) stopping, then running through a sign. In the first instance, while all ages are represented, younger and middle age drivers predominate. In the latter situation, where a driver stops and then pulls into the intersection, older drivers predominate. Although the sample selected was stratified by age, the selection criteria did not differentiate between the two crash types. However, when crashes were classified according to these two crash types, only 10 percent of the drivers running a stop or yield sign were over 60 years of age and 45 percent were under 25. In contrast, for crashes involving a driver who stopped and then pulled out, 69 percent were over 60 years of age and only 8 percent were under 25. The number of cases on which these analyses are based is small, but the findings are so striking that they appear to warrant further investigation.

Other possible contributing factors include slippery road conditions, and lack of adequate right-of-way markings.

Crossing Path Crashes at Signed and Signalized Intersections
Michigan 1986 Cases from CARDfile

Accident Configuration	SIGNED		SIGNALIZED		Diagram
	Number	Percent	Number	Percent	
Both Straight	28,588	64.1%	19,593	69.5%	
Both Curving/Turning	1,227	2.7	563	2.0	
Resulting Same Dir. Turn Right	1,857	4.2	1,819	6.5	
Resulting Same Dir. Turn Left	2,859	6.4	1,755	6.2	
Resulting Opp. Dir. Turn Right	1,898	4.3	918	3.3	
Resulting Opp. Dir. Turn Left	7,869	17.6	3,342	11.9	
Other/Unknown	323	0.7	207	0.7	
TOTAL	44,621	100.0%	28,197	100.0%	

NOTE: In each case, one of the vehicles may be stopped.

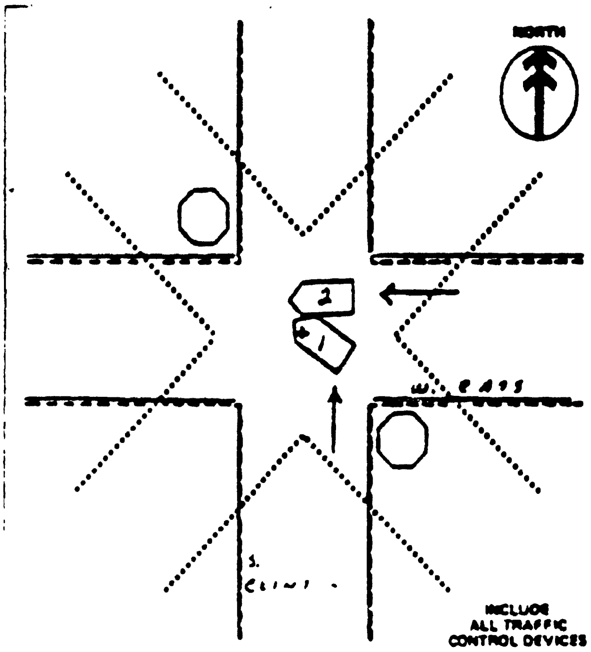
CASE# 28

Fail to stop at stop sign

V1:CASE SEQUENCE NUMBER = 975687
V2:ACCIDENT MONTH = January
V5:TIME OF DAY = 10 am-11 am
V8:DAY OF WEEK = Monday
V17:HIGHWAY AREA TYPE = Intersection
V19:ACCIDENT LOCATION = On regular road
V21:HIGHWAY CLASS SUBSCRIPT = Local road or MD
V22:ROAD ALIGNMENT = Straight
V23:ROAD SURFACE = Dry
V25:TRAFFIC CONTROL = Stop sign
V26:CONSTRUCTION ZONE = Non const zone
V27:WEATHER = Clear/cloudy
V28:LIGHT = Daylight
V29:POPULATION = 10000 to 25000
V30:ACCIDENT TYPE = Col w other veh
V31:ACC ANALYSIS - WHERE = Angle -at int
V32:ACC ANALYSIS - HOW = 1
V33:ACC ANALYSIS SUBSCRIPT = 1
V34:SPECIAL ACCIDENT TAG = None of above
V36:NSC ACC CIRCUMSTANCE = Failed to yield
V40:DRINKING IN ACCIDENT = No drinking
V44:ENFORCEMENT IN ACCIDENT = Hazrdous violatn
V48:WORST INJURY IN ACC = No injury
V107:VEHICLE CONDITION = No defect
V112:DRIVER INTENT = Going straight
V118:VEHICLE DAMAGE SEVERITY = 3
V123:VISUAL OBSTRUCTION = No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE = Other/unknown
V125:HAZARDOUS ACTION = Failed to yield
V126:POLICE ACTION = Hazard violation
V128:LF RESTRAINT USAGE = Belt used
V147:DRIVER/PED AGE = 20
V150:DRIVER/PED SEX = Female

ULD

Vehicle 2
Going straight
4
No violation
Belt used
26
Female



ACCIDENT DESCRIPTION AND REMARKS

VEHICLE #1 FAILED TO STOP FOR STOP SIGN AND STRUCK VEHICLE #2.

FORWARD COPY TO

CASE# 314

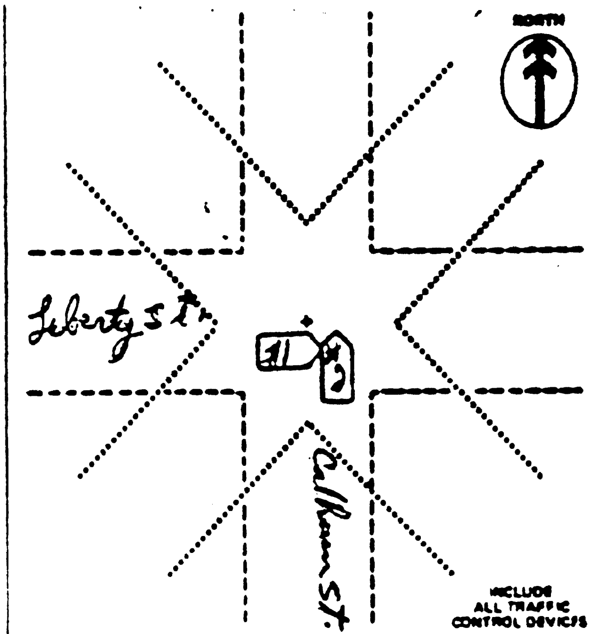
Stop at stop sign and then pulling out

V1:CASE SEQUENCE NUMBER	=	689976
V2:ACCIDENT MONTH	=	May
V5:TIME OF DAY	=	1 pm- 2 pm
V8:DAY OF WEEK	=	Tuesday
V17:HIGHWAY AREA TYPE	=	Intersection
V19:ACCIDENT LOCATION	=	On regular road
V21:HIGHWAY CLASS SUBSCRIPT	=	Local road or MD
V22:ROAD ALIGNMENT	=	Straight
V23:ROAD SURFACE	=	Dry
V25:TRAFFIC CONTROL	=	Stop sign
V26:CONSTRUCTION ZONE	=	Non const zone
V27:WEATHER	=	Clear/cloudy
V28:LIGHT	=	Daylight
V29:POPULATION	=	5000 to 10000
V30:ACCIDENT TYPE	=	Col w other veh
V31:ACC ANALYSIS - WHERE	=	Angle -at int
V32:ACC ANALYSIS - HOW	=	1
V33:ACC ANALYSIS SUBSCRIPT	=	1
V34:SPECIAL ACCIDENT TAG	=	None of above
V36:NSC ACC CIRCUMSTANCE	=	Failed to yield
V40:DRINKING IN ACCIDENT	=	No drinking
V44:ENFORCEMENT IN ACCIDENT	=	No violation
V48:WORST INJURY IN ACC	=	No injury
V107:VEHICLE CONDITION	=	No defect
V112:DRIVER INTENT	=	Going straight
V118:VEHICLE DAMAGE SEVERITY	=	2
V123:VISUAL OBSTRUCTION	=	No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	=	Other/unknown
V125:HAZARDOUS ACTION	=	Failed to yield
V126:POLICE ACTION	=	No citation
V128:LF RESTRAINT USAGE	=	Belt used
V147:DRIVER/PED AGE	=	79
V150:DRIVER/PED SEX	=	Male

OLD

Vehicle 2

Going straight
2
No violation
Belt used
30
Male



Driver #1 stated he was going East on Liberty and stopped for the stop sign at Calhoun looked both ways and did not see any Vehicles and pulled out and hit Vehicle #2

Driver #2 states he was going North on Calhoun and Driver #1 pulled out from Liberty St. and he could not stop in time (minor damage)

Badge No. 4 — Damaged Property Other Than Vehicle: *None*

FORWARD COPY TO — Michigan Department of State Police, Traffic Services Division

APPENDIX F
Multi-Vehicle, Non-Intersection, Driveway/Parking Cases

Multiple Vehicle, Non-Intersection Driveway/Parking

15.1% of the case vehicles in 1988 Michigan accidents

Percent All Veh.	Percent Driveway	Most Common Situations
4.2%	28%	Left turn entering driveway
3.5%	23%	Left turn exiting driveway
2.0%	13%	Passing on right or left of turning vehicle
2.0%	13%	Rear-end with vehicle slowing or starting
1.4%	9%	Backing out
0.8%	5%	Right turn exiting driveway

Associated factors not evident.

Backing out is not the problem

In general, these situation are common to signed intersections

Multiple-Vehicle Driveway/Parking Accidents
(includes intersection-related)

Driveway/Parking Case Highlights
15.1% of involved vehicles

1. 59 total cases.

2. No obvious correlations with age.

3. 4 involved some sort of visual obstruction.

4. Only 2 had an obvious weather component. In one case, a car was unable to stop in exiting a driveway and slid into traffic. The other case involved blowing snow obscuring vision.

5. 47 occurred during the day; 12 at night.

6. 39 occurred on dry pavement; 20 on wet.

7. Only 6 out of the 59 involved backing, either from a driveway or from angled parking.

8. Four accident configurations accounted for 83% of the driveway/parking accidents.

9. Of the 17 cases of a car pulling from a driveway into traffic, in 15 the driver intended to turn left, in only 2 did he intend to turn right. Of the 9 cases of a driver being passed as he turned into a driveway, 6 involved left turns.

Problems

Twenty-seven of the 59 cases are coded as intersection-related. Another 4 are like intersections in that they involve driveways at a mall (2 were K-Marts). One of these had a signal, another a stop sign. Roughly half the cases in each accident configuration were coded as intersection-related. The intersection appeared to have a direct influence on the accident in only some of the cases. In a few others, the intersection also seemed to be a factor, but only in that it presented a set of additional demands on the driver.

Possible computer runs

The accident scenarios can probably be identified in the Michigan data. Distributions could then be run, with splits on age. No age associations suggested themselves in reviewing individual cases, but apparently there was some problem with the case selection. Distributions by urban/rural, road condition, and road type should also be done to check representativeness.

Technological interventions

In many of the accidents, there was not enough information in the report about the critical error or errors and consequently little aid in determining the type of intervention which may be helpful. As an example, one of the cases involved a left turn into a driveway in front of a motorcycle at night. Did the driver see the motorcyle but fail to judge closing speeds correctly? Is it a night-vision problem? Was the headlight of the cycle lost in background clutter? Did the driver notice the cycle at all? If the problem is failure to detect an oncoming motorcycle with its headlight on, what sort of collision warning in the car will be noticed?

Moreover, in a case like this, the problem is that the paths of the two vehicles intersect only after one of them starts turning. This would seem to drastically limit the response time of a collision detector. Assuming a machine could give a warning, it may already be too late for the driver to both comprehend the warning and act on it.

Clearly, though, the problem of driveway/parking accidents will not be solved by rear-mounted area scanners.

Future research

Assuming the collision types identified are representative of the major configurations, more information is necessary to determine if the problems are ones of perception, judgment, or attention, and to determine the amounts of time available for intervention in each type.

Some of the accident configurations do not seem peculiar to driveway/parking involvements. For example, rear-ends of vehicles slowing to enter a driveway are probably not different from rear-ends in the non-intersection, multiple vehicle accident type. It may be possible to develop a typology of vehicle movements which could supplement or supersede the 18-level accident type variable. This typology would bring together vehicle configurations in which the same or similar demands are put on the car and driver, regardless of the location of the accident.

MANEUVERS IN 1988 MULTI-VEHICLE DRIVEWAY ACCESS ACCIDENTS IN MICHIGAN

1. **15.12%** of accident-involved moving passenger cars in which the driver was over 15 and was not considered to have been drinking or driving recklessly collided while at least one vehicle was entering or leaving a commercial, public, or residential driveway or a street parking spot.
2. When the collision was between two passenger cars **98.4%** of these accidents involved entering or exiting a driveway, and those are the ones for which the maneuvers of the first two involved cars are shown below.

One Car	Second Car	Entering Driveway	Exiting Driveway
Going Straight	Going Straight	3.3%	10.9%
Going Straight	Passing/Changing Lanes	0.3%	0.7%
Going Straight	Turning Right	15.5%	8.9%
Going Straight	Turning Left	57.4%	38.9%
Going Straight	Backing Up	0.7%	15.2%
Going Straight	Starting Up	---	7.2%
Going Straight	Stopped on Road	1.9%	0.3%
Going Straight	Avoiding a Vehicle	---	1.1%
Passing/Changing Lanes	Turning Right	2.8%	0.1%
Passing/Changing Lanes	Turning Left	11.6%	0.4%
Turning Right	Turning Right	0.5%	0.3%
Turning Right	Turning Left	0.2%	1.3%
Turning Left	Turning Left	0.7%	4.4%
Turning Right	Backing Up	0.2%	0.1%
Turning Left	Backing Up	0.5%	0.8%
Backing Up	Backing Up	0.2%	1.6%
Backing Up	Stopped on Road	---	1.1%
Turning Right	Stopped on Road	---	0.8%
Turning Left	Stopped on Road	---	0.5%
Turning Right	Avoiding a Vehicle	0.3%	---
Turning Left	Avoiding a Vehicle	3.1%	1.8%
Turning Right	Starting Up	---	0.4%
Turning Left	Starting Up	---	0.5%
Backing Up	Avoiding a Vehicle	0.2%	1.3%
Miscellaneous Combinations of Maneuvers		0.7%	1.2%
		100.0%	100.0%

CASE# 192

residential driveway

V1:CASE SEQUENCE NUMBER	= 795515
V2:ACCIDENT MONTH	= June
V5:TIME OF DAY	= 11 pm-12 am
V8:DAY OF WEEK	= Thursday
V17:HIGHWAY AREA TYPE	= Other area
V19:ACCIDENT LOCATION	= On regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Nonlim acc US rt
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Dry
V25:TRAFFIC CONTROL	= Stop & go signal
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Dark-street lght
V29:POPULATION	= Township
V30:ACCIDENT TYPE	= Col w other veh
V31:ACC ANALYSIS - WHERE	= Driveway access
V32:ACC ANALYSIS - HOW	= 8
V33:ACC ANALYSIS SUBSCRIPT	= 17
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Failed to yield
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= Hazrdous violatn
V48:WORST INJURY IN ACC	= A-injury
V107:VEHICLE CONDITION	= No defect
V112:DRIVER INTENT	= Turning left
V118:VEHICLE DAMAGE SEVERITY	= 4
V123:VISUAL OBSTRUCTION	= No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown
V125:HAZARDOUS ACTION	= Failed to yield
V126:POLICE ACTION	= Hazard violation
V128:LF RESTRAINT USAGE	= Belt used
V147:DRIVER/PED AGE	= 16
V150:DRIVER/PED SEX	= Female

R Wayne Cty

Vehicle 2

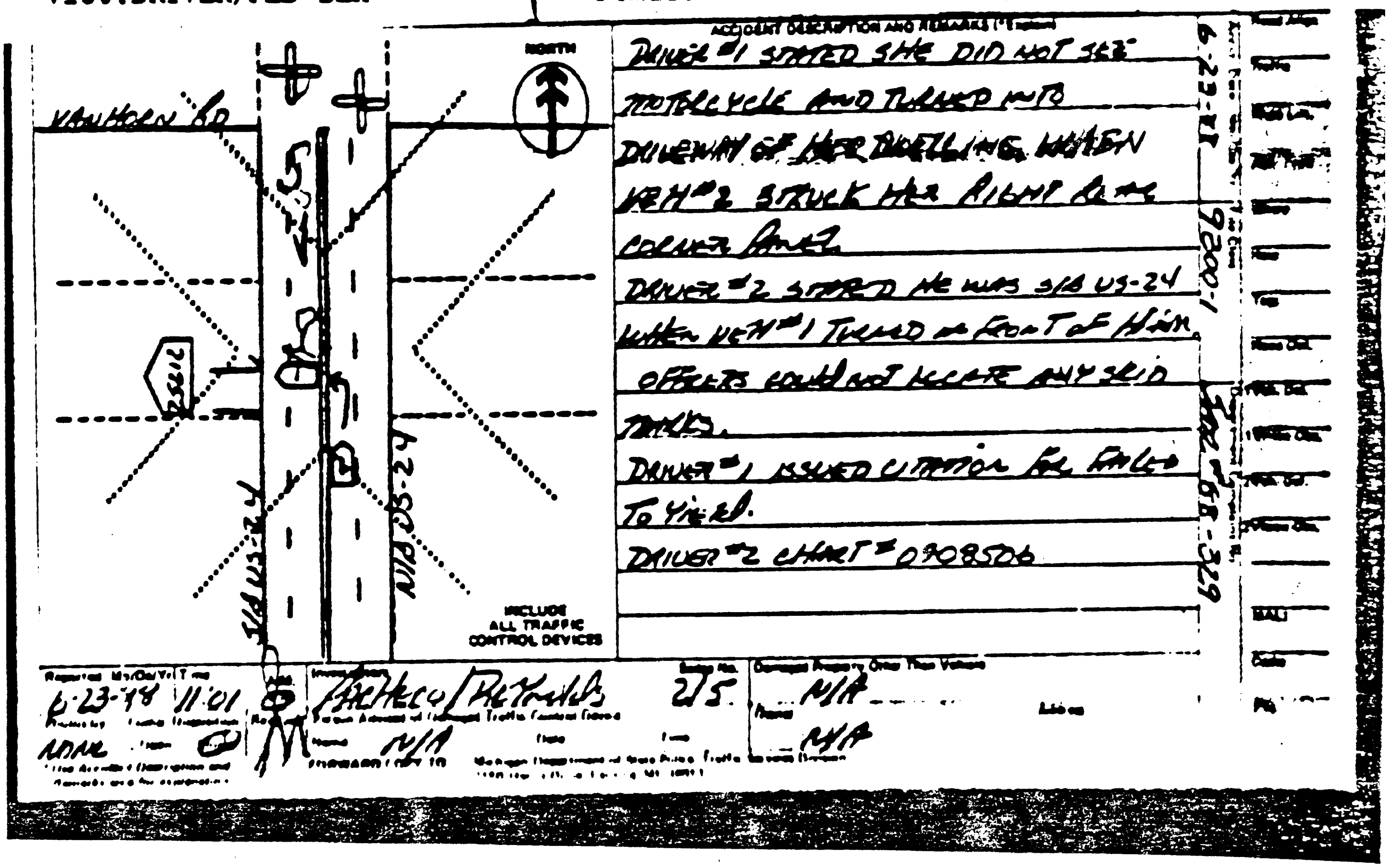
Going straight

4

No violation

20

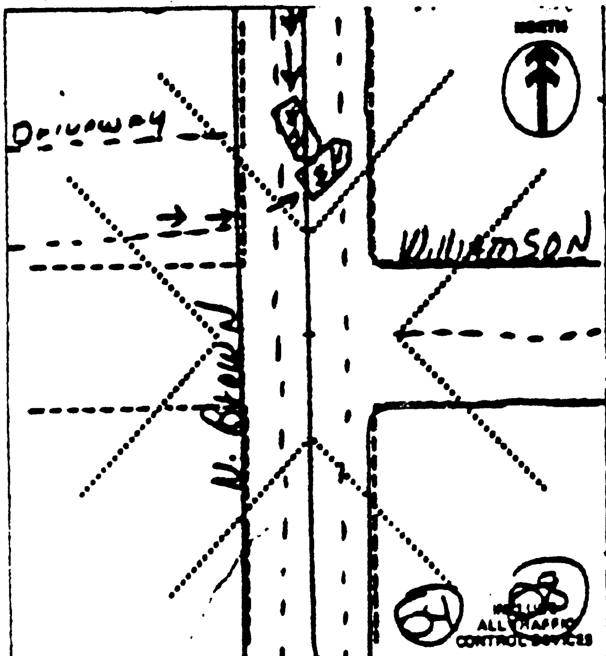
Male



CASE# 160

residential driveway

Variable		Value	Vehicle 2
V1:CASE SEQUENCE NUMBER	=	837349	
V2:ACCIDENT MONTH	=	June	
V5:TIME OF DAY	=	11 am-12 pm	
V8:DAY OF WEEK	=	Thursday	
V17:HIGHWAY AREA TYPE	=	Intersection	
V19:ACCIDENT LOCATION	=	On regular road	
V21:HIGHWAY CLASS SUBSCRIPT	=	Local road or MD	
V22:ROAD ALIGNMENT	=	Straight	
V23:ROAD SURFACE	=	Dry	
V25:TRAFFIC CONTROL	=	None	
V26:CONSTRUCTION ZONE	=	Non const zone	
V27:WEATHER	=	Clear/cloudy	
V28:LIGHT	=	Daylight	
V29:POPULATION	=	25000 to 50000	
V30:ACCIDENT TYPE	=	Col w other veh	
V31:ACC ANALYSIS - WHERE	=	Driveway access	
V32:ACC ANALYSIS - HOW	=	8	
V33:ACC ANALYSIS SUBSCRIPT	=	17	
V34:SPECIAL ACCIDENT TAG	=	None of above	
V36:NSC ACC CIRCUMSTANCE	=	Speed too fast	
V40:DRINKING IN ACCIDENT	=	No drinking	
V44:ENFORCEMENT IN ACCIDENT	=	No violation	
V48:WORST INJURY IN ACC	=	No injury	
V107:VEHICLE CONDITION	=	No defect	
V112:DRIVER INTENT	=	Turning left	Avoid a vehicle
V118:VEHICLE DAMAGE SEVERITY	=	4	3
V123:VISUAL OBSTRUCTION	=	No obstruction	
V124:CONTRIBUTNG CIRCUMSTANCE	=	Other/unknown	skidding
V125:HAZARDOUS ACTION	=	Failed to yield	Speed too fast
V126:POLICE ACTION	=	No citation	No citation
V128:LF RESTRAINT USAGE	=	Belt used	Belt used
V147:DRIVER/PED AGE	=	66	31
V150:DRIVER/PED SEX	=	Female	Female



Witness Stated Vehicle #1 Pulled out From Driveway, Crossed Two Lanes of Traffic, and Vehicle #2 Was South Bound on N. Brown went into a Skid Partially Sideways and Struck Vehicle #1. Driver #1 Stated She Pulled out as Vehicle #2 Was Far Away, and She Almost Got Across the Street and Was Struck by Veh #1.

Driver #2 Stated She Could not Stop in Time. 30' Skidmarks by Veh #2.

6-23-88 9303 8801484

Reported 6-23-88 | Time 1152 | Investigator Hubert Stephens | Badge No. 226 | Damaged Property Other Than Vehicle: None

CASE# 77

commercial driveway

V1:CASE SEQUENCE NUMBER	=	913135
V2:ACCIDENT MONTH	=	March
V5:TIME OF DAY	=	6 am- 7 am
V8:DAY OF WEEK	=	Friday
V17:HIGHWAY AREA TYPE	=	Other area
V19:ACCIDENT LOCATION	=	On regular road
V21:HIGHWAY CLASS SUBSCRIPT	=	Local road or MD
V22:ROAD ALIGNMENT	=	Straight
V23:ROAD SURFACE	=	Wet
V25:TRAFFIC CONTROL	=	None
V26:CONSTRUCTION ZONE	=	Non const zone
V27:WEATHER	=	Clear/cloudy
V28:LIGHT	=	Dark-street lght
V29:POPULATION	=	100000 to 250000
V30:ACCIDENT TYPE	=	Col w other veh
V31:ACC ANALYSIS - WHERE	=	Driveway access
V32:ACC ANALYSIS - HOW	=	7
V33:ACC ANALYSIS SUBSCRIPT	=	16
V34:SPECIAL ACCIDENT TAG	=	None of above
V36:NSC ACC CIRCUMSTANCE	=	Left of center
V40:DRINKING IN ACCIDENT	=	No drinking
V44:ENFORCEMENT IN ACCIDENT	=	Hazrdous violatn
V48:WORST INJURY IN ACC	=	C-injury
V107:VEHICLE CONDITION	=	No defect
V112:DRIVER INTENT	=	Overtake/pass
V118:VEHICLE DAMAGE SEVERITY	=	3
V123:VISUAL OBSTRUCTION	=	No obstruction
V124:CONTRIBUTNG CIRCUMSTANCE	=	Other/unknown
V125:HAZARDOUS ACTION	=	Left of center
V126:POLICE ACTION	=	Hazard violation
V128:LF RESTRAINT USAGE	=	Belt not used
V147:DRIVER/PED AGE	=	34
V150:DRIVER/PED SEX	=	Female

d

Vehicle 2

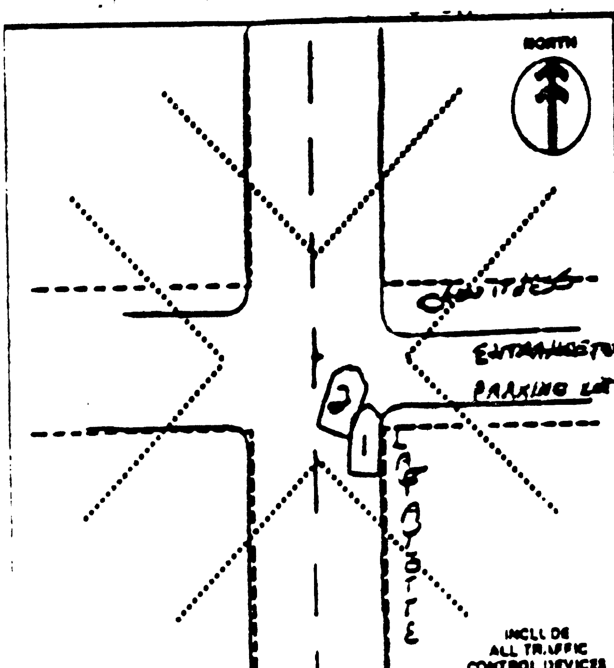
Turning right
4

No violation

Belt used

23

Female



ACCIDENT DESCRIPTION AND REMARKS

#2 SAID SHE WAS TURNING Right INTO THE PARKING LOT WHEN #1 TRIED TO PASS ON THE Right #1 SAID SHE DIDN'T SEE ANY TURN SIGNALS ON #2 & THOUGHT SHE WAS going TO TURN LEFT BECAUSE SHE SWUNG OUT TO THE LEFT. WITNESS [illegible] SAID HE SAW #2 HAD HER TURN SIGNALS ON TO MAKE A RIGHT TURN AND #1 TRIED PASSING ON THE RIGHT V10# D-083597 TO #1. #1 COMPLAINED OF SORE NECK & CHEST.

Reported Mo/Day/Yr Time: 3-25 85 0644 | Badge No.: 36 | Damaged Property Other Than Vehicle: NONE

Person Advised of Damaged Traffic Control Device: NONE | 211

APPENDIX G
Multi-Vehicle, Non-Intersection, Same Direction Cases

Multiple Vehicle, Non-Intersection
Same Direction

19.3% of the case vehicles in 1988 Michigan accidents

Percent All Veh.	Percent Same Dir.	Most Common Situations
14.9%	77%	Rear end 18% involve three or more vehicles
4.2%	22%	Sideswipe resulting from passing or lane change

Associated factors not evident, although a reduced coefficient of friction due to weather may have contributed in 18%.

Multi-Vehicle, Same Direction, Non-Intersection Crashes

Summary/Highlights

1). This category accounts for 19.28% of 1988 Michigan crashes or approximately 90,000 passenger cars.

2). Two dominant accident types occur in this category:

a). Rear-end accidents: The lead driver is stopped for traffic or is waiting to turn and is impacted in the rear by trailing vehicle. 77% of 1986 Michigan crashes in this category.

b). Sideswipe accidents: Driver judged to be at fault attempts a passing maneuver or lane change and strikes adjacent vehicle. 22% of 1986 Michigan crashes in this category.

3). Case study analysis indicates that nearly 20% of these accidents involved 3 or more vehicles.

Other Contributing Factors

1). Stopping ability on wet/icy pavement contributes a minor, but possibly significant factor.

2). Age, population density, lighting conditions and roadtype show no significant correlation or discrepancy.

Possible Countermeasures

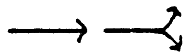
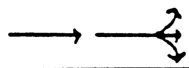
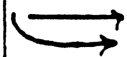
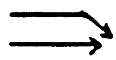
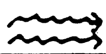
1). Rear-end accidents:

a). Forward radar warning, cooperative braking, ABS and traction control (for wet/icy conditions).

2). Sideswipe/angle accidents:

b). Side obstacle detection, lane-guidance, improved rear/side visibility.

Multi-Vehicle, Same Direction, Non-Intersection Crashes
Michigan 1986 Cases from CARDfile

Accident Configuration	Number	Percent	Diagram
REAR-END			
Lead Vehicle Stopped[1]	15,521	30.7%	
Lead Vehicle Straight[2]	11,477	22.7	
Lead Vehicle Turning	6,961	13.8	
Specifics Unknown	5,080	10.0	
SUBTOTAL	39,039	77.1%	
SIDESWIPE			
Passing	4,518	8.9%	
Overtaking/Right	261	0.5	
Overtaking/Left	568	1.1	
Change Lanes	5,045	10.0	
Specifics Unknown	772	1.5	
SUBTOTAL	11,164	22.1%	
TURN ACROSS PATH			
Turn Right[3]	35	0.1%	
Turn Left[3]	66	0.1	
Specifics Unknown	308	0.6	
SUBTOTAL	409	0.8%	
TOTAL	50,612	100.0%	

(1) Includes vehicles stopped prior to turning.

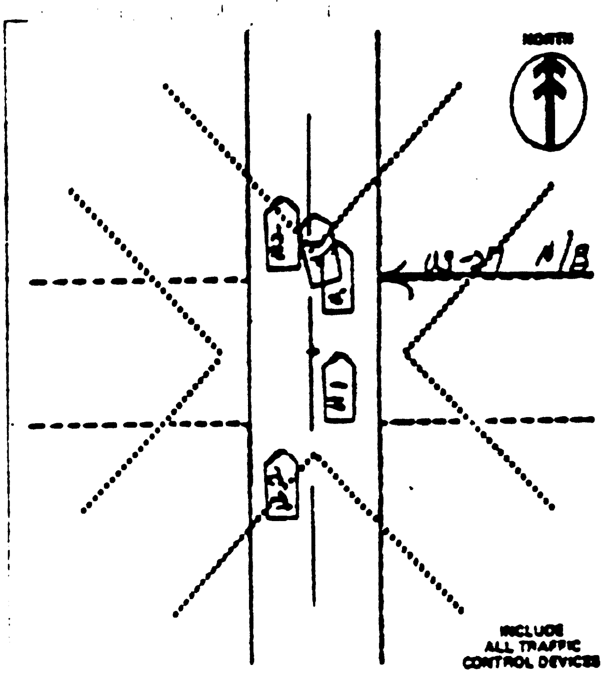
(2) Includes decelerating vehicles.

(3) The non-turning vehicle may either be moving or stopped.

CASE# 132

Changing [illegible] a freeway

V1:CASE SEQUENCE NUMBER	= 856232		
V2:ACCIDENT MONTH	= June		
V5:TIME OF DAY	= 9 am-10 am		
V8:DAY OF WEEK	= Saturday		
V17:HIGHWAY AREA TYPE	= Other area		
V19:ACCIDENT LOCATION	= On lim acc road		
V21:HIGHWAY CLASS SUBSCRIPT	= Other lim access		
V22:ROAD ALIGNMENT	= Straight		
V23:ROAD SURFACE	= Dry		
V25:TRAFFIC CONTROL	= None		
V26:CONSTRUCTION ZONE	= Non const zone		
V27:WEATHER	= Clear/cloudy		
V28:LIGHT	= Daylight		
V29:POPULATION	= Township	RLD	
V30:ACCIDENT TYPE	= Col w other veh		
V31:ACC ANALYSIS - WHERE	= Same dir -nonint		
V32:ACC ANALYSIS - HOW	= 1		
V33:ACC ANALYSIS SUBSCRIPT	= 11		
V34:SPECIAL ACCIDENT TAG	= None of above		
V36:NSC ACC CIRCUMSTANCE	= Left of center		
V40:DRINKING IN ACCIDENT	= No drinking		
V44:ENFORCEMENT IN ACCIDENT	= Hazrdous violatn		
V48:WORST INJURY IN ACC	= No injury	Vehicle 2	
V107:VEHICLE CONDITION	= No defect		
V112:DRIVER INTENT	= Changing lanes	Going straight	
V118:VEHICLE DAMAGE SEVERITY	= 2	3	
V123:VISUAL OBSTRUCTION	= No obstruction		
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown		
V125:HAZARDOUS ACTION	= Left of center	No violation	
V126:POLICE ACTION	= Hazard violation		
V128:LF RESTRAINT USAGE	= Belt used	Belt used	
V147:DRIVER/PED AGE	= 24	22	
V150:DRIVER/PED SEX	= Male	Male	



Both Vehicles N/B on US-27. Vehicle #1 in R/Lane Attempted To Change Lanes And Exit To Clare, MI, Didn't See #2 in L/Lane And Struck #2.

Reported Mo/Day/Yr / Time: 10:30 AM — Investigator — Badge No. 710 — Damaged Property Other Than Vehicle: None

FORWARD COPY TO: Michigan Department of State Police, Traffic Services Division

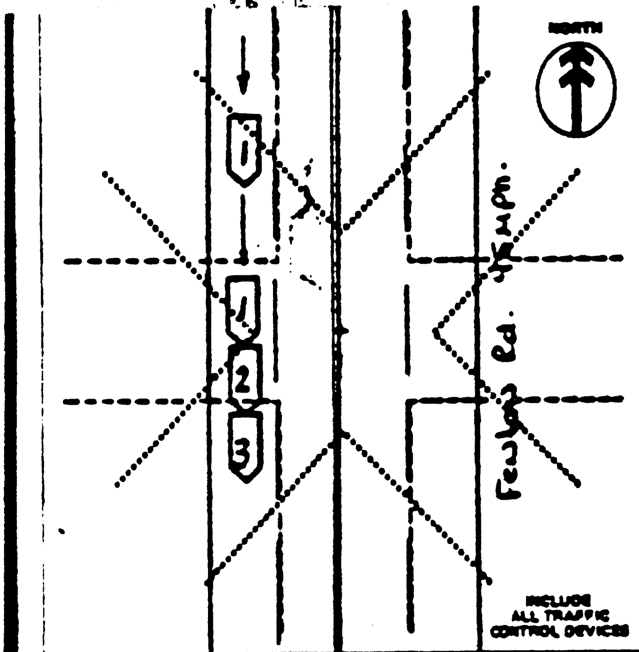
CASE# 322

Following too closely

V1:CASE SEQUENCE NUMBER	= 683476
V2:ACCIDENT MONTH	= November
V5:TIME OF DAY	= 12 pm- 1 pm
V8:DAY OF WEEK	= Friday
V17:HIGHWAY AREA TYPE	= Other area
V19:ACCIDENT LOCATION	= On regular road
V21:HIGHWAY CLASS SUBSCRIPT	= Local road or MD
V22:ROAD ALIGNMENT	= Straight
V23:ROAD SURFACE	= Dry
V25:TRAFFIC CONTROL	= None
V26:CONSTRUCTION ZONE	= Non const zone
V27:WEATHER	= Clear/cloudy
V28:LIGHT	= Daylight
V29:POPULATION	= Township
V30:ACCIDENT TYPE	= Col w other veh
V31:ACC ANALYSIS - WHERE	= Same dir -nonint
V32:ACC ANALYSIS - HOW	= 5
V33:ACC ANALYSIS SUBSCRIPT	= 13
V34:SPECIAL ACCIDENT TAG	= None of above
V36:NSC ACC CIRCUMSTANCE	= Follow too close
V40:DRINKING IN ACCIDENT	= No drinking
V44:ENFORCEMENT IN ACCIDENT	= Hazrdous violatn
V48:WORST INJURY IN ACC	= No injury

RLD

		Vehicle 2	Vehicle 3
V107:VEHICLE CONDITION	= No defect		
V112:DRIVER INTENT	= Going straight	stopped	stopped
V118:VEHICLE DAMAGE SEVERITY	= 2	3	2
V123:VISUAL OBSTRUCTION	= No obstruction		
V124:CONTRIBUTNG CIRCUMSTANCE	= Other/unknown		
V125:HAZARDOUS ACTION	= Follow too close	none	none
V126:POLICE ACTION	= Hazard violation		
V128:LF RESTRAINT USAGE	= Belt used	belt used	belt used
V147:DRIVER/PED AGE	= 28	20	32
V150:DRIVER/PED SEX	= Male	Female	Male



ACCIDENT DESCRIPTION AND REMARKS

SIR: ALL VEHICLES WERE S/B. DRIVER #2 AND #3 WERE AT A COMPLETE STOP TO ALLOW A VEHICLE TO MAKE A LEFT TURN IN FRONT OF THEM, HOWEVER, DRIVER #1 FAILED TO STOP AND STRUCK THE REAR OF #2, FORCING #2 INTO THE REAR OF #3. DRIVER #1 FOUND AT FAULT AND ISSUED TT#254966 FOR FAILING TO STOP IN A SAFE ASSURED DISTANCE. DRIVER #1 STATED HE WAS LOOKING DOWN AND DID NOT SEE THE VEHICLES IN FRONT OF HIM STOP.

11/25/88 3300-1 2156-88

Reported Mo/Da/Yr 11-25-88 Time 12:56 Investigator OFF. [illegible] Badge No. #8 Damaged Property Other Than Vehicle NONE

Photos by NONE Case Disposition Open Closed

FORWARD COPY TO Michigan Department of State Police, Traffic Services Division