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IDENTIFICATION OF SPECIFIC PROBLEMS AND COUNTERMEASURES TARGETS FOR REDUCING ALCOHOL RELATED CASUALTIES

By

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16. Abstract

Police reports of accidents were analyzed in terms of accident characteristics and driver behaviors to determine the problems of drinking drivers. Analyses were conducted to profile the culpable drinkers and to compare them to culpable nondrinkers in terms of the nature of the accident generation, accident situations, and driver characteristics. In addition, driver drinking status and culpability were studied in conjunction with driver accident and conviction records.

Major findings included listings of accident types for drinkers and comparisons to nondrinkers, extremely high culpability rates for drinkers, a propensity for drinkers to have accidents in low demand situations, an overrepresentation of the young among the drinkers (but somewhat less so than among the nondrinkers), and a higher proportion of drinkers in accidents among drivers with previous drinking convictions. Results also showed different problems for drinkers charged with drinking violations versus those who were not.

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FOREWORD

This report presents the results of a study conducted by Calspan Field Services, Inc. for the National Highway Traffic Safety Administration under Contract No. DOT-HS-4-00945.

The objective of this study was to identify the problems of drinking drivers which led to accident involvement.

This report has been reviewed and is approved by:

John W. Garrett, Manager
Accident Research Division

EXECUTIVE SUMMARY

The purpose of this study was to delineate the problems of drinking drivers in order to provide a basis for countermeasures. This was done by profiling accident types for drinking drivers, and by contrasting them with accident types for nondrinking drivers.

The primary data source was 7,421 police accident reports sampled to obtain an approximately equal number of alcohol and nonalcohol related accidents. Auxiliary data included 344 telephone interviews and 1,773 driver histories for subsets of the main data.

One of the major data elements was drinking status: normal - no drinking or other impairment noted; HBD - had been drinking, but no citation issued; and DWI - charged with driving while under the influence of alcohol. Other data included driver and vehicle characteristics, and accident circumstances. Finally, each driver's accident involvement was recorded in terms of the object struck, the behavior leading to impact and the reason for it, his pre-impact path and that of the object struck, and driver culpability, or initial responsibility for the accident.

Accident configurations were studied in conjunction with accident context factors to determine accident types. Nine specific accident types were developed; four of them accounted for 70 percent of the culpable drinkers' accidents.

<u>Class R accidents</u> involved running off the road (hence the Class R reference) or striking a parked vehicle due to the failure to maintain one's pat current path. Forty-two percent of the drinkers' accidents were of this type; the nondrinkers had eighteen percent of their accidents in this way. Among the culpable drinkers, 45 percent of these accidents resulted from lateral tracking errors (moving into another lane) and 27 percent were due to control failures (not associated with slippery road surfaces). The culpable drinkers' Class R accidents occurred mostly on suburban or rural roads, straight roads, two lane roads, dry surfaces, and at night. The drivers were mostly males with a

high representation of ages 17 through 25. In contrast to the nondrinkers, the drinkers had more Class R accident problems on suburban and rural roads, on dry roads, and at night; males and ages 36 to 55 were overrepresented, as were light trucks.

<u>Rear end accidents</u> involved a vehicle continuing along its path to strike a slower or temporarily stopped vehicle ahead; tailgating accidents were not included here. The rear end accidents accounted for fourteen percent of the accidents among culpable drinkers and eighteen percent among culpable nondrinkers. For the drinkers, 88 percent of these accidents were due to driver errors involving information failures. The drinkers' rear end accidents occurred most often in suburban areas, on straight roads, on dry pavements, and on lighted roads at night. The drivers were mostly males with a high representation of ages 21 to 25. In comparison to the nondrinkers, the drinkers had significantly more rear end accidents on dry and wet roads and at night; there was an overrepresentation of males, ages 36 to 55, and automobiles as opposed to trucks.

<u>Stationary target ahead (STA) accidents</u> generally involved continuing along one's path to strike a parked vehicle ahead. They accounted for eight percent of the drinkers' accidents and four percent for the nondrinkers. Similar to rear end accidents, 87 percent of the drinkers' involvements were associated with information failures. Among the drinkers, these accidents most often occurred in urban areas, on straight roads, on two lane roads, on dry pavements, and on lighted roads at night. The drivers were mostly males with a high representation of ages 21 through 25. In comparison with culpable nondrinkers, nighttime accidents were overrepresented as were males and light trucks.

<u>Parallel opposite-lateral move (PO-LM) accidents</u> typically involved a lane departure (but not a turn) to the left to strike an oncoming vehicle. They accounted for seven percent of the drinkers' accidents and five percent of the nondrinkers' accidents. For the drinkers, 76 percent were due to lateral tracking errors, eight percent were due to undifferentiated information

failures or slippery road control failures, and seven percent were due to primary control failures. Among the drinkers' PO-LM accidents, most occurred in suburban areas, on straight roads, on two lane roads, on dry pavements, and at night. Males were predominant, and there was a high representation of ages 21 through 25. In contrast to PO-LM accidents for nondrinkers, the drinkers were overrepresented on curves, dry roads, and at night; there were significantly more males and drivers in the 36 to 55 age group.

Considering all accidents, irrespective of the particular configuration, drinkers had most of their problems with nonintersection accidents, on dry roads, at night, on lighted roads, on two lane roads, on straight roads, and on suburban and rural roads; most of the drivers were males with an elevated representation of ages seventeen to 25. Six percent of the vehicles were trucks. Adjusting for these general effects, and in comparison to the nondrinkers, factors specific to individual accident types were found. These factors were straight roads, daytime, and lighted nighttime roads for Class R accidents; straight roads for rear end accidents; urban areas, multilane roads, and ages 56 to 65 for STA accidents; and urban areas, multilane roads, dry surfaces, lighted roads, and ages 36 to 55 for PO-LM accidents.

Aside from the detailed specification of accident types, a number of other conclusions were reached. First, the drinkers had extremely high culpability rates. That these rates were high even in situations where they were low for nondrinkers underscores the undesirable effects of alcohol.

Second, a comparison of accident configurations for culpable drinkers and nondrinkers showed the drinkers more often initiated their accidents in low demand situations. For example, their accidents often involved simple lane maintenance failures, but few involved turning in front of oncoming traffic, backing up, or starting into an intersection. The lane maintenance problem is one which might benefit from engineering countermeasure considerations.

Third, the DWI's were often more similar to the nondrinkers than were the HBD's. Among these three groups, the HBD accidents most often involved running off the road, control failures, and citations for high speed or reckless driving. This tended to imply an excessively carefree attitude or mood for the HBD's.

These low demand and mood related considerations suggest an inverse relationship between perceived risk and accident involvement. If this is the case, it implies that further consideration should be given to psychological or perhaps even pharmaceutical approaches to the problem. Other potential methods include believable driver education regarding the risks attendant to drinking and driving, increasing the actual risk of loss via licensing and judicial measures, and drunk driver warning systems which call attention to the vehicle if the driver fails a drinking effect test.

Fourth, accident drivers with previous traffic-related alcohol convictions were more often culpable in their recent accidents than were other drivers. This was almost totally due to their higher incidence of drinking in the recent accidents. This, then, underscores the need for help from judicial and licensing approaches to the drinking driver problem.

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INTRODUCTION

The problem of the drinking driver has been recognized for over half a century. During that time, the effects of alcohol on driving and accidents have been extensively studied. However, most of the studies of effects upon performance have been conducted in the laboratory, and thus had questionable application in the real world. On the other hand, most accident studies have been limited to statistical measures of accident and injury frequencies and rates.

As a result, the generally held view is that drinking and driving is hazardous, and the major remedial effort has been to reduce the frequency of such occurrences. Much of this effort has been directed through the ASAP endeavors which have focused upon enforcement, rehabilitation, and public education.

In contrast, the goal of this study was to examine accident data in order to provide a more detailed description of the drinking driver problem and to delineate the needs for countermeasures. Specifically, this involved the investigation of (1) how the accidents occurred, (2) the driving situations in which they occurred, and (3) the characteristics of the drivers involved. Using these data, drinking accident drivers were profiled and compared to nondrinking accident drivers. In this way, determinations were made of the problems of drinking drivers, their special problems in comparison to normal drivers, and those conditions in which drinking drivers were a problem.

SUMMARY OF FINDINGS

Almost all findings were based on the study of culpable driver/vehicle units in accidents. The culpable unit is the one that initiated, or was responsible for, the accident sequence. By studying these drivers, the analyses focused on the driver who "caused" the accident.

Driver and Vehicle Characteristics

Driver Sex

The vast majority of culpable drinking drivers were males; only ten percent were females. For culpable nondrinking drivers, only 73 percent were males; thus, there was an overrepresentation of males among the culpable drinkers.

Driver Age

Driver age effects were more complicated. Among the culpable drinking drivers, the 19 and 20 year old drivers were most highly represented. On the other hand, for normal culpable drivers, the most highly represented group was the 17 and 18 year olds. In fact, in comparison to the nondrinkers, the drinkers were found to be overrepresented in the 21 to 55 age range, and not among the younger drivers. It was also found that among drinkers older than 25, there were more DWI's* than HBD's**

* DWI's: Drivers cited by the police for drinking/driving violations.
** HBD's: Drivers reported by the police to have been drinking, but no citation was issued.

Vehicle Type

Cars were compared to light trucks and heavy trucks in terms of culpable accident involvements. The most notable finding here was that drivers of heavy trucks represented only one-half of one percent of the drinkers as compared to five percent of the nondrinkers. In other terms, while 17 percent of the car drivers were drinkers, and 20 percent of the light truck drivers were drinkers, only two percent of the heavy truck drivers were drinkers.

Driver History

It was found that the proportion of drinkers among accident drivers increased with the number of previous accidents, the number of previous non-alcohol driving convictions, and the existence of at least one previous alcohol driving conviction. While eight percent of the accident drivers without previous alcohol convictions were reported as drinking in their accidents, for those with at least one previous alcohol driving conviction, fully 36 percent were drinking in their accidents.

It was also found that these previously convicted drivers were more often culpable in their accidents (38 percent for no convictions versus 56 percent for those with at least one alcohol driving conviction). Essentially all of this difference was accounted for by the fact that those with previous convictions were more likely to be drinking, and drinkers were more likely to be culpable. The culpability rate was uniformly low for nondrinkers irrespective of previous convictions, and uniformly high for drinkers irrespective of their previous convictions.

Accident Situations

Situational analyses showed drinkers, in comparison to nondrinkers, had a higher proportion of their accidents at night, on unlighted roads, in rural areas, on two-lane roads, on curves, on dry roads, and not at intersections. These results, then, showed the drinker to have had relatively more accidents than nondrinkers in situations characteristic of low traffic conflict, rural roads.

Culpability Analyses

The likelihood of being culpable, or initiating the accident sequence, was determined for drinkers and nondrinkers as a function of the situation in which the accidents occurred. For technical reasons, single and multivehicle accidents were analyzed separately. In all instances, the drinking drivers were more often culpable than the nondrinkers by a wide margin. In fact, the culpability rate of the drinkers was so high that it overwhelmed all situational effects except one. (Drinkers were more often culpable on curves than on straight roads.)

A culpability ratio measuring the extent of the greater culpability for drinkers was analyzed as a function of situational variables. The ratio was higher (1) on dry roads compared to wet, and wet roads compared to ice or snow covered roads; (2) on multilane versus two-lane roads; (3) on straight versus curved roads; and (4) in clear versus rainy weather. The basis for these effects was that some situations were less conducive than others to culpability among nondrinking drivers; but the drinking drivers received little or no benefit in them. That is, although for normal drivers, nonslippery road surfaces, multilane roads, straight roads, and clear weather were less conducive to culpable behaviors leading to accidents, the propensity toward culpable accident involvements by drinkers effectively wiped out these benefits.

Accident Characteristics

Class R Accidents

For drinking drivers, 42 percent of their accidents involved striking a stationary target (usually the road edge or a parked vehicle) located toward the front but to the side of the vehicle's path. The subject vehicle left its path due to a lateral move as distinguished from an intended turn. Because most of these accidents were a run-off-road type, they were referred to as Class R accidents. The 42 percent for the drinking drivers can be contrasted to 18 percent for nondrinking drivers.

These Class R accidents accounted for the largest proportion of accidents for drinking drivers under 21 years old in rural areas (66 percent). Under similar circumstances, but considering only nighttime accidents, they accounted for 68 percent of the accidents. They were least frequent for drinkers among daytime urban accidents (18 percent), and accounted for only 25 percent of all urban drinking accidents.

More generally, the Class R accidents accounted for a larger proportion of accidents for the young, for nighttime accidents, for rural versus suburban, and for suburban versus urban. Overall, there was little distinction between males and females in this regard.

While the young drivers in rural areas had the highest frequency of Class R accidents relative to all drinking accidents, they did not have the largest absolute frequency of Class R accidents. This is simply because most drivers were older than 20. Only 26 percent of the Class R drinking accidents involved young drivers, the remainder involved drivers over 20. For them, 37 percent of the accidents were Class R.

Thus, while the above discussion pertains to the problems of drinking drivers within specified conditions of age, sex, etc., they should also be viewed in absolute terms. In the analysis of 1,025 Class R accidents for drinkers, 922 (90 percent) of the drivers were males, 884 (86 percent) occurred at night, 759 (74 percent) involved the older drivers, and 498 (49 percent) occurred on rural roads. Over half of them (56 percent) involved males over 20 at night. On the other hand, of these older male drinkers at night, only 39 percent of their accidents were Class R types.

Rear End Accidents

The second most frequently occurring accident configuration for the drinkers was the rear end accident in which the drinking driver continued a collision course into a slower or stopped car ahead. Fourteen percent of the culpable drinking drivers were involved in such accidents. For non-drinking culpable drivers, rear end accidents accounted for 18 percent of the total. This does not necessarily imply drinkers had a reduced propensity for rear end accidents, but to some extent reflects the dominance of Class R accidents for the drinkers.

Among the culpable drinking drivers, the rear end accidents occurred more frequently for drivers over 20, during the day, and in urban and suburban areas. Males and females showed little difference in this regard. There were 259 daytime accidents for the older drinking drivers in urban and suburban areas. Of these, 61, or 24 percent, were rear end accidents. Although the proportion of rear end accidents was highest in these conditions, the preponderance of nighttime drinking was such that most rear end accidents involving drinking occurred at night. There were 81 daytime rear end accidents and 256 at night. Thus, while drinkers had a greater propensity for these accidents during the day, the greater problem in absolute terms existed at night.

Stationary Target Ahead

Eight percent of the culpable drinkers' accidents involved the vehicle continuing along its path and striking a stationary target, usually a parked vehicle. This accident type differs from those Class R accidents which involved parked vehicles since the latter involved a lateral move to precipitate the accident. It differs from the rear end accidents in that they included collisions with stopped vehicles, but not parked ones. The nondrinking drivers had only four percent of their accidents in this way.

For drinkers, these accidents constituted 14 percent of all their urban accidents. They were also somewhat more frequent among accidents involving older drivers, male drivers, and among accidents occurring at night. When all four of these factors were present, there were 403 accidents; of them 73, or 18 percent involved striking a parked car in the subject's path.

Moving Laterally to Strike an Oncoming Vehicle

The last accident configuration to account for more than five percent of the drinkers' accidents involved moving, as opposed to turning, into an adjacent lane and striking an oncoming vehicle; seven percent of the culpable drinkers were involved in this way. This configuration accounted for five percent of the culpable nondrinkers' accidents.

Relative to all accident configurations for drinking drivers, this one occurred most frequently for females, during the day, in suburban areas. However, only 14 accidents occurred when all three conditions were met; of these, three involved this class of lane departure accident.

The Active-Passive Dimension

The analysis of nine accident configurations for culpable drinkers and nondrinkers showed that the two groups of drivers tended to have accidents which differed in a fundamental way. The drinkers had fewer of their accidents in situations where their attention was likely to have been drawn to the task at hand. More specifically, they tended to initiate relatively fewer accidents when a maneuver was planned (e.g., turning), there was prior activity (e.g., stopping), the situation inherently required increased caution (e.g. intersections), or some effort would have been required to avoid the accident. Briefly, the drinkers less often initiated accidents in conditions requiring their attention, and more often initiated accidents in nondemanding situations.

Considering these findings and those implying characteristically rural accidents for drinkers, the question was raised as to whether one of these two factors accounted for the other. An analysis of the proportion of drinking drivers in the various configurations in urban, suburban, and rural areas showed a greater representation of drinkers in suburban and rural areas for most accident types. On the other hand, the configurations accounted for a much greater part of the variation in the proportion of drinkers than did location. Perhaps most importantly, the tendency for drinkers to be over-represented in passive, low demand accidents was observed in all three types of locations, including urban locations.

Critical Reasons

The reasons for drivers' activities leading to culpable accident involvements were analyzed as a function of driver status. Because police reports were used in this study, only general categories of critical reasons were analyzed. Sixty-five percent of the culpable drinkers were involved due to tracking errors; i.e., the failure to maintain the intended vehicle path either due to insufficient information or insufficient vehicle control, but exclusive of gross vehicle maneuvers reflecting an "out of control" condition. Fifteen percent of the drinkers' critical reasons were primary control failures--the out of control condition referred to above.

In comparison to nondrinkers, the drinkers had a higher proportion of accidents due to primary control failures and driver breakdowns, but they had a smaller proportion due to induced control failures (control failures arising at least partly from slippery road surfaces). Finally, in comparison to the HBD's, the DWI's had more tracking errors, but fewer driver breakdowns, primary control failures, and induced control failures.

Police Citations

Analyses of police citations, excluding drinking citations, showed that 23 percent of the drinkers were cited for rules of the road violations; the figure for nondrinkers was seven percent. This difference was largely accounted for by the greater frequency for the drinkers of high speed or reckless driving citations, and citations for lane departures. It was also shown that the greatest increment in speeding violations for drinkers versus normals occurred for the younger drivers.

In looking at citations involving driving the wrong way on one-way roads, almost all such violations were associated with drinking drivers. However, there was only a total of eleven one-way citations among 6,780 accident drivers.

Context Factors

Accident location, road curvature, number of lanes, road surface condition, day versus night, road lighting, driver sex, driver age, and vehicle type were analyzed for each of the nine accident configurations, for some combinations of configurations and critical reasons, and for selected critical reasons. Each analysis provided the distribution of these context factors for drinkers and nondrinkers, and measures of drinker effects both before and after adjustment for drinker effects derived from accidents in general. In this way, drinker-nondrinker differences specific to each configuration were measured. Additionally, the proportion of drivers who were drinking was provided for each combination of context factors and configurations.

The results were numerous and highly detailed. Only some examples are given here to provide the flavor of the findings. The interested reader is referred to the Context Factor section of the text.

One accident configuration involved vehicles moving to the rear and continuing along a collision course to impact. Of these accidents, the drinkers had sixteen percent more than did the nondrinkers in lots (parking lots, service stations, etc.). When considering all accidents, irrespective of configuration, the drinkers had one percent less in lots. Thus, there was a seventeen percent drinker effect specific to these rearward accidents, thereby reflecting a propensity for drinkers to have such accidents in lots. In contrast, the drinkers were less likely than nondrinkers to have their rearward accidents while backing out of driveways.

Another result was that when considering all accidents, drinkers had 43 percent more accidents at night than did the nondrinkers. However, when considering accidents in which the culpable driver had stopped and then started into cross traffic, the drinkers had 60 percent more at night. For this configuration, then, the drinkers had an overrepresentation of nighttime accidents which was mainly attributable to general accident propensities, but which also contained a large component specific to these intersecting path-start accidents.

The intent of this kind of analysis was to provide a basis for determining whether countermeasures for accidents in a given setting are best directed toward general drinker propensities or toward effects associated with the specific accident configuration.

The example of rearward accidents suggests that the drinker's problem in lots is better approached by countermeasures specific to the rearward configuration in lots rather than countermeasures directed toward all accidents in lots. On the other hand, countermeasures for intersecting path-start accidents would be more beneficial if directed toward the general nighttime, alcohol accident problem as opposed to nighttime problems peculiar to intersecting path-start accidents.

Interviews

Telephone interviews were conducted with a sample of culpable drivers. There was no significant difference when comparing the driver status distribution in this sample to the sample from which they were drawn. The major finding here was technical in nature. Of the interviewees who admitted to drinking before their accidents, only approximately 15 percent were not reported as drinking by the police. This implies the potential under-reporting of drinking by the police was quite limited, and was not likely to be a major source of bias in the analyses in this report.

Other interview findings showed HBD's were more often involved in accidents 11 to 50 miles from their homes than were cited drivers and non-drinking drivers. This agreed with other findings showing the HBD's to have more rural accidents. There was, however, no important difference in familiarity with the accident road across driver status groups. This suggested the HBD's also had more exposure in this distance range. It was also shown that lack of familiarity with the road could not have been a major contributor in many accidents since approximately 85 percent of the drivers in each of the driver status groups had driven the accident road at least a few times per month.

Finally, among the interviewed drivers, the incidence of drinking in their accidents decreased from 67 percent for those who had not completed high school to approximately 45 percent for those who had completed high school and had additional vocational or college training.

DWI's Versus HBD's

Since a blood alcohol level of 0.10 percent or higher is the police officer's most objective basis for justifying a citation, one might well expect the DWI's to have suffered greater impairment than the HBD's. In turn, one could expect the proportions in the analyses to have aligned themselves in a DWI-HBD-normal ordering. This was often not the case. In almost all analyses of accident characteristics, driver behaviors, police citations, and accident situations, approximately half or more of the comparisons showed DWI's were more similar to the normals than were the HBD's.

Some of the more notable departures from the expected ordering are: (The percent of involvements is given in order of DWI-HBD-normal.)

Class R Accidents:	36-48-18
Rear End Accidents:	15-12-18
Primary Control Failures:	12-20-7
High Speed and Reckless Driving Citations:	6-10-3
Two Lane Roads:	65-80-60

Such departures may suggest that the DWI is more concerned about his condition (he probably has greater fear of an accident or of the police), and therefore makes greater attempts to be cautious thereby emulating, to some extent, the nondrinking driver. The HBD's, unconcerned about a few drinks, seem more carefree. This is suggested by their higher incidence of Class R accidents, control failures, and high speed or reckless driving citations.

Drinker-Nondrinker Similarities

While the major focus of this study was the problems of drinkers and their differences from nondrinkers, in many instances there were similarities between the two groups. In both groups, the most frequent object struck was another motor vehicle. Considering accident configurations, Class R followed by rear end accidents were most frequent. Both had more speeding violations for the young. Both had an overrepresentation of the young in accidents. Both groups had many more male than female drivers.

Other similarities were highest accident frequencies on two lane roads, on straight roads, in clear weather, and on dry roads. For both groups, approximately half of the accidents were within three miles from home and approximately 85 percent of the drivers had driven the accident roads at least a few times per month.

CONCLUSIONS

In this study, the serious nature of the drinking-driving problem was best measured by culpability rates. Ninety to 95 percent of the drinkers were responsible for the initiation of the accidents in which they were involved. Furthermore, in considering situations where nondrinkers had low culpability rates, the propensity of the drinkers for culpable involvement almost completely dominated those situational benefits.

It should be noted that previous experience of CFSI accident investigators suggests some police reporting bias exists against drinking accident drivers. However, the primary nature of this bias is not so much to "nail" the drinker, but to emphasize his responsibility if, indeed, he was at fault. This could have had some influence in determining culpability in the accident analysis process, but such biases would certainly be an order of magnitude smaller than the effects noted above. In an earlier study (Perchonok, 1972), where 80 percent of the accidents were investigated in-depth, the culpability rate for drinkers was also over 90 percent.

Regarding accident types, the most frequent problems for culpable drinkers, and therefore, the greatest needs for countermeasures, were (1) Class R accidents, (2) rear end accidents, (3) accidents where an in-path parked vehicle was struck, and (4) accidents involving a move to the left thereby striking an oncoming vehicle. The Class R accidents were, by far, the most frequent accident type for drinkers. When drinkers were compared to nondrinkers, they were found to have proportionately more Class R accidents and more accidents involving collisions with parked cars in their path. The drinkers had proportionately fewer accidents starting into intersections, continuing into intersections, and turning left in front of oncoming traffic.

The drinkers' accidents were also characterized in terms of situational factors and driver and vehicle characteristics. The drinkers had most of their accidents between, not at, intersections, on dry roads, at night, on lighted roads, on two lane roads, on straight roads, and in suburban and rural areas; most of the drivers were males and there was a high representation of ages 17 to 25; 94 percent of their vehicles were automobiles.

In comparison to nondrinkers, the drinkers had proportionately more nonintersection accidents, accidents at night, on unlighted roads, on two lane roads, on curves, in rural areas, and proportionately fewer accidents on icy or snowy roads; males and ages 21 to 55 were overrepresented, and heavy trucks were underrepresented.

These context factors were analyzed in conjunction with the accident configurations to determine in more detail high frequency accident types as target groups deserving countermeasure attention. The resultant mappings of accident types took several forms including the distributions of context factors for each configuration for drinking drivers, differences between these distributions and those for nondrinking drivers, these differences adjusted for general effects, and the proportion of drinkers for each combination of configuration and context factor. Because of the multifaceted nature of these findings, they are not readily susceptible to a simple summary and the reader is referred to the individual analyses for specifics.

As explained in the text, each of these sets of statistics has a different meaning. For example, there is a clear distinction between the problems of drinking drivers and differential problems derived from drink-nondrinker comparisons. To illustrate, Class R accidents were a major problem for drinkers; in addition, the problem was much greater than for nondrinkers. Rear end accidents were also a problem for drinkers, but no more so than for nondrinkers. Thus, drinkers need help regarding both Class R and rear end accidents; however, while drinkers appeared to have a particular problem with Class R accidents, this was not shown to be true of rear end accidents.

In reviewing these analyses, the reader is also reminded that the results do not reflect accident rates; that is, they were not adjusted for exposure. Rather, the findings portray the combined effects of exposure and accident propensity. However, because the analyses were restricted to culpable drivers, the findings are focused on those drivers who were instrumental in precipitating their accidents.

Finally, it is important to note that the data were collected in Western New York and generalizations to other areas must be made carefully. For example, that drinkers had approximately one-third of their accidents in urban areas was strongly influenced by the geographic character of the sample; in contrast, however, for comparisons between drinkers and nondrinkers such effects tend to cancel out.

In the following, some of the more general results are discussed in terms of implications for countermeasures and further research. No attempt is made here to justify countermeasures via cost/benefit analyses, rather, a less rigorous approach is taken. Simply, do the findings suggest any potentially useful countermeasures for further consideration? Even from this viewpoint, the problem is made difficult by the nature of drinkers' problems: specifically, the propensity of drinkers to have accidents in low demand situations. If drinkers frequently suffered from overload problems, then the task would clearly be to simplify the driving situation. But this is not the problem, and it appears that simplification of the stimulus universe might, in fact, be counterproductive. Indeed, the very problem is that drinkers had most of their accidents in simple situations. The only recommendations here are based on the fact that drinkers were underrepresented in those situations where their attention was brought to focus upon the driving task. In this regard, a large portion of their accidents, including Class R and left-hand moves toward oncoming vehicles, reflected failures in simple lane maintenance activities. This brings to mind improved lane delineation. Possibly active delineation techniques, in which drivers would be warned of impending out-of-lane moves, could be cost effective. Possibilities range from improved visual detection properties of delineators, to delineators generating tire noise, to slightly raised delineators providing mechanical feedback to the driver, to electronic detection of lane edges. Note that such techniques would be effective primarily with shallow angle lane departures where time for corrective maneuvers could be available. The frequency of shallow angle departures as well as specific delineation approaches could be studied in more detail using in-depth accident data.

Regarding rear end accidents, most occur at intersections. Perhaps early warning to drivers approaching intersections would be fruitful. For example, those signalized intersections which are controlled by induction loops, or the like, could also provide active upstream warning to approaching drivers. Storage lanes for left turning vehicles would also be effective.

That there were many more rear end accidents than accidents involving citations for passing through traffic control signs and signals, suggests drivers do a better job of recognizing signs and intersections than stopped vehicles. This may reinforce the concept of active signals upstream, or it may suggest the need for improved rear lighting for stopped vehicles. Note, in this latter instance, the countermeasure resides with the "other vehicles", not the culpable one.

Third, it is possible that if drivers understood the nature of this problem, their responsiveness to traffic controls or intersections could be extended to vehicles stopped at intersections.

One more point regarding these approaches: the examples of potential countermeasures were in no way specific to drinkers; they could be applicable to all drivers. Indeed, the concept of finding problems more or less unique to drinkers may, in many instances, be unduly restrictive.

There are, however, a family of countermeasures which are specific to drivers who are drinking. They are the various ignition interlock systems involving breath testers, short term memory testers, and tracking testers. The basic problem with these devices is that they produce false positives and raise legal issues regarding the right to drive. One way to resolve these difficulties is to reduce the effect of a failed test. For example, a test failure could activate a warning light observable to other drivers and to the police. It could preclude ignition only if the system were tampered with. In this way, the risk to the drinking driver of being stopped by the police would be considerably increased. If the trip were an absolute necessity (an emergency, for example), and the vehicle were stopped by the police, the police could then assist the driver. In the case of a false positive, only inconvenience would be involved.

It would be reasonable to have such systems installed only on vehicles owned by convicted drinking drivers; as part of their punishment, they would bear the cost of equipment and installation.

There are a number of findings which show that there were certain factors which limited the alcohol problem. They may point the way for broader application of similar approaches. For example, that the DWI's often had patterns approaching those of nondrinkers implies that the more heavily drinking drivers do, to some extent, recognize the risks of their condition. Complementing this was the low incidence of induced control failures for DWI's and the generally low frequency of accidents on icy and snowy roads for both DWI's and HBD's. Finally, the very small number of drinking accidents for truck drivers supports the same view. Although it is not known whether these effects were due to limited exposure when drinking, limited drinking when driving, or special caution when drinking and driving, the point is that when perceived risk was high, there were those who took useful steps to limit it. Another finding which strongly supports this viewpoint was the relatively lower frequency of accidents for drinkers, in comparison to normals, in situations where the driver's attention was drawn to the driving task. Thus, there may be benefits, in terms of reduced alcohol accidents, if the perceived risk of drinking and driving were increased for all drivers. While the story is an old one, this means sincere efforts to improve educational efforts, punitive techniques, and perhaps driver licensing.

Regarding education, perhaps improved knowledge of drinking effects will help drivers to help themselves. Regarding punitive efforts, it seems reasonable to impose more substantial economic penalties on drunk drivers. For repeaters, licensing techniques may be more appropriate. While some people will drive without a license, others will not. In extreme cases, it has been suggested that vehicle registration be suspended or, if necessary, the vehicle impounded. One target group here could be those drivers with previous drinking convictions who were drinking in later accidents. While the imposition of effective penalties has been limited in the courts, it should be recognized that a heavy truck driver working for a large firm risks his livelihood by drinking and driving; it seems, therefore, that increased punitive risks for other drivers should not be dismissed as untenable.

There are a number of lines of inquiry which are suggested as a result of this study. The results showed HBD's had greater relative frequencies of class R accidents, of control failures (both primary and induced), and speeding and reckless driving violations than DWI's. If, in fact, the DWI's had more to drink or greater BAL's than the HBD's, these results suggest the real problem may be more one of mood effects of alcohol rather than impairment, per se. Again, the relatively lower involvements for drinkers in more demanding situations also support this view. That is, the drinker's impairment can, to some extent, be mitigated if the driver attempts to be cautious. It appears the DWI, on average, more often perceived the need for increased caution, whereas the HBD may have been less fearful of accidents or the police, and therefore, provided little compensation for his condition.

If this hypothesis is correct, it suggests the need to incorporate it in our thinking about the drinking problem. If drivers with high BAL's can act cautiously and if those with low BAL's tend not to, then the relationship between BAL and mood needs to be better understood, as do means for altering moods. Most experimental work on drinking and driving has focused on impaired tracking ability, split task performance, etc. Yet, the best known limitation of these efforts has been their questionable application to the real world. In particular, it is extremely difficult to elicit real world mood effects in experimental subjects. None the less, it seems clear that such studies, probably performed outside the laboratory, are needed. A second approach which may merit research consideration is the application of pharmaceutical methods prior to driving after drinking.

Another area of inquiry is based on the results showing that drinking drivers need not have a severe alcohol-accident problem. What are the motives here? Is it fear of accident involvement? Is it fear of the police and ensuing penalty? Is it some sort of generalized concern for doing what is right? Indeed, how many drivers are concerned about drinking and driving at all? It would seem one of the most constructive approaches to the drinking driving problem is to determine the motives that can reduce it.

The data indicated drinking drivers had serious lane maintenance problems as exemplified by class R accidents. Furthermore, results implied that the drinking driver can exert useful caution when he is aware of the need. It is therefore recommended that detailed accident reports be studied to determine whether conditions in general and departure angles in particular would allow sufficient time for drivers to correct their paths if methods alerting the driver to lane delineation encroachment were available. In this regard, it might be well to distinguish lane departures associated with the lapse of control versus loss of control.

Regarding accident research in general, many questions remain about the nature of alcohol accidents. There is a need for a more thorough understanding of the reasons for accident involvement by drinkers. A more detailed examination of the relationship between accident characteristics and accident situations could be expected to shed more light on the problems of drinkers. In-depth driver interviews gathering information on accident driver moods seems indicated. In terms of the current data set, it is clear that the information therein exceeds that which has been utilized. Indeed, while this study focused upon the drinking driver, there is much information in the data set pertaining to normal drivers which does not exist in the current literature.

Finally, results suggested that the increase in perceived risk tends to limit the alcohol accident problem. This suggests greater penalties for convicted drinkers. On the other hand, the reticence of judges and juries to mandate large penalties is well known. Apparently, greater effort is needed in determining meaningful penalties which are also palatable to the courts.

METHODOLOGY

Data Collection

Data were collected in the eight contiguous counties comprising Western New York. The counties are: Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Niagara, Orleans, and Wyoming. The major cities in this area are Buffalo and Niagara Falls. A map of the area appears in Appendix A.

The primary data source was police reports. They were sampled directly from police files and duplicated for use at CFSI. It was desirable to obtain a sample in which half the accidents involved drinking, and half not. From previous data, it was estimated that the police reported at least one driver had been drinking in approximately ten percent of the accidents. Thus, it was decided to include all accidents involving reported drinking and one out of every nine nondrinking accidents. The latter was accomplished by a systematic sampling of every ninth nondrinking accident report.

Case selection was performed by CFSI personnel. The sampling process required an examination of each of the approximately 40,000 reports to determine if the accident belonged to the drinking or nondrinking subsample. In some districts, where the reports were filed by location rather than year, the process was particularly tedious. Nonetheless, the process was maintained at all police departments so as to develop samples quite nearly representative of the Western New York area for one full calendar year (1973).

It cannot be said that every police agency was included. First, many agencies do no accident investigation work. Second, some agencies were so small that their inclusion would have been of little value. Of the 50 agencies requested to participate, 48 did so; one refused, and the files at the other were not sufficiently well organized so as to allow confident sampling. Comparison of the number of accident reports generated by the nonparticipating agencies with those represented by the data suggests less than five percent of all police reported accidents were excluded. As such it was deemed appropriate to treat the data as if all of Western New York were represented.

Other data sources included a BAL file, New York State driver history data, and telephone interviews. The BAL file is a central data set containing blood alcohol levels for drivers charged with DWI by most police jurisdictions in Erie County. The BAL's were derived almost exclusively from breath tests, although in some instances blood was used.

Driver history data was based on CFSI's merged accident file obtained from the New York State Department of Motor Vehicles. The accidents in this file are derived from those police reports sent to Albany by the local agencies plus all driver reported accidents. (Most local police agencies forward only the reports of the more severe accidents.) DMV, when possible, matches drivers and vehicles in these accidents with the corresponding drivers in their driver license file and vehicles in the vehicle registration file. The resultant merged file was obtained by CFSI for its NHTSA Tri-Level Accident Study.

Police reported accidents in the DMV file were then matched with those sampled from the police records. This process utilized accident county, month and date, hour, and driver age and sex to produce reasonably stringent rules for matching accidents. When a good match occurred, driver history information was taken from the DMV file and added to the tape for this study.

The final data source was telephone interviews of drivers in the original accident sample. The drivers were randomly selected from all culpable* drivers in Erie County accidents in the original sample. Once selected, contact with a driver was repeatedly attempted; calls were made during the day and evenings, and when needed, appointments were made for return calls. Approximately three-eighths of those selected could not be contacted, and one-eighth refused to cooperate. The result was a sample of approximately 400 interviews. A copy of the interview format is in Appendix B.

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* A culpable driver is one who initiated the accident sequence. Culpability is discussed more fully in the Findings section.

Data Processing and Data Elements

Police reports were coded in a format allowing analysis with either the accident or the vehicle as the statistical unit. The data from each accident consisted of one record containing accident data (i.e., data describing the conditions in which the accident occurred) and one record for each motor vehicle involved. The coding was performed in two separate steps. The routine coding involved all those data items which appeared more or less explicitly on the police forms. The accident and vehicle forms for the routine coding appear in Appendix C.

The second coding step was performed during the same time period by a separate group of analysts. This effort involved the coding of the causal structure, a description in a structured format of the way each vehicle was involved in its accident. The coding form for the causal structure appears in Appendix D as does a description of the causal elements.

The causal structure allows for a very wide variety of combinations of its elements. In order to simplify the analysis of these data, related elements were studied empirically in terms of the frequencies of the various combinations in the current data. In this process new codes were computer generated which reflected the most frequent combinations of the individual elements. This resulted in five variables with highly concentrated information. The first was the accident configuration; it gives the path of the subject vehicle along with the location and relative path of the target. (The target signifies the thing "struck", be it another vehicle, a pedestrian or bike, train, animal, road departure, or rollover, whichever occurred first.) The second was the critical event specifying what the driver/vehicle unit did to create a condition such that, short of highly skilled maneuvers, an accident would occur. Examples are start, wide left turn, and continue. The third variable was the critical reason; it describes the condition allowing or eliciting the critical event. Examples are information failure, external influence, and control failure due to slippery roads. The fourth and fifth variables were the prior event and the prior reason; they were based on codes allowing the case analyst to describe behaviors preceding the critical event if if added to the accident description.

A final part of the causal structure which received frequent use is culpability. This concept is based on the premise that drivers rely heavily on their expectations. They expect vehicles to stay in their lanes, to stop at stop signs, etc. Without the validity of such expectations, safe traffic flow would not be possible. Thus, a situation is said to be abnormal if the expectations of a hypothetical, normal driver would be violated. The first driver/vehicle unit to create an abnormal situation is said to be culpable.

The data resulting from the routine coding and the causal structure were rigorously monitored using three computer edit programs. The first two checked for illegal codes and inconsistencies within the routine data and within the causal coding. Because of the logical relationships among the elements in the causal structure, the resultant data could be very effectively edited. The third program checked consistency between the routine codes and the causal codes. Because these two coding steps were performed independently, errors in coding which would not be detected in the first two edits were detected in the third.

One point of particular importance refers to the terms used to describe driver status with regard to drinking. Since driver status was used in almost all analyses, a clear definition of terms is necessary. The levels of driver status were determined on the basis of both drinking citations and reported driver condition. The first level was used whenever the driver was charged with operating a motor vehicle while his ability to do so was impaired, while his blood alcohol level was .10 percent or higher, or while he was intoxicated; impairment due to the use of drugs was not included. This level, for convenience, is referred to throughout this report as DWI, and drivers so charged are called DWI's. The second level was used whenever the driver was reported to have been drinking but did not receive any of the three alcohol related charges specified above;

this level is labeled HBD. Together the HBD's and the DWI's constitute the drinkers in the sample; throughout the text the term is used this way. The third level of driver status includes those drivers who were not reported as drinking and for whom there was no other indication of impaired condition such as drug use, ill, asleep, etc. For lack of a better term, these drivers are referred to as normals or nondrinkers.

Thus, driver status has three levels: DWI, HBD, and normal. It can be expected that a large majority of the drivers in the first level had consumed enough alcohol to meet or exceed the .10 percent blood alcohol level. This follows from the fact that many alcohol charges are contested by drivers so that, in general, the police officers will not cite a drinker unless he is quite certain of his grounds. To verify this, BAL's for DWI's in Erie County were tabulated. They are shown in Table 1.

TABLE 1

Blood Alcohol Level for DWI's

BAL (%)	Frequency	Cumulative Percent for Known BAL
0.0	5	0.6
0.01-0.03	11	1.8
0.04-0.06	15	3.6
0.07-0.09	48	9.1
0.10-0.14	171	28.8
0.15-0.19	291	62.3
0.20-0.24	208	86.3
0.25-0.29	84	96.0
0.30-0.34	28	99.2
0.35-0.39	6	99.9
0.40 and more	1	100.0
Drugs	3	
Refused Test	167	

These data show that of 868 DWI's where BAL was known, nine percent tested below the .10 level; conversely, 91 percent were .10 or higher. Of the nine percent, it is not known whether the investigating officer misjudged the condition of the driver, the test was inaccurate, the driver was impaired due to drugs but tested for alcohol, or the driver was indeed impaired due to alcohol and this BAL was, nonetheless, below .10. In any event, the data clearly show that most DWI's had BAL's equal to or greater than .10 percent.

If an investigating officer is not convinced that a driver will fail a breath test, he is likely to report only that the driver had been drinking, thus placing the driver in the second driver status category. It is also known through informal discussion with the police that the drinking status of such drivers may be ignored or overlooked so that some drinkers may, in our data, be classified as normal (assuming no other deficiency).

Thus, DWI's, HBD's, and normals can be characterized in the following ways. On the average, the DWI's could be expected to have higher BAL's than the HBD's. Essentially all drinkers (the DWI's plus HBD's) had consumed alcohol; possible exceptions are those drivers, particularly the HBD's, who had used drugs but were reported by the police officer to have been drinking. One can assume that many of the normals, in fact, had consumed alcohol. Nonetheless, it is reasonable to assume the normals were, on the average, less impaired than the HBD's. Thus, in the remainder of this report it is assumed that the drinkers formed a homogeneous group who in fact had been drinking, and that, on the average, DWI's were more impaired than HBD's who were more impaired than normals.

Finally, it should be noted that in comparisons across driver status levels, differences are better thought of as the effects associated with drinking drivers rather than with drinking, per se. The reason is that people who drink and drive may be characteristically different than those who do not. Thus, in comparing drinkers to normals, differences may be due to both alcohol consumption and these characteristic differences. Of course, this is as it should be. Since we are interested in the problems of drinking drivers, it would not be realistic to isolate the effects of drinking alone; rather, we are interested in drinking within the context that it occurs in the real world.

Sample Description

Following the procedures described above, a total of 7421 accident reports were collected. Of these, 3579 accidents involved drinking, 3842 did not. The drinking accidents essentially constituted the population of police reported drinking accidents in Western New York. The non-drinking accidents represented some 34578 (3842 x 9) accidents in which drinking was not reported. Table 2 shows the distribution of these accidents in terms of the reported status of the drivers. It shows a very likely under-reporting of drug usage. The "other" category includes accidents for which no drinking or drug use was reported and at least one driver's condition was abnormal or unknown.

TABLE 2

Condition of Drivers in the Accident Sample

Driver Condition	Frequency	Percent
At least one DWI	1948	26.2
No DWI but at least one HBD	1631	22.0
No DWI or HBD but at least one drug charge	2	0.0
All normal	2482	33.4
Other	1358	18.3
Total	7421	100.0

Considering drivers rather than accidents, there was a total of 12734. Of these, 1965 (15.4%) were DWI's; 1700 (13.4%) were HBD's, and 6227 (48.9%) were normal.

As further background information, Tables 3, 4 and 5 give the distribution of police jurisdictions, injury, and number of vehicles involved in the accidents. In preparing these tables, the number of non-alcohol accidents in each category were multiplied by nine, to account for the sampling fraction, and added to the alcohol-related accidents. In this way, estimates were obtained pertaining to the population from which the data were drawn.

Table 3 shows that over half of the police reported accidents in Western New York occurred in Erie County. Approximately 35 percent occurred in the cities of Buffalo and Niagara Falls. The sheriffs' departments, small agencies, and state police, which investigate primarily rural accidents, accounted for almost 30 percent of the accidents.

TABLE 3

Police Jurisdiction

	Estimated Frequency	Percent
Buffalo	10142	26.6
Niagara Falls	3339	8.8
Other Cities	1873	4.9
Erie County excluding Buffalo and Sheriff	10316	27.0
Sheriff's Dept.	5646	14.8
Small Agencies	1047	2.7
Thruway Police	1506	3.9
State Police	4288	11.2
Total	38157	100.0

Table 4 shows the distribution of accidents in terms of injury. Because previous research indicated that injury differentation was not accurate using the K, A, B, C injury reporting system (Garrett, Braisted, and Morris, 1972), only the three categories in the table were used. For 30 percent of the accidents there was at least one non-fatal injury reported. Accidents involving fatal injuries constituted six-tenths of one percent of the total. In the sample, 41 of the 3579 alcohol related accidents (or 1.1 percent) involved fatal injuries. Of the other 3842 accidents, 21 (or 0.5 percent) produced fatal injuries.

TABLE 4

Police Reported Injury

	Estimated Frequency	Percent
No Injury	26465	69.4
At Least One Injury	11462	30.0
At Least One Fatal Injury	230	0.6
Total	38157	100.0

Table 5 shows over thirty percent of the accidents were single vehicle accidents. Together, single vehicle and two vehicle accidents comprised 95 percent of the total.

TABLE 5

Number of Vehicles Involved

No. of Vehicles per Accident	Estimated Frequency	Percent
1	11821	31.0
2	24436	64.0
3	1609	4.2
4	232	0.6
5	44	0.1
6	15	0.0
Total	38157	100.0

FINDINGS

In order to maximize the reliability of the driver status codes, several restrictions were placed on the data. First, any accidents not investigated by the police at the scene were excluded. This was particularly applicable in Buffalo; there were a large number of accidents which were reported at the station. In such instances, not only could one expect an underreporting of drinking, but the accident description itself would be in doubt. Second, hit and run drivers, if not apprehended, were excluded for the same reasons. Third, parked vehicles were excluded since in many reports it was not clear whether the driver's status regarding drinking was applicable at the time the vehicle was parked. (These last two conditions apply only to the subject vehicles under study, not the vehicles they struck.)

In those analyses which pertain to the causal structure, only culpable drivers were included. This served two purposes; the first is statistical in nature. In coding the causal structure for multivehicle accidents, there are certain inescapable relationships among the vehicles: If one driver is culpable, the others are not; if one vehicle is involved by continuing, its target is most likely also involved by continuing; the specification of the accident configuration for one vehicle often bears fixed relationships with the accident configuration of the vehicle it struck, etc. Note that these reciprocal relationships are partly induced by the causal structure for coding, but, for the most part, they result from the nature of multivehicle accidents. Clearly, then, data from different vehicles in the same accident cannot be considered independent. However, since there can be no more than one culpable vehicle per accident, restricting analysis to these vehicles assures the desired independence.

The second reason for limiting study to culpable drivers is that it focuses attention on the driver who initiated the accident generation process.

As a result, the causal elements pertain to "what went wrong" and the driver who "caused" the accident. Without the culpable behaviors, the accident would not have occurred.

Situational Variables

The following analyses pertain to the relationships between driver status and characteristics of the situations in which their accidents occurred. While the analyses are straightforward, some introductory discussion may extend their utility. Each table contains two sections. The upper part of the table contains the raw data plus the distribution of situations in each driver status group. In addition, estimates of population frequencies are given for the normal drivers. (Recall that for drinking drivers, the accident sample is essentially equivalent to the population.) The proportions in this part of the table measure that part of the drivers' (DWI's, HBD's, normal's) accidents which were associated with specific situations.

On the other hand, if one feels that countermeasures responsive to drinking drivers and problematic situations are likely to reside with the situation rather than the driver, then these proportions are of little value. The reason for this is that there remains the possibility that, while drinkers have problems with situation S, the proportion of drivers in situation S who are drinkers may be low. As an example, drinkers may have severe problems on hot summer days, but it would not be cost beneficial to increase surveillance unless it were established that on such days there was a reasonably high proportion of drivers who were drinkers.

For this reason, the lower part of the table has been added. Here the proportion of drivers who were drinkers in the specific situation is significant (X_1^2 = 254.32; the subscript indicates degrees of freedom).* The difference between the DWI's and HBD's was small and not statistically significant (X_1^2 = 2.13). These results show that culpable drinking drivers had considerably more difficulty with nonintersection accidents in comparison with normal drivers. This may, or may not, have been due to differential exposure.

The lower portion of the table shows that at intersections only ten percent of the culpable accident drivers were drinkers; for nonintersection accidents, 23 percent were drinkers.

Road Condition

The road surface was reported as dry, wet, or icy and/or snowy. Table 7 gives the cross tabulation of road condition with driver status for culpable drivers. It can be seen that 70 percent of the culpable accident involvements by drinkers occurred on clear roads. Only seven percent occurred on icy or snowy roads. Thus, such slippery roads do not appear to have been a major problem for the drinkers.

In comparing drinkers to normals, a significant interaction was found (X_2^2 = 92.89). The major effect was due to the lesser incidence of slippery road accidents among drinkers as compared to normals; indeed, the proportion of slippery road accidents was twice as great for the normal drivers. The most likely explanations are less exposure of drinkers to icy and snowy roads, or that the drinker, recognizing the threat of slippery roads and the need to avoid the police after drinking, exerted greater caution. If the latter were the case, the wet road data, showing near equality for drinkers and nondrinkers, imply wet roads were far less threatening to drinking drivers than were ice or snow covered roads.

*All statistical tests were run at the .05 level using two-sided hypotheses.

TABLE 7

Road Condition by Driver Status

Road Condition	DWI N	DWI %	HBD N	HBD %	Normal N	Normal 9N	Normal %	Drinker N	Drinker %
Road Condition Problem for Drivers									
Dry	1108	70.2	832	68.3	949	8541	61.5	1940	69.4
Wet	371	23.5	289	23.7	342	3078	22.2	660	23.6
Ice/Snow	99	6.3	97	8.0	251	2259	16.3	196	7.0
Total	1578	100.0	1218	100.0	1542	13878	100.0	2796	100.0
Driver Problem for Road Conditions									
Dry		10.6		7.9			81.5		18.5
Wet		9.9		7.7			82.3		17.7
Ice/Snow		4.0		4.0			92.0		8.0

(Driver Status: DWI, HBD, Normal, Drinker)

A test was performed to compare DWI's and HBD's; their differences were not statistically significant ($X_2^2 = 3.17$). Nonetheless, these data tend to support, although in a weak way, the findings above. Specifically, if drinkers were concerned about the hazards of slippery roads particularly in view of the threat of a drunk-driving arrest, then one could expect greater preventive action by those drivers who had consumed the most alcohol. In this regard, the data show relatively fewer slippery road culpable involvements among the DWI's as opposed to the HBD's.

The lower portion of the table shows that in slippery road conditions, HBD's and DWI's accounted for an equal proportion of the accidents with the total for the two being only eight percent. This can be contrasted with a total of approximately 18 percent for dry and wet roads.

Day Versus Night

Light condition was reported as dawn, day, dusk, night with street lighting, night without lighting, and night with unknown lighting. When the light condition was not reported, tables based on sunrise and sunset for each month were employed to give day/night information. In these tables, buffers for dawn and dusk were used, but to be conservative only the day and night categories were analyzed. Since the dawn and dusk categories appeared infrequently in any of the data, they were excluded from analysis. The first analysis was performed to compare day to night. The night category includes lighted and unlighted roads as well as those in which the presence of street lighting was unknown. The results appear in Table 8.

TABLE 8

Day-Night by Driver Status

Light Condition	Driver Status: DWI		HBD		Normal			Drinker	
	N	%	N	%	N	9N	%	N	%
Day-Night Problem for Drivers									
Day	286	18.6	213	17.5	931	8379	61.3	499	18.1
Night	1252	81.4	1002	82.5	587	5283	38.7	2254	81.9
Total	1538	100.0	1215	100.0	1518	13662	100.0	2753	100.0
Driver Problem for Day-Night									
Day		3.2		2.4			94.4		5.6
Night		16.6		13.3			70.1		29.9

As might be expected, drinkers initiated accidents much more often at night than during the day. Over 80 percent of their accidents occurred at night. The comparison of drinkers to nondrinkers was statistically significant (X_1^2 = 820.10). The lower part of the table shows, of the accidents represented here, fully 30 percent of the nighttime accident involved culpable drinkers. From another viewpoint, of the total of 16,415 accidents, 14 percent involved drinking drivers at night; only three percent involved drinkers during the daytime. Whether drinking drivers have increased accident generation proclivities at night cannot be determined from these data. Clearly, one major influence is the fact that most drivers do their drinking at night.

The difference between HBD's and DWI's was tested and found not to be statistically significant (X_1^2 = 0.52). Examination of the relative frequencies shows near equality of the two groups.

Roadway Lighting

The light condition data were also used to examine the relationship between driver status and road lighting for drivers culpably involved in nighttime accidents. The results are shown in Table 9. Lighted roads were somewhat overrepresented for drinking drivers; 57 percent of the culpable drinkers had their accidents on such roads. The difference between normals and drinkers was statistically significant (X_1^2 = 5.49). It can be seen that although the drinkers had fewer of their accidents on unlighted versus lighted roads; the decrease in culpable involvements on unlighted roads was even greater for the nondrinking drivers. Thus drinkers, as a group, had more problems on unlighted roads than did normal drivers.

TABLE 9

Road Lighting by Driver Status for Nighttime Accidents

Roadway Lighting	Driver Status: DWI N	DWI %	HBD N	HBD %	Normal N	Normal 9N	Normal %	Drinker N	Drinker %
Lighting Problem for Drivers									
Lights	500	63.4	440	51.5	254	2286	63.7	940	57.2
No Lights	289	36.6	414	48.5	145	1305	36.3	703	42.8
Total	789	100.0	854	100.0	399	3591	100.0	1643	100.0
Driver Problem by Lighting Conditions									
Lights		15.5		13.6			70.9		29.1
No Lights		14.4		20.6			65.0		35.0

In comparing the DWI's to the HBD's, the difference was significant ($X_1^2 = 23.52$). Indeed, the DWI's and HBD's differed more than did the drinkers versus the nondrinkers. By looking at the upper part of the table as a whole it can be seen that the DWI's were quite similar to the normals, and that the difference between the normals and the drinkers was wholly attributable to the HBD's.

The lower portion of the table gives the magnitude of the drinking problem on lighted and unlighted roads. It shows that on lighted roads, drinkers accounted for 29 percent of the accidents; this was almost evenly split between DWI's and HBD's. For unlighted roads, 35 percent of the accidents were attributable to drinkers, with 21 percent due to the HBD's.

Road Type

Road type was coded as ramp, limited access, other divided, one way, multilane, two lane, unknown number of lanes, driveway and/or alley, and lot (parking lot, gas station, etc.). In the following analysis only non-intersection related accidents were included. Furthermore, due to low frequencies, many road type categories were excluded. Only limited access, multilane, and two lane roads, along with lots remained. The results appear in Table 10.

TABLE 10

Road Type by Driver Status

Road Type	DWI		HBD		Normal			Drinker	
	N	%	N	%	N	9N	%	N	%
Road Problem for Drivers									
Limited Access	58	6.0	22	2.7	55	495	8.7	80	4.5
Multilane	249	25.9	103	12.7	154	1386	24.4	352	19.9
Two Lane	625	64.9	647	80.0	377	3393	59.7	1272	71.8
Lots	31	3.2	37	4.6	46	414	7.3	68	3.8
TOTAL	963	100.0	809	100.0	632	5688	100.0	1772	100.0
Driver Problem for Roads									
Limited Access		10.1		3.8			86.1		13.9
Multilane		14.3		5.9			79.7		20.3
Two Lane		13.4		13.9			72.7		27.3
TOTAL		6.4		7.7			85.9		14.1

The results show that 72 percent of the culpable drinkers had their accidents on two lane roads, 20 percent were on multilane roads, and the remainder were almost evenly split between limited access roads* and lots. The comparison between drinkers and normals was statistically significant (X_3^2 = 40.66). The contributors to the difference were several. Normals had relatively fewer of their culpable accidents on two lane roads, with more on limited access roads and in lots. Looking at the lower portion of the table, it can be seen that two lane roads had the greatest drinking driver problem; 27 percent of the accidents were due to the drinkers. On multilane roads, 20 percent of the accidents were generated by drinking drivers. This means that if countermeasures applicable to drinkers could be applied to multilane or two lane roads with equal costs, the greater potential for improvement would reside with the two lane roads.

Within drinkers, the differences between DWI's and HBD's were also statistically significant (X_3^2 = 64.77). Again, the primary differences were associated with multilane roads versus two lane roads. Note that the multilane accidents accounted for twice as many of the DWI accidents as the HBD accidents. Again, it can be seen in these comparisons that the DWI's were almost identical to the normals, with the HBD's alone accounting for the difference between the drinkers and the nondrinkers. Thus the major effects shown in the table are the relatively fewer accidents on multilane roads and more accidents on two lane roads for HBD's versus normals.

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* While the figures were not available, it is probably safe to assume that most thruway traffic in Western New York is local, and therefore made up of relatively short trips.

Horizontal Alignment

Accidents were coded as to whether the roads were straight or curved. The results of cross tabulating driver status and road alignment appear in Table 11.

TABLE 11

Horizontal Alignment by Driver Status

Horizontal Alignment	Driver Status: DWI N	DWI %	HBD N	HBD %	Normal N	Normal 9N	Normal %	Drinker N	Drinker %
	Alignment Problem for Drivers								
Straight	878	79.9	747	73.2	895	8055	88.2	1625	76.7
Curve	221	20.1	274	26.8	120	1080	11.8	495	23.3
Total	1099	100.0	1021	100.0	1015	9135	100.0	2120	100.0
	Driver Problem for Alignment Conditions								
Straight		9.1		7.7			83.2		16.8
Curve		14.0		17.4			68.6		31.4

The ratio of straight road culpable accident involvements to such involvements on curves was approximately three to one for drinkers. This primarily reflects the fact that straight roads account for much more roadway mileage than do curved road segments. Testing the difference between drinkers and nondrinkers showed a significant result (X_1^2 = 57.83). The interaction effects can be seen in the row for curves. It shows that drinkers had twice the proportion of accidents on curves than did nondrinkers. Thus, while drinkers had most of their accidents on straight roads, curves were a greater problem for them than for normal drivers. It seems unlikely that the exposure of drinkers to curves could be twice that of normals to curves. If this is correct, one can conclude a greater effect on the rate of accident generation due to curves for drinkers as compared to nondrinkers. The lower portion of the table shows that drinkers constituted 31 percent of the accident problem on curves. That is, if drinkers in curves were accident free, there would be 31 percent fewer accidents in curves.

A significant difference was also found between DWI's and HBD's (X_1^2 =13.38). The effect was a greater relative frequency of culpable accident involvements on curves for HBD's than for DWI's. Thus, as has been seen in some earlier tables, the DWI's were more similar to the normals than the HBD's were.

Accident Location

Information relating to accident location was coded in terms of (1) each of the eight counties with a separate code for Buffalo, (2) location class [city or village, township], (3) area type [urban, rural], and (4) reporting agency. In order to obtain relatively homogeneous location categories (urban/rural is too ambiguous), all four codes were used to create the following groups: Buffalo and Niagara Falls, Buffalo suburbs, other cities with populations exceeding 15,000, smaller cities, and rural areas. The cross tabulation of driver status with these location types for culpable drivers appears in Table 12.

Of course, the percentages given in the table are peculiar to Western New York, but two purposes are served by these data. First, they further describe the data in this study. Second, comparisons within rows (i.e., within location type) may have applicability to similar location types elsewhere.

TABLE 12

Location by Driver Status

Location	Driver Status: DWI N	DWI %	HBD N	HBD %	Normal N	Normal 9N	Normal %	Drinker N	Drinker %
Location Problem for Drivers									
Buffalo and Niagara Falls	420	26.1	233	18.6	481	4329	30.1	653	22.8
Buffalo Suburbs	612	38.1	446	35.5	533	4797	33.4	1058	37.0
Cities	90	5.6	32	2.5	109	981	6.8	122	4.3
Small Cities	63	3.9	48	3.8	77	693	4.8	111	3.9
Rural	422	26.3	497	39.6	397	3573	24.9	919	32.1
TOTAL	1607	100.0	1256	100.0	1597	14373	100.0	2863	100.0
Driver Problem for Location									
Buffalo and Niagara Falls		8.4		4.7			86.9		13.1
Buffalo Suburbs		10.5		7.6			81.9		18.1
Cities		8.2		2.9			88.9		11.1
Small Cities		7.8		6.0			86.2		13.8
Rural		9.4		11.1			79.5		20.5

Results show that 37 percent of the drinkers had their accidents in the suburbs of Buffalo, 32 percent were rural, and 23 percent were in Buffalo or Niagara Falls. The remainder were evenly split between the other cities and the small cities. The distribution was significantly different from the normal drivers ($X_4^2 = 58.62$). The major effect in comparing drinkers to normals is that the drinkers had fewer of their culpable involvements in Buffalo and Niagara Falls, and more in rural areas.

The differences between DWI's and HBD's were also significant ($X_4^2 = 73.39$), with the major effect again pertaining to Buffalo and Niagara Falls, and to rural accidents. Generally speaking, once again the DWI's were more similar to the normals than to the HBD's.

The lower part of the table shows that the Buffalo suburbs and rural areas had the most trouble with culpable drinking drivers. On the other hand, the ratio of DWI's to HBD's was highest in Buffalo and Niagara Falls, Buffalo suburbs, and other cities.

Rain

The final analysis in this section pertains to the effects of rain. It was decided to exclude snow because of its possible correlation with road surface conditions which were studied elsewhere. While rain obviously correlates with wet roads, this was not thought to be a problem since the effect of wet surfaces in an earlier analysis was of limited magnitude. Hence, if differences were found in the following comparisons, they could reasonably be attributed to precipitation effects rather than wet road effects. The results are shown in Table 13.

TABLE 13

Rain by Driver Status

Precipitation	DWI N	DWI %	HBD N	HBD %	Normal N	Normal 9N	Normal %	Drinker N	Drinker %
				Rain Problem for Drivers					
None	860	86.3	825	83.4	986	8874	85.5	1685	84.9
Rain	136	13.7	164	16.6	167	1503	14.5	300	15.1
TOTAL	996	100.0	989	100.0	1153	10377	100.0	1985	100.0
				Driver Problem by Rain Condition					
None		8.1		7.8			84.0		16.0
Rain		7.5		9.1			83.4		16.6

The data show that in comparing rainy weather to clear, only 15 percent of the culpable drinking drivers had their accidents in the rain. Furthermore, the percentage of accidents in the rain remained quite constant from one driver group to the next, thereby indicating no particular effect of rain as a function of driver status. The chi-squares for drinkers versus nondrinkers and for DWI's versus HBD's were not significant ($X_1^2 = .23$ and $X_1^2 = 3.32$, respectively).

Summary

For the combined drinking group (DWI's plus HBD's), the conditions in which 70 percent of their culpable accident involvements occurred were dry roads, nighttime, two lane roads, straight roads, nonintersection related accidents, and no precipitation.

The most notable differences between culpable drinkers and culpable normals are shown in Table 14.

TABLE 14

Incidence of Accidents for Situational Variables - Drinkers as Compared to Nondrinkers

Higher Incidence for Drinkers	Lower Incidence for Drinkers
Night	Day
Unlighted Roads	Lighted Roads
Rural	Buffalo and Niagara Falls
Two Lane Roads	Limited Access Roads and Lots
Curves	Straight Roads
Nonintersection Accidents	Intersections
Dry Roads	Icy and/or Snowy Roads

The table suggests several points. First is the rural character of situations in which culpable drinking drivers were overrepresented. In addition to rural areas themselves, unlighted roads, two lane roads, curves, and nonintersections were included. Second, but certainly not independently, low traffic density situations are suggested by nighttime, unlighted roads, rural roads, two lane roads, and nonintersections.

The major differences between the DWI's and the HBD's was underinvolvement by the DWI's in accidents on unlighted roads, two lane roads, curves, and rural roads. In fact, regarding road lighting, two lane roads, and rural areas, the DWI's had proportions very close to the normals. Thus, much of the rural characterization of the drinkers' accidents was attributable to the HBD's, not the DWI's.

Regarding the DWI's and the HBD's more broadly, in the vast majority of comparisons, the proportions of accident conditions showed greater similarity between the DWI's and the normals, than between the HBD's and the normals. That is, if one simply counts the occurrences, in the upper portions of the tables, in which the proportions for DWI's were closer to those for the normals (as opposed to the HBD's being closer to the normals), he will find that overall the DWI's looked more like the normals than the HBD's did. This may imply, as was noted with earlier results, that the DWI's may have attempted to compensate for their condition, and were sufficiently successful that their accident patterns began to approach those of the normals. Conversely, the HBD's having had less to drink may have felt no impairment and no need for compensation. One could speculate that joy riding in rural areas by the HBD's may be an example.

Culpability Rates

The same variables analyzed in the situational studies were examined in a different way. In the previous section, situational effects and driver status effects were studied for culpable drivers. In this section, culpability becomes the dependent variable. That is, the proportion of drivers who were culpable was studied as a function of driver status and accident situations. These proportions, or culpability rates, being computed within driver status and accident situation, are not a function of exposure. As before, only accidents investigated by the police on scene were included. Similarly, hit and run vehicles and parked vehicles were excluded.

Intersection Related Accidents

The first analysis pertains to accidents which were intersection related versus those which were not. The results are in Table 15. In studying culpability rates, it was necessary to separate single vehicle and multivehicle accidents. The reason for this will become clear when the lower portion of the table is discussed.

Regarding single vehicle accidents with drinking drivers, the table shows the culpability rate was .95 for both intersection and nonintersection related accidents. (It will be seen that such extremely high culpability rates were characteristic of the drinkers in all situations.) Thus, drinkers in single vehicle accidents appeared equally as culpable for intersection and nonintersection related accidents. A test for differences was not significant (X_1^2 = .27).

The normal drivers were somewhat more often culpable in intersection accidents than in nonintersection accidents. However, a chi-square test here also failed to show significance (X_1^2 = 1.52).

TABLE 15

Culpability Rate by Driver Status and Intersection vs. Nonintersections

Single Vehicle Accidents

	Drinking				Normal				
Intersection Related?	Culp	Not Culp	Total	% Culp	Culp	Not Culp	Total	% Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Yes	154	9	163	94.5	77	42	119	64.7	1.46
No	1078	52	1130	95.4	298	211	509	58.5	1.63

Multivehicle Accidents

	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Yes	544	56	600	90.7
No	442	33	475	93.1

Next, the drinkers were compared to the normals in order to determine if the increase in culpability associated with drinking was different for intersection versus nonintersection accidents. In interpreting these results, it was useful to incorporate a summary variable which was called the culpability ratio. It is the ratio of two culpability rates, the numerator being the culpability rate for drinking drivers and the denominator the culpability rate for normal drivers. Typically, the culpability ratio is greater than one, reflecting the greater likelihood of culpability for drinking, as compared to nondrinking, drivers. Note, for example, that a culpability ratio of 1.30 indicates drinking drivers were 30 percent more likely to have been culpable than were nondrinking drivers.

Table 15 shows the culpability ratio in intersection-related accidents was 1.46, while for nonintersection-related accidents, it was 1.63. This reflects a somewhat greater increase in culpability for drinkers in nonintersection (single vehicle) accidents. However, the chi-square test was not significant ($X_1^2 = .18$).*

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* There was some difficulty in testing the difference in culpability ratios. The test statistic referenced here was a chi-square test for three-way interactions in a three-way table. The fact that it did not yield a significant result was sufficient to state no significant difference between the culpability ratios. However, this test is responsive to the null hypothesis of <u>no</u> three-way interactions; since the comparison of culpability ratios is <u>a</u> specific three-way interaction, a significant chi-square is not sufficient to specify that the culpability ratios are different. That is, rejecting the hypothesis of no interactions implies that some interactions were significant, but the one under study may not be. Since no appropriate test procedure for the specific hypothesis of equal culpability rates could be found, the following strategy was adopted.

First, the hypothesis of no three-way interactions was tested. If it was not significant, it implied the equal culpability ratio hypothesis could not be rejected. If the initial three-way test was significant, we then reconsidered the two-way tests, one for the drinkers and one for the normals. If one of these tests was significant and the other not, or if both were significant but two tables had opposite "signs", it was concluded that drinking status interacted with the influence of the situation upon culpability. Third, if the culpability ratios themselves differed only slightly, it was concluded that the effect, significant or not, was unimportant.

The lower portion of the table shows results for multivehicle accidents. They required special procedures due to the fact that the behavior of one vehicle in an accident may not be independent of other vehicles in the same accident. This is particularly true of culpability since, by definition, if one vehicle is culpable the others cannot be. This problem was overcome by using the accident, rather than the individual vehicle, as the statistical unit. For example, in row one of Table 15, there are 600 multivehicle accidents, all intersection related. Only the first two vehicles in each accident were considered.* Furthermore, the sample was restricted to those accidents in which one of the first two vehicles was culpable and one of them involved a drinker while the other did not. Returning to row one, of the 600 such accidents, it was the drinker who was culpable in 544 or 91 percent of them. The finding of greater culpability for the drinking driver in intersection related accidents, was clearly significant (X_1^2 = 396.91). Similarly, the data in the second row showed that the drinking driver in multivehicle accidents which were not intersection related was more often culpable (X_1^2 =352.17).

The major point of interest here, however, was not whether the drinkers were more often culpable (They clearly were.), but whether the situation influenced the degree of culpability relative to nondrinkers. The aim is the same as that in comparing culpability ratios in the single vehicle analyses. The question tested here was whether 90.7 percent was significantly different from 93.1 percent. If so, it could be concluded that in multivehicle accidents the increased culpability associated with drinkers was further magnified in nonintersection related accidents. An ordinary chi-square test of the two-by-two table showed the difference was not significant (X_1^2 = 1.99).

* Vehicles were numbered according to the following: #1, first striking vehicle; #2, first struck vehicle; #3, second struck vehicle, etc. The culpable vehicle was almost always number 1 or 2.

Thus, data in Table 15 show that although drinkers were more likely to be culpable than nondrinkers, the difference in rates did not vary significantly for intersection versus nonintersection-related accidents. Or, equivalently, the effect of intersection versus nonintersection-related accidents on culpability was not significantly different for drinkers versus nondrinkers.

Road Condition

Table 16 contains data for the analysis of culpability rates as a function of road surface conditions. The differences among culpability rates for drinkers were small and not statistically significant (X_2^2 = .41). On the other hand, comparisons among normal drivers showed them to be most culpable on icy and snowy roads and least culpable on dry roads. The differences were statistically significant (X_2^2 = 39.19).

A test for culpability by driver status by road condition interactions was statistically significant (X_2^2 = 40.89). In addition, the culpability ratios differed considerably. They show the greatest increase in culpability from normals to drinkers occurred in dry road accidents; the smallest increase occurred on icy or snowy roads. Notice that the variation in culpability ratios was not attributable to differences in culpability among the drinkers but, rather, due to differences among the normal drivers. It appears that the drinking drivers' propensity toward culpable behaviors in accidents so dominated their accident involvements that road condition effects upon culpability were negligible.

TABLE 16

Culpability Rates by Driver Status and Road Condition

Single Vehicle Accidents

Road Condition	Drinking Culp	Drinking Not Culp	Drinking Total	Drinking % Culp	Normal Culp	Normal Not Culp	Normal Total	Normal % Culp	Culpability Ratio [P(C | Dr)÷P(C|N)]
Dry	823	42	865	95.1	199	189	388	51.3	1.85
Wet	289	16	305	94.8	92	45	137	67.2	1.41
Ice/Snow	104	4	108	96.3	71	11	82	86.6	1.11

Multivehicle Accidents

Road Condition	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Dry	666	58	724	92.0
Wet	235	19	254	92.5
Ice/Snow	65	7	72	90.3

Nonetheless, the data clearly show a large increase in culpability for drinkers on dry roads (85 percent), and a small increase on slippery (ice/snow) roads (11 percent). Thus, the drinkers effectively converted a comparatively safe situation into one which was as dangerous as an inherently hazardous one.

Looking at the multivehicle accidents, the very high incidence of culpability for drinking drivers was evident. There was no statistically significant change from one road surface condition to another (X_2^2 = 0.38). This, again, demonstrates the dominance of the drinking effect over road condition effects.

Day Versus Night

The culpability rates for drinkers and nondrinkers, and hence, the culpability ratios, are given in Table 17 for daytime versus nighttime accidents. It can be seen that the culpability rates for drinkers in the two situations were almost equal; a chi-square showed no significance (X_1^2 = .24). Similarly, the difference in rates for normal drinkers was not significant (X_1^2 = .11). Therefore, it is not surprising that the culpability ratios were almost equal.

TABLE 17

Culpability Rate by Driver Status and Night Versus Day

Single Vehicle Accidents

	Drinking				Normal				
Light Condition	Culp	Not Culp	Total	% Culp	Culp	Not Culp	Total	% Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Day	173	7	180	96.1	179	114	293	61.1	1.57
Night	1030	51	1081	95.3	178	120	298	59.7	1.60

Multivehicle Accidents

Light Condition	Driver Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Day	234	14	248	94.4
Night	704	71	775	90.8

For the first two vehicles in multivehicle accidents the proportion of culpable drinkers was somewhat higher in daytime than in nighttime accidents. However, the difference was not significant (X_1^2 = 3.05).

We can conclude that the increase in culpability associated with drinkers was not shown to differ for daytime versus nighttime accidents. Thus, while drinkers have most of their accidents at night, there is no evidence that their susceptibility to culpability was greater then.

Roadway Lighting

Table 18 gives the data for culpability by driver status and street lighting for nighttime accidents. It shows that for single vehicle accidents, drinking drivers had essentially equal culpability rates on both lighted and unlighted roads (X_1^2 = .02). The normal drivers were more often culpable on lighted roads, but the difference was not significant (X_1^2 = 1.83). Because of the normal driver difference, the culpability ratio was greater on unlighted roads. A chi-square test of the three-way interactions was significant (X_1^2 = 5.83). However, because the culpability rates were essentially equal for the drinkers and not significantly different for the normal drivers, it appears that the specific interaction involving the culpability ratios is best treated as not significant.

For multivehicle accidents, the greater culpability of the drinkers increased only slightly from lighted to unlighted roads. The change was not significant (X_1^2 = .48). Thus, it was concluded that road lighting did not differentially influence drinkers and nondrinkers with regard to culpability.

TABLE 18

Culpability Rates by Driver Status for Roadway Lighting in Nighttime Accidents

Single Vehicle Accidents

Roadway Lighting	Drinking Culp	Drinking Not Culp	Drinking Total	Drinking % Culp	Normal Culp	Normal Not Culp	Normal Total	Normal % Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Lighted	352	17	369	95.4	57	32	89	64.0	1.49
Not Lighted	494	25	519	95.2	81	66	147	55.1	1.73

Multivehicle Accidents

Roadway Lighting	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Lighted	141	17	158	89.2
Not Lighted	201	19	220	91.4

Road Type

Due to limited numbers of observations, only two road types (two lane roads versus multilane roads) were included in this analysis. The data appear in Table 19. For the single vehicle accidents, the culpability rates were almost identical for the drinkers but significantly different for the normals ($X_1^2 = 0.00$, and $X_1^2 = 4.90$, respectively). This implied a differential effect of road type on culpability for drinkers and nondrinkers. Considering this, along with a significant test for three-way interactions ($X_1^2 = 12.84$) and a sizable difference in culpability ratios, it was concluded that road type differentially influenced the relationship between driver status and culpability. Specifically, the increase in culpability for drinkers was greater on multilane roads than on two lane roads. As before, the effect was not noted in terms of differences in culpability rates for drinkers. Rather, the advantage that multilane roads offered to normal drivers was lost for drinking drivers -- at least regarding single vehicle accidents. For multivehicle accidents, the type of road did not have a significant effect on the relationship between driver status and culpability ($X_1^2 = 1.56$). Thus, the drinker effect was greater on multilane roads than on two lane roads, but only for single vehicle accidents.

TABLE 19

Culpability Rate by Driver Status and Road Type

Single Vehicle Accidents

	Drinking				Normal				
Road Type	Culp	Not Culp	Total	% Culp	Culp	Not Culp	Total	% Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Two Lane	798	41	839	95.1	191	134	325	58.8	1.62
Multilane	118	6	124	95.2	29	37	66	43.9	2.17

Multivehicle Accidents

Road Type	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Two Lane	234	11	245	95.5
Multilane	108	9	117	92.3

Alignment

The effect of straight versus curved roads is analyzed in Table 20. For drinkers in single vehicle accidents, the culpability rate was significantly higher on curves than on straight roads (X_1^2 = 9.11); note, however, that the difference was not large. For normal drivers, the effect was in the same direction and also significant (X_1^2 = 15.59); here, however, the change in culpability rate was much larger.

TABLE 20

Culpability Rates by Driver Status and Road Alignment

Single Vehicle Accidents

Road Alignment	Drinking				Normal				Culpability Ratio
	Culp	Not Culp	Total	% Culp	Culp	Not Culp	Total	% Culp	[P(C | Dr)÷P(C|N)]
Straight	698	42	740	94.3	226	177	403	56.1	1.68
Curve	409	8	417	98.1	90	28	118	76.3	1.29

Multivehicle Accidents

Road Alignment	Drinker Culpable Normal Not	Normal Culpable Driver Not	Total	% (Drinker Culpable, Normal Not)
Straight	745	70	815	91.4
Curve	98	4	102	96.1

The difference in culpability ratios shows that although curves, in comparison to straight roads, were a greater problem for both drinkers and nondrinkers, the increase in culpability associated with drinkers was greater on straight roads. The test for three-way interactions was statistically significant (X_1^2 = 25.40), indicating a lack of independence among alignment, culpability, and driver status. Because the culpability ratios were considerably different, it was concluded that the increase in culpability associated with drinkers was greater on straight roads than on curved roads. Thus, the drinkers were more likely to be culpable on curves, but in comparison to normals they had more incremental culpability on straight roads.

For multivehicle accidents, the relative frequency of the drinking driver being the culpable one was higher on curves than on straight roads. While the difference was not statistically significant (X_1^2 = 2.66), the direction of the relationship opposed that for single vehicle accidents. This may be a random effect, or it may reflect the fact that one can be involved in single and multivehicle accidents in quite different ways.

Location

Table 21 shows the data for different accident locations. For single vehicle accidents, the differences in culpability rates as a function of location were not statistically significant for either the drinkers or the normals (X_3^2 = 2.79 and 1.35, respectively). Thus, there was no evidence that the likelihood of being culpable changed from location to location; this, for both the drinkers and the normals. A test of the three-way interactions was significant (X_3^2 = 11.76); however, the above findings, along with limited differences among the culpability ratios, led to the conclusion that the specific interaction (the differential effect of location upon culpability ratios) had not been demonstrated.

TABLE 21

Culpability Rate by Driver Status and Accident Location

Single Vehicle Accidents

Location	Drinking Culp	Drinking Not Culp	Drinking Total	Drinking % Culp	Normal Culp	Normal Not Culp	Normal Total	Normal % Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Buffalo and Niagara Falls	134	8	142	94.4	78	61	139	56.1	1.68
Buffalo Suburbs	435	27	462	94.2	118	75	193	61.1	1.54
Cities*	107	5	112	95.5	34	19	53	64.2	1.49
Rural	565	22	587	96.3	145	98	243	59.7	1.61

Multivehicle Accidents

Location	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not)
Buffalo and Niagara Falls	224	14	238	94.1
Buffalo Suburbs	445	51	496	89.7
Cities*	76	5	81	93.8
Rural	244	19	263	92.8

*Cities and small cities were combined.

For multivehicle accidents, the differences among the proportion culpable were not significant (X_3^2 = 5.29). Thus, the proportion culpable did not significantly vary as a function of location for drinking drivers, nondrinking drivers, or both taken together.

Rain

The effects of rain on culpability rates and ratios are given in Table 22. As has been the case in most of these analyses, the difference in culpability rates for drinkers in single vehicle accidents was not significant (X_1^2 = 0.26). For normal drivers, however, there was a statistically significant increase in culpability in rainy weather accidents (X_1^2 = 8.43). As a result, the difference in culpability ratios were relatively large.

TABLE 22

Culpability Rate by Driver Status and Precipitation

Single Vehicle Accidents

	Drinking				Normal				
Precipitation	Culp	Not Culp	Total	% Culp	Culp	Not Culp	Total	% Culp	Culpability Ratio [P(C|Dr)÷P(C|N)]
Clear	771	36	807	95.5	206	176	382	53.9	1.77
Rain	137	5	142	96.5	45	16	61	73.8	1.31

Multivehicle Accidents

Precipitation	Drinker Culpable Normal Not	Normal Culpable Drinker Not	Total	% (Drinker Culpable, Normal Not
Clear	598	57	655	91.3
Rain	113	8	121	93.4

The test for three-way interactions was significant ($X_1^2 = 10.07$). Because of the near equality of the drinkers, the difference among the normals, and the difference in the culpability ratios, it was concluded that in single vehicle accidents the increase in culpability for drinkers versus normals was greater when it was not raining. Again, this was a case of the inherently safer situation being brought to the same level as a more hazardous one by drinking drivers. For multivehicle accidents, the effect of rain was not statistically significant.

Summary

The major finding in this section is that the culpability of the drinkers was so dominant that it overwhelmed almost all situational effects. For example, all of the culpability rates fell between 94 and 98 percent for the drinkers in single vehicle accidents. In contrast, the range was 44 to 87 percent for the nondrinkers. While the culpability of normal drivers in single vehicle accidents was influenced by road surface conditions, two lane versus multilane roads, horizontal alignment, and rain, only horizontal alignment significantly affected the culpability of drinking drivers: they were more often culpable on curved, as opposed to straight roads.

Regarding the interactive effects of situations and driver status upon culpability, four situational variables were thought to be important. The increase in culpability for drinkers compared to normals was greatest for dry roads and least for icy or snowy roads; it was high for multilane versus two lane roads; it was high for straight roads compared to curves; and it was high in clear weather compared to rain. In no instance, however, were these interactions due to differential culpability rates for the drinking drivers. Rather, in every instance, it was a matter of the drinkers losing the benefits of situations inherently advantageous to nondrinkers. For example, in single vehicle accidents on dry roads, 51 percent of the normal drivers were culpable.

The effect of icy and snowy roads was profound for the normals; the culpability rate increased to 87 percent. Yet for the drinking drivers the culpability rate was only one percent lower on dry roads than slippery ones.

A technical note is added here regarding the meaning of a culpability rate. When the culpability rate is high, it implies a dangerous situation for the driver, but in a special way; after all, if there are many accidents, the situation was dangerous even for the nonculpable drivers. The culpability rate specifically measures the proportion of accidents which were initiated by the driver or his vehicle; this, as opposed to accidents initiated by other drivers or situational events. For example, in a rural setting where animals often precipitate accidents, the culpability rate can have a tendency to be low. Thus, a high culpability rate implies the drivers and their vehicles initiated most of the accidents. As such, the results pertaining to single vehicle accidents show the drinking driver was more hazardous (primarily to himself) on curves than on straight roads.

In this regard, the fact that the culpability rates were so much higher for the drinkers than the nondrinkers, implies that the contribution of the driver to the initiation of accidents was extremely high for drinkers, whereas for the normals, there was a greater mix of environmental accident precipitators along with the driver contribution. It is obvious, therefore, that if one can find a way to improve drivers, the potential gains to be made with drinkers is enormous. It is well to keep in mind that if the culpable behaviors could be prevented, the percentage reduction in accident involvements would be equal to the culpability rate.

Driver and Vehicle Characteristics

In the following, the relationships of driver status to two driver characteristics (sex and age), and one vehicle characteristic (vehicle type) are examined for culpable accident drivers. As before, only accidents investigated on scene by the police were included; hit and run drivers and parked vehicles were excluded. It is well to bear in mind that vehicle characteristics may reflect more about the nature of the driver than about the effect of the vehicle, per se.

As in the situational analyses, proportions were computed two ways. In the upper portion of the table, the percentages reflect the effect of age, for example, given driver status. The percentages in the lower part of the table reflect the effect of driver status given age. Thus, the percentages in the upper part of the table are applicable to the consideration of countermeasures residing with a particular driver status group, while those in the lower part are applicable to the consideration of countermeasures residing with particular age groups.

Driver Sex

Table 23 gives the cross tabulation of driver status and driver sex. It shows that among the drinkers, 90 percent were males. In comparing the drinkers and normals, it is clear that the males were more highly represented among the drinkers; this was statistically significant (X^2_1 = 231.59). The lower part of the table shows 20 percent of the culpable males were drinkers, while only seven percent of the culpable females were drinkers.

Regarding HBD/DWI differences, these were also significant (X^2_1 = 12.40). The females constituted 12 percent of the HBD's, but only eight percent of the DWI's. The lower part of the table shows that while the females were rather evenly split among the DWI's and HBD's, more of the males were cited for DWI.

TABLE 23

Driver Sex by Driver Status for Culpable Drivers

	Driver Status									
	DWI		HBD		Normal			Drinker	
Sex	N	%	N	%	N	9N	%	N	%
					Driver Sex Effect				
Male	1477	92.0	1103	88.0	1162	10458	72.8	2580	90.2
Female	129	8.0	150	12.0	434	3906	27.2	279	9.8
TOTAL	1606	100.0	1253	100.0	1596	14364	100.0	2859	100.0
					Driver Status Effect				
Male		11.3		8.5			80.2		19.8
Female		3.1		3.6			93.3		6.7

Driver Age

The data relating driver age and driver status for culpable drivers are shown in Tables 24 and 25. While it was desirable to employ age groups with equally sized ranges so that proportions would not be distorted by range size effects, it was also desirable to use smaller ranges for younger drivers because the nature of young people changes more rapidly over time. First, the raw data are presented at the top of Table 24 with unequal age ranges. Here, it can be seen that the major influence on the percentages was the size of the age range. Since the proportions at the bottom of the table were computed within age groups, the differential range sizes have no effect. In Table 25, the data in the upper part of the first table are repeated but the percentages were divided by the size of each range.

TABLE 24

Driver Age by Driver Status for Culpable Drivers

	Driver Status									
	DWI		HBD		Normal			Drinker	
Driver Age	N	%	N	%	N	9N	%	N	%
				Driver Age Effect					
16	10	0.6	8	0.6	44	396	2.8	18	0.6
17, 18	82	5.2	110	8.8	188	1692	11.9	192	6.8
19, 20	123	7.8	174	14.0	181	1629	11.5	297	10.5
21 - 25	273	17.2	274	22.0	261	2349	16.6	547	19.3
26 - 35	356	22.5	270	21.7	310	2790	19.7	626	22.1
36 - 55	569	35.9	314	25.2	378	3402	24.0	883	31.2
56 - 65	143	9.0	77	6.2	119	1071	7.6	220	7.8
66+	28	1.8	19	1.5	95	855	6.0	47	1.7
Total	1584	100.0	1246	100.0	1576	14184	100.0	2830	100.0
				Driver Status Effect					
16		2.4		1.9			95.7		4.3
17, 18		4.4		5.8			89.8		10.2
19, 20		6.4		9.0			84.6		15.4
21 - 25		9.4		9.5			81.1		18.9
26 - 35		10.4		7.9			81.7		18.3
36 - 55		13.3		7.3			79.4		20.6
56 - 65		11.1		6.0			83.0		17.0
66+		3.1		2.1			94.8		5.2

TABLE 25

Driver Age by Driver Status for Culpable Drivers

Corrected for Age Range

Driver Age Effect

Driver Age	DWI N	DWI %/Yr.	HBD N	HBD %/Yr.	Normal N	Normal %/Yr.	Drinker N	Drinker %/Yr.
16	10	-	8	-	44	-	18	-
17, 18	82	2.6	110	4.4	188	6.0	192	3.4
19, 20	123	3.9	174	7.0	181	5.7	297	5.2
21 - 25	273	3.4	274	4.4	261	3.3	547	3.9
26 - 35	356	2.2	270	2.2	310	2.0	626	2.2
36 - 55	569	1.8	314	1.3	378	1.2	883	1.6
56 - 65	143	0.9	77	0.6	119	0.8	220	0.8
66+	28	-	19	-	95	0	47	-
Total	1584		1246		1576		2830	

Looking at Table 25, it can be seen that the most highly represented ages among the drinkers were 19 and 20. Next were the drivers in the 21 to 25 year group, followed by the 17 and 18 year old drivers. In general, as age increased beyond 20 years, the accident generation problem became less severe. The pattern was quite similar for the normal drivers, but some differences were evident. Most notably, the problem was greatest for the 17 and 18 year old drivers among the normal drivers. A chi-square test showed the difference to be statistically significant ($X_5 = 54.15$).* The general

* Percent/year was not computed for the youngest and oldest age groups because the appropriate range size was unknown. The test was based on the data given in the upper portion of Table 24. This was appropriate since age range size was consistent across driver status groups. The data used in testing also excluded the youngest and oldest drivers. Had they been included, we would have obtained $\chi^2_7 = 150.89$. Obviously, the youngest and oldest culpable drivers also contributed to the difference between drinkers and normals, with both being underrepresented among the drinkers.

pattern of differences showed the young drivers (under 21) were a greater problem among the normals than among the drivers.

The age group most troublesome among the drinkers, as compared to the normals, extended from 21 to 55. Although the difference was not large, this range did include over 70 percent of the culpable drinking drivers. Finally, among the drinkers the oldest age group presented less of a problem than they did among the normals (cf. previous footnote).

Differences among the HBD's and DWI's in the 17 to 65 age groups were also statistically significant (X^2_5 = 80.55; if all age groups are included, X^2_7 = 80.83, implying that the oldest and youngest age groups added little to the difference). These data show the primary difference to have been an overrepresentation of the young drivers among the HBD's in comparison to the DWI's.

Looking at the lower part of Table 24, it can be seen that drivers in the 21 to 65 age range had relatively more drinking/accident problems than did older and younger drivers. The first two columns show that these are the ages where DWI charges tended to be high, both in an absolute sense and in comparison with HBD's. Thus, the problems in this age group may well be simply that they include more drinkers, and that when they drink, they consume larger amounts.

In summary, one can conclude that among the culpable drinkers, the young had the most serious accident problem. On the other hand, the same was true for the non-drinkers. Indeed, the drinkers had proportionately more culpable involvements than the normals only for the large group of drivers from ages 21 to 55, or perhaps 65. These drivers were more often reported as drinking and, in the 26 to 65 group, were more often cited for DWI as opposed to simply reported as HBD. It is important to note that this does not imply the young should be ignored regarding countermeasures. Although they represented a small part of the problem -- only three percent of the culpable drivers were drinkers under 21 [(18 + 192 + 297) ÷ (14184 + 2830) = .03] -- it may be best to treat them before they grow older.

Vehicle Type

The next analysis is a comparison of automobiles, light trucks, and heavy trucks. The upper portion of Table 26 shows that among these culpable drivers, six percent were driving trucks with almost all of them driving light trucks. Among non-drinking drivers, nine percent were driving trucks; they were evenly split between light and heavy trucks. The differences between the normals and the drinkers were statistically significant ($X^2_2 = 88.85$), with the major effect obviously due to the contribution of the heavy trucks.

TABLE 26

Vehicle Type by Driver Status for Culpable Vehicles

	Drinking Status									
	DWI		HBD		Normal			Drinker	
Vehicle Type	N	%	N	%	N	9N	%	N	%
Cars	1478	94.0	1143	93.3	1397	12573	90.7	2621	93.7
Light Trucks	83	5.3	79	6.4	72	648	4.7	162	5.8
Heavy Trucks	11	0.7	3	0.2	71	639	4.6	14	0.5
Total	1572	100.0	1225	100.0	1540	13860	100.0	2797	100.0
Cars		9.7		7.5			82.7		17.3
Light Trucks		10.2		9.8			80.0		20.0
Heavy Trucks		1.7		0.5			97.9		2.1

The differences are most meaningfully portrayed at the bottom of the table. Here it can be seen that while 17 percent of the automobile drivers were drinking, and 20 percent of the light truck drivers were, only two percent of the heavy truck drivers were drinking.

In comparing the DWI's to the HBD's, the cars were not significantly different from the trucks ($X^2 = 0.60$), but there was a significant difference between the light and heavy trucks ($X_1^2 = 3.87$). While among the light trucks, drivers were evenly split between DWI and HBD, for heavy trucks there was over a three-to-one ratio of DWI's to HBD's. While both figures were low, this suggests that drivers of heavy trucks, if they decide to drink at all, often decide to drink in quantity.

Thus, the main finding here is that culpable drivers of heavy trucks were far less likely to have been drinking than either drivers of light trucks or automobiles. This, by a factor of nearly ten to one. One might consider that part of this could be accounted for by reduced police reporting of drinking in sympathy for a person who makes his living by driving, but this could apply to drivers of both large and small trucks, and yet the estimated incidence of drinking among light truck drivers was even greater than that for drivers of cars. Furthermore, it is extremely unlikely that reporting biases could account for a ten-to-one differential. Thus, there can be only two explanations. First, drivers of heavy trucks may drink and drive less than other drivers. Second, the effect of drinking upon accident generation may be less for drivers of heavy trucks. In either case, why should these differences exist? There appears to be several possibilities. First, it is likely that the drivers of the heavy trucks were better trained drivers than others. Second, it is likely that they perceive the opportunity for a greater economic loss if charged with drinking or being in an accident. If these are the basic reasons, it suggests better training and more rigorous application of the laws involving economic loss would benefit other drivers as well. Of course, there could be a third explanation; truckers hired by large firms may have been selected so as to exclude those with drinking problems. If so, this may have implications for licensing practices for drivers of other vehicles.

Summary

Males constituted 90 percent of the culpable drinkers. In comparison to female drinkers, the males had a higher proportion of DWI's as opposed to HBD's.

Among culpable drinkers, the most highly represented age group were the 19 to 20 year olds. However, when compared to nondrinking drivers, the overrepresented drinkers were not the young, but those in the broad range from 21 to 55.

Regarding vehicle type, only two percent of the culpable heavy truck drivers had been drinking. This can be compared with 17 percent for automobiles and 20 percent for light trucks. This suggested that either drinking - accident generation can be avoided if the driver has a perceived need to do so, or that drivers can be selected as to minimize such problems.

Composite Analysis

In order to look at the drinking accidents in more detail, they were cross tabulated for driver characteristics (age, sex, driver status) and two situational factors (day/night and location) simultaneously. The results are in Table 27. It includes 2,503 accidents in which the drinking driver was culpable and the five variables listed above were known. As before, only accidents investigated at the scene were included; unidentified hit-and-runs and parked cars were excluded; only culpable drivers were included.

The four tabular blocks in the upper left include all the raw data. The remainder of the table provides various sums based on the raw data. Because of limited observations in some locations, only urban (Buffalo and Niagara Falls),

TABLE 27

Drinking Accidents for Cross-Classifications of Driver and Situational Variables

Driver Variables			Situational Variables											
			Day				Night				Day Plus Night			
Age	Sex	Driver Status	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total
Young	Male	DWI	1	6	10	17	23	80	56	159	24	86	66	176
Old			76	67	74	217	264	370	238	872	340	437	312	1089
Young	Female		0	0	1	1	4	3	5	12	4	3	6	13
Old			4	8	4	16	17	43	20	80	21	51	24	96
Young	Male	HBD	1	12	19	32	20	73	111	204	21	85	130	236
Old			40	55	56	151	139	224	247	610	179	279	303	761
Young	Female		0	0	1	1	4	14	12	30	4	14	13	31
Old			3	6	5	14	19	39	29	87	22	45	34	101
Young	Male	-	2	18	29	49	43	153	167	363	45	171	196	412
Old			116	122	130	368	403	594	485	1482	519	716	615	1850
Young	Female		0	0	2	2	8	17	17	42	8	17	19	44
Old			7	14	9	30	36	82	49	167	43	96	58	197
-	Male	-	118	140	159	417	446	747	652	1845	564	887	811	2262
	Female		7	14	11	32	44	99	66	209	51	113	77	241
Young	-	-	2	18	31	51	51	170	184	405	53	188	215	456
Old			123	136	139	398	439	676	534	1649	562	812	673	2047
TOTAL			125	154	170	449	490	846	718	2054	615	1000	888	2503

suburban (specifically, suburban Buffalo), and rural groupings were used. Driver age was dichotomized so that the young group contained all drivers under 21 years. This grouping was based on earlier results showing a greater drinking-accident problem for drivers over twenty; it also allowed further study of the young since this is of current interest.

It can be seen that of the 2,503 accidents, there were 2,054 nighttime accidents and only 449 during the day, 2,047 older drivers and only 456 young, and 2,262 males and only 241 females. Thus, the data set was dominated by older males in nighttime accidents. The intersection of these three sets contained 1,482 (or 59 percent) of all the accidents. The smallest subset defined in terms of sex, age, and time consisted of two young females in daytime accidents. In fact, there were only 44 young females altogether; this is only two percent of the data set. In comparison to those variables, location and driver status were more uniformly distributed.

Considering first the problems of the young drinkers, 405 (89 percent) of their accidents occurred at night, and 403 (88 percent) were in either suburban or rural areas with the difference between the two being small. Thus, the young had most of their accidents in suburban and rural areas at night (78 percent). Similarly, during the day, they had more of their accidents in suburban and rural areas, but this constituted a much smaller part of their problem. These patterns applied to both young males and young females, but because the number of young females was small, the major trends were determined by the males.

Considering the old drivers (i.e., 21 and older), 1,649 (81 percent) of their accidents occurred at night. Their accidents were more uniformly divided over location than were the young drivers. While the young had only 12 percent of their accidents in urban areas, the old drivers had 27 percent there. Furthermore, while the young favored rural areas, the old drivers had more accidents in suburban areas. In the daytime, the accidents of the old drivers were approximately evenly distributed over location. Females constituted ten percent of the old drivers; almost half their accidents were suburban, both during the day and at night. Whether this high incidence of suburban accidents for females reflects women that live there is unknown.

Comparing the HBD's to the DWI's, it can be seen that for young males, rural accidents were more frequent for the HBD's (55 percent) than for the DWI's (38 percent). For the old males, the figures were 40 percent and 29 percent, respectively. For the females, the respective figures were 36 percent and 28 percent. Thus, in general, the HBD's had more rural accidents than did the DWI's. This might imply that if a driver planned to drive in rural areas, he may have limited his drinking to some extent. (In rural accidents, 54 percent were HBD's as opposed to DWI's; this can be compared with 42 percent in suburban accidents, and 37 percent in urban accidents.)

Comparing daytime and nighttime drinking accidents, the young had 11 percent of their accidents during the day and the females had 13 percent then. In contrast, the males had 18 percent during the day and the older drivers had 19 percent then. In the extreme, the young females had five percent during the day and the older males had 20 percent during the day. This may reflect differential drinking habits, or less availability of cars to women and young drivers during the day.

Finally, to provide general measures of the scope of the drinking accident problem, we can look at the third data block from the top for the highest frequency combinations of age, sex, time of day, and location. The most frequent combinations were the 594 (or 24 percent) accidents involving men over 20 in suburban areas at night. Next were 485 (19 percent) accidents involving these drivers in rural areas. Following that closely were the 403 of the same driver types in urban accidents (16 percent). Next were young males in rural (167 - seven percent) and suburban (153 - six percent) nighttime accidents. Following that were rural, suburban, and urban daytime accidents for the older men (each five percent). These eight groups accounted for 2,170 (or 87 percent) of the accidents in this data set.

Driver History

Some additional driver oriented analyses were performed using data from CFSI's 1973 merged accident tape. This is a file from the New York State Department of Motor Vehicles in which, where possible, driver license and vehicle registration information has been merged with accident records. Because many police agencies do not forward their accident reports to DMV, most of the accidents in the sample for this study did not appear in this merged tape.

By matching county, month and date for the accidents, and driver age and sex, and vehicle model year, a new file was created which contained both the driver license information and the basic data obtained for this study. A total of 1,773 accidents appear in this file. The variables of primary interest were the frequencies of accidents, convictions, alcohol convictions, and alcohol convictions in accidents. This historical driver information was compiled from 1968 up to but not including the date of the accident in the study sample. In the analyses that follows, only drivers 24 years old and older at the time of the accident were included. Since these are 1973 accidents, all such drivers were at least 18 in 1968. (In New York State a driver can obtain a learner's permit at the age of 16 and an ordinary operator's license at 17 or 18, depending on whether he has had a driving instruction course.) It was thought that by excluding drivers under 24, the problem of younger drivers having less opportunity to develop a driver history would be minimized.

It should be noted that the state police and the sheriff's departments tend to send most of their reports to DMV. Other agencies, for the most part, send only reports of the more severe accidents. Thus, the findings tend to be weighted toward rural, or injury-producing accidents. As in most previous analyses, the following were limited to accidents investigated on scene; hit and run drivers as well as drivers of parked vehicles were excluded. The analyses were not restricted to culpable drivers.

The first analysis was performed to study relationships between drinking status in the 1973 accident sample and number of previous accidents. The results are in Table 28. A chi-square test was applied to compare the DWI's to the HBD's and the difference was not significant (X_3^2 = 3.22). However, a comparison of drinkers (HBD's plus DWI's) with normals was statistically significant (X_3^2 = 15.77)*. The table clearly shows an increase in the proportion of drinkers in the 1973 accidents as the number of previous accidents increased. The proportions increased from seven percent for no previous accidents to approximately twelve percent for two or more previous accidents. Thus, the data support the conclusion that likelihood of drinking in current accidents was greater for those drivers who had more previous accidents.

TABLE 28

Driver Status by Previous Accidents

Driver Status	Number of Accidents: None N	None %	One N	One %	Two N	Two %	More N	More %
DWI	111	3.3	85	5.6	25	6.5	8	4.9
HBD	121	3.6	66	4.4	25	6.5	11	6.7
Drinkers	232	6.9	151	10.0	50	13.1	19	11.7
(Normal)	(349)		(151)		(37)		(16)	
9 x Normal	3141	93.1	1359	90.0	333	86.9	144	88.3
TOTAL	3373	100.0	1510	100.0	383	100.0	163	100.0

* As in other tests, the actual number of normal drivers in the sample was utilized. In the table, all proportions are based on the weighted observations.

The next analysis was an attempt to relate drinking status to previous accidents in which the driver was convicted of an alcohol related violation. The results appear in Table 29. Because of the limited number of observations (there were only 18 drivers with previous alcohol convictions in accidents), neither the comparison of drinkers to normals, nor DWI's to HBD's was significant (X_1^2 = 3.48 and 2.92, respectively). However, if there is a trend, its direction is clear: Of those drivers with no alcohol/accident convictions, eight percent were drinking in the 1973 sample; for those who had a previous accident-related alcohol conviction, 18 percent were drinking.

TABLE 29

Driver Status by Previous Alcohol/Accident Convictions

Driver Status	Number of Alcohol/Accident Convictions			
	None		One	
	N	%	N	%
DWI	220	4.1	9	13.6
HBD	220	4.1	3	4.5
Drinkers	440	8.2	12	18.2
(Normal)	(547)		(6)	
9 x Normal	4923	91.8	54	81.8
Total	5363	100.0	66	100.0

An analysis was performed to examine the relationship between the number of non-alcohol-related convictions and drinking status.* The results are in Table 30. The comparison between normals and drinkers was significant and that between DWI's and HBD's was not (X_3^2 = 59.93 and 6.57, respectively). That drinking occurred most frequently for accident drivers with more previous convictions was clearly evident. The proportion of drinkers increased from five percent for those with no previous convictions to 16 percent for those with three or more convictions; this, although only non-drinking convictions were included. (Of course, many of these convictions may have been the result of plea bargaining.)

TABLE 30

Driver Status by Previous Non-Alcohol Convictions

Driver Status	None N	None %	One N	One %	Two N	Two %	More N	More %
DWI	70	2.3	32	3.0	57	8.6	37	8.6
HBD	80	2.7	42	3.9	37	5.6	32	7.5
Drinkers	150	5.0	74	6.8	94	14.2	69	16.1
(Normal)	(317)		(112)		(63)		(40)	
9 x Normal	2853	95.0	1008	93.2	567	85.8	360	83.9
TOTAL	3003	100.0	1082	100.0	661	100.0	429	100.0

(Column group heading: Number of Non-alcohol Convictions)

The last driver history variable is previous alcohol-related driving convictions. The data appear in Table 31. Because there were only eight drivers with more than one conviction, the data were dichotomized to drivers with no previous convictions and those with at least one.

The results are most emphatic. While those accident drivers with no previous drinking convictions were found to be drinking in eight percent

* All convictions considered in this analysis were restricted to violations of the New York Vehicle and Traffic Law, but excluded any individuals having previous V and T convictions pertaining to drinking.

of their accidents, those with at least one such conviction were drinking in 36 percent. The difference was statistically significant ($X_1^2 = 42.00$). It is important to recognize that because driver status (DWI, HBD, normal) was determined by the police in the field, and was not based on court convictions, this result is not likely to have been artifactually influenced by the driver's previous record. In comparing the DWI's to the HBD's, the DWI's were over-represented among those drivers with previous convictions; however, the difference was not statistically significant ($X_1^2 = 2.18$).

TABLE 31

Driver Status by Previous Alcohol Convictions

Driver Status	Number of Convictions: None N	None %	At Least One N	At Least One %
DWI	196	3.7	33	21.4
HBD	201	3.8	22	14.3
Drinkers	397	7.5	55	35.7
(Normal)	(542)		(11)	
9 x Normal	4878	92.5	99	64.3
Total	5275	100.0	154	100.0

An analysis was performed to determine whether drivers with previous drinking convictions were more likely to be culpable in their 1973 accidents. The analysis was performed for all drivers, and then separately for drivers who had and had not been drinking in their 1973 accidents. The results are in Table 32.

The first part of the table shows the relationship between culpability in the 1973 accidents and previous drinking/driving convictions. While 38 percent of those without convictions were culpable, 56 percent of those with previous convictions were culpable.

TABLE 32

Culpability by Previous Alcohol Convictions

Culpable?	Convictions: None N	None %	At Least One N	At Least One %
	All Drivers (Corrected for Sampling Fraction)			
Yes	2012	38.1	87	56.5
No	3263	61.9	67	43.5
Total	5275	100.0	154	100.0
	Normal Drivers			
Yes	184	33.9	4	36.4
No	358	66.1	7	63.6
Total	542	100.0	11	100.0
	Drinking Drivers			
Yes	356	89.7	51	92.7
No	41	10.3	4	7.3
Total	397	100.0	55	100.0

The remaining parts of the table contain the same data separately for drinking and non-drinking drivers. In both instances, the culpability rate was quite similar for drivers with and without previous drinking convictions.* Thus, when driver status in the accident was controlled, the higher culpability rate for convicted drivers was lost.

* Unfortunately, rigorous tests of these effects could not be performed. This would have required the separation of single and multi-vehicle accidents to avoid the dependence problems associated with culpability analyses. In attempting to do so, it quickly became apparent that the resultant number of observations were too small to provide meaningful results. The chi-squares for the three parts of Table 32 were 21.25, 0.03, and 0.50, each with one degree of freedom.

These findings imply that drivers with previous driving-related drinking convictions were more likely to be culpable in ensuing accidents. But, because there was no evidence that drivers with previous convictions were more culpable when driver status was held constant, the explanation lies in the facts that convicted drivers were more likely to have been drinking, and drinking drivers were more likely to be culpable.

Summary

The driver history data implied that previous driver experience was an important indication of their drinking status in later accidents. Among accident drivers, the proportion drinking increased from 7 to 13 percent as a function of previous non-alcohol convictions, and from eight to 37 percent as a function of previous alcohol convictions. It was also shown that the culpability rate increased from 38 to 56 percent as a function of previous alcohol convictions; this was attributed not directly to the history of convictions, per se, but rather to continued drinking.

The vehicle type results and those relating to driver history can be usefully considered together. The findings pertaining to heavy trucks implied either a driver could avoid an alcohol-accident problem if it was important to do so, or drivers could be selected so as to minimize this problem. The driver history data indicated greater alcohol-accident problems for drivers with previous accidents and convictions, particularly drinking convictions.

These findings complement each other in suggesting that driver selection, and therefore licensing methods, can be important in reducing the alcohol-accident problem. It appears that driver histories are a good tool for doing so.

Secondly, if one believes that the truck data imply the drinking-accident problems can be minimized if the driver perceives sufficient economic risk, the driver history data indicate the perceived risk was not sufficient for drivers even though they had previous convictions. Perhaps an increase in the economic penalty would be beneficial, assuming the courts would cooperate.

Driver Interviews

Culpable drivers, randomly selected from the 1973 accidents in Erie County, were called on the telephone for interviews. Because approximately one-half of the drivers could not be interviewed (three-eighths could not be contacted and one-eighth refused), the sample size was limited to 391 interviews. For the same reasons, it is unlikely that the random nature of the sample was preserved. While one cannot demonstrate that the interview sample was or was not random, the following was encouraging. Among the 344 interviews in which driver status could be identified as DWI, HBD, or normal from the police reports, the percentages were: DWI-35.5, HBD-18.3, and Normal-46.2. Among the 2,964 police reported culpable drivers in Erie County accidents, the corresponding percentages were 39.2, 18.1, and 42.7; the differences were not statistically significant ($X_2^2 = 2.04$). Thus, one can conclude that the interview sample was reasonably representative of the sample from which it was drawn, at least with regard to driver status.

Because of the limited sample size, only a small number of analyses are reported here. The first analysis is a comparison of driver status, as determined from the accident report, with amount of drinking as reported in the interview. The amount of drinking as used here was simply by the number of drinks, irrespective of the type (beer, wine, mixed drink, etc.). The results are in Table 33.

It can be readily seen that some of the interviewed drivers were not totally honest. For example, of the 180 who reported no drinking, 19 were cited for DWI, and 22 were reported as HBD. Of the three refusals for this question, all were cited for DWI. Of those who said they did not know how much they drank, almost three-fourths were cited for DWI and one-fifth were reported as HBD's.

TABLE 33

Driver Status by Number of Drinks Reported in the Interview

Number of Drinks	Driver Status: DWI N	DWI %	HBD N	HBD %	Normal N	Normal %	Drinker N	Drinker %	Total N	Total %
None	19	10.6	22	12.2	139	77.2	41	22.8	180	100
1, 2	22	50.0	16	36.4	6	13.6	38	86.4	44	100
3, 4	23	71.9	4	12.5	5	15.6	27	84.4	32	100
5, 6	10	50.0	7	35.0	3	15.0	17	85.0	20	100
More	23	65.7	8	22.9	4	11.4	31	88.6	35	100
Refused	3	100.0	0	0.0	0	0.0	3	100.0	3	100
Unknown	22	73.3	6	20.0	2	6.7	28	93.3	30	100

However, the primary interest here was not in the quality of the interview information but, rather, in the police reporting. The concern was that the police may have often failed to report drinking. Looking at the second through fifth rows, it can be seen that for those instances when the driver said he had been drinking, the police had also reported either DWI or HBD in 84 to 89 percent of the cases. While this does indicate some amount of underreporting by the police, the problem was not large in magnitude and not conducive to serious biases in the results of the study.

Regarding the driver status among the drinkers, if a driver admitted to more than seven drinks, it is quite likely that his BAL exceeded .10 percent; yet only two-thirds of these drivers were cited for DWI.

The proportion of DWI's among the drinkers was computed for each of the interview response classes. They are: None - .46, 1 or 2 - .58, 3 or 4 - .85, 5 or 6 - .59, and 7 or more - .74. Except for the middle category, the proportion of DWI's increased monotonically with the amount of drinking as stated by the driver.

Generally speaking, it appears that the police reporting of drinking was far more reliable than one might have expected. While it appears that DWI's citations were not always given when they could have been, the reporting of DWI and HBD, taken together, was quite good.

The next two analyses refer to the nature of the trip in which the accident occurred. Table 34 gives the stated distance from home of the accident within each driver status category. The percentages are based on cumulative frequencies. For the purposes of testing, chi-square tests were applied to the original frequencies with the last two rows combined. Comparing the normals to the drinkers, it can be seen that the cumulatives never differed by more than a few percentage points, and the differences were not significant ($X_4^2 = 1.67$).

TABLE 34

Distance from Home by Driver Status

Distance (Miles)	DWI N	DWI C.%	HBD N	HBD C.%	Normal N	Normal C.%	Drinker N	Drinker C.%
1 or less	27	22.3	16	25.4	43	27.4	43	23.4
2, 3	34	50.4	9	39.7	32	47.8	43	46.7
4, 5	23	69.4	8	52.4	22	61.8	31	63.6
6-10	27	91.7	14	74.6	34	83.4	41	85.9
11-50	9	99.2	15	98.4	20	96.2	24	98.9
More	1	100.0	1	100.0	6	100.0	2	100.0
Total	121		63		157		184	

In comparing the DWI's and the HBD's, however, differences are apparent, and the test was significant (X_4^2 = 13.14). The data show that while 69 percent of the DWI's had their accidents within five miles of their homes, only 52 percent of the HBD's did. This 17 percent differential held up for accidents within 10 miles as well. When considering accidents within 50 miles, the differences were minor. Thus, the HBD's tended to have their accidents further from home than did the DWI's. Specifically, the HBD's had more accidents in the 11 to 50 mile range.

Regarding the absence of differences between drinkers and normals, the table shows that the DWI's and the HBD's tended to straddle the normals. That is, while 83 percent of the normals had their accidents within 10 miles of their homes, 92 percent of the DWI's did, but only 75 percent of the HBD's did. This sort of relationship was true for accidents within five miles and even within three miles. That the HBD's had an overinvolvement in accidents in the 11 to 50 mile range correlates well with the earlier findings in which they were overrepresented in rural accidents and ran-off-road accidents.

The next analysis is related to the last. It involves the frequency with which the interviewees said they had previously driven on the road where the accident occurred; this can be thought of as a measure of familiarity with the road. The results are in Table 35. Again, the percentages reflect relative cumulative frequencies. There were no large discrepancies in the percentages either when comparing drinkers to normals or DWI's to HBD's, and the tests did not indicate statistical significance (X_4^2 = 1.79 for drinkers vs. normals, and X_2^2 = 0.68 for DWI's vs. HBD's after combing rows 2 and 3, and rows 4 and 5).

TABLE 35

Road Familiarity by Driver Status

	Driver Status							
	DWI		HBD		Normal		Drinker	
Frequency	N	C.%	N	C.%	N	C.%	N	C.%
Few times per week or daily	88	72.1	42	66.7	118	76.1	130	70.3
Few times per month	15	84.4	9	81.0	17	87.1	24	83.2
Few times per year	5	88.5	4	87.3	6	91.0	9	88.1
A few times	11	97.5	5	95.2	9	96.8	16	96.8
Never before	3	100.0	3	100.0	5	100.0	6	100.0
TOTAL	122		63		155		185	

Thus, while the HBD's had their accidents further from home, there was no important decrease in their familiarity with the roads on which the accidents occured. This seems to indicate that the HBD's more habitually drove in the 11 to 50 mile range. That earlier results had shown the culpable HBD's to be younger than culpable DWI's tends to complement this result. It is quite believable that younger drivers, particularly those that drink, characteristically traveled within a larger radius than did older drivers.

A second point of interest regarding Table 35 is the fact that in any of the driver status groups, a large portion of the accidents occurred on roads familiar to the drivers. Over 70 percent of the accidents occurred on roads which the drivers traveled at least a few times per week. Approximately 85 percent occurred on roads which the drivers used at least a few times per month. Thus, lack of familiarity with the road had only limited opportunity to influence the accidents; in particular, there was no reason to believe it had differential effects as a function of driver status.

The final analysis of the interview data pertains to the relationship between educational level and driver status. The data appear in Table 36. The percentages were computed within rows and reflect the proportion of the driver status given the educational level. The differences between the drinkers and nondrinkers were significant (X_3^2 = 9.39; the last two rows were combined). The difference between DWI's and HBD's, although it grew smaller with increasing education, was not significant (X_2^2 = 0.76; the last three rows were combined).

TABLE 36

Driver Status by Educational Level

	Driver Status							
	DWI		HBD		Normal		Drinker	
	N	%	N	%	N	%	N	%
Did not finish high school	34	46.6	15	20.5	24	32.9	49	67.1
Graduated from high school	48	36.4	24	18.2	60	45.5	72	54.5
High school plus vocational training or college	32	29.4	19	17.4	58	53.2	51	46.8
Bachelor's Degree	4	25.0	3	18.8	9	56.3	7	43.8
Graduate Degree	1	14.3	1	14.3	5	71.4	2	28.6

Thus, there was a monotonically decreasing incidence of drinking with increasing educational level. While driver age might have been a factor here (there were too few observations to study this directly), it is quite unlikely. Recall that early findings showed drinkers to be overrepresented among culpable drivers in the 21 to 55 age groups. These were the very drivers who had the greater opportunity to attain higher educational levels.

Summary

From a technical viewpoint, the most important result in this section is that the police failed to report a drinking driver for only approximately 15 percent of those drivers who said they did drink before the accident. Thus, the opportunity for biases due to police reporting were quite limited. It is possible that a number of drinkers were reported as nondrinkers in both the interview and the police report; nontheless, the finding was encouraging, particularly in view of the fact that, among the drivers who said they were not drinking, the police reported 23 percent were.

Other results showed the HBD's had their accidents further from home than did the DWI's. On the other hand, no difference was found among the driver status groups regarding familiarity with the road. This suggested HBD's typically take longer trips. It was also found that approximately 85 percent of the drivers had accidents on familiar roads, regardless of their drinking status.

The final analysis showed that among culpable drivers interviewed, the likelihood of being reported as drinking in their accidents decreased with higher educational levels.

Accident Characteristics

The Target

The previous analyses were related primarily to the driver, vehicle, and environmental conditions in which the accidents occurred. In the analyses which follow, the emphasis is on the nature of the accident itself.

The target is that event which signifies an accident has occurred. It is (1) a collision with a vehicle, pedestrian, object, etc.; (2) a road departure, or (3) a rollover, whichever occurred first. Note that due to this definition, rollovers occurred very seldom since a rollover in the roadside was classified as a road departure. If one's primary interest were in injury, other definitions might be more suitable. In studying accident causation, a departure from the path intended for vehicles (i.e., the road) is sufficient to designate an accident.

The results of cross classifying driver status and target appear in Table 37, where targets were grouped into five categories. In this analysis and other similar ones, attention was first given to the drinking driver column where the HBD's and DWI's combined are profiled regarding the variable under study. Next the drinking drivers were compared to the normal drivers. Finally, the DWI's and the HBD's were compared. Note that the total number of observations may vary somewhat from table to table due to the exclusion of data points which were coded unknown.

TABLE 37

Target by Drinking Status for Culpable Drivers

	Drinking Status							
	DWI		HBD		Normal		Drinker	
Target	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Motor Vehicle	962	59.9	575	45.9	1206	75.6	1537	53.8
Pedestrian, bike, train, animal	17	1.1	16	1.3	37	2.3	33	1.2
Road Departure	584	36.4	634	50.6	312	19.6	1218	42.6
Rollover	2	0.1	4	0.3	9	0.6	6	0.2
Other	40	2.5	24	1.9	31	1.9	64	2.2
TOTAL	1605	100.0	1253	100.0	1595	100.0	2858	100.0
After Deleting Road Departures								
Motor Vehicle	962	94.2	575	92.9	1206	94.0	1537	93.7
Pedestrian, bike, train, animal	17	1.7	16	2.6	37	2.9	33	2.0
Rollover	2	0.2	4	0.6	9	0.7	6	0.4
Other	40	3.9	24	3.9	31	2.4	64	3.9
TOTAL	1021	100.0	619	100.0	1283	100.0	1640	100.0

The table shows that approximately one-half of the culpable drinking drivers struck other motor vehicles. Over 40 percent of them ran off the road. (Note that the distinction here is not equivalent to a multivehicle-single vehicle accident difference, since a vehicle leaving the road might eventually strike another vehicle.) Only approximately one percent of the targets for drinkers were pedestrians, bicycles, trains, or animals.*

The culpable normal drivers had a quite different distribution of targets. Three-fourths of their accidents initially involved striking other motor vehicles; only 20 percent were ran-off-road accidents. The differences between the normals and the drinkers were statistically significant (X_4^2 = 250.67). Obviously, the major contribution was the greater incidence of road departures relative to motor vehicles as targets for the drinking drivers.

All tests were performed assuming an unlimited population. The effective power of the tests could have been increased by using a finite population approach. However, in that case, all conclusions would have been limited to Western New York. While it cannot be said that the findings can be generalized to the nation or other parts of it, at least the reader can decide to what extent his area is different than, or similar to, the eight county area and decide for himself whether the findings apply.

In comparing DWI's to HBD's, the differences were also statistically significant (X_3^2 = 59.88, with rollovers and others combined); again, the primary contribution was due to the differences between collisions with motor vehicles and road departures. Interestingly, however, the trend was not an increasing one from normal, to HBD, to DWI. Rather, the greatest likelihood of a road departure was for the HBD's.

*The general composition of this category for all drivers was pedestrians and bikes -- 66 percent; animals 32 percent; and trains -- 2 percent.

Because it could be argued that the drinkers' propensity for run-off-road accidents could reduce the opportunity for other types of accidents, the analysis was repeated with road departures deleted. The result can be thought of as reflecting the expected targets if all road departures could be prevented. The results are shown in the lower portion of the table. A comparison of the proportions across columns shows very little variation in the relative frequency with which motor vehicles were targets. In comparing drinkers and normals the differences were statistically significant (X_3^2 = 8.76). The primary contribution here was the "other" category, which was overrepresented for the drinkers. This category was composed primarily of known but unclassified objects in the road or in parking lots. The comparison between DWI's and HBD's was not significant (X_2^2 = 1.84).

In summary, drinking drivers were involved in accidental road departures twice as often as nondrinkers. Just over one-half the accidents for HBD's were ran-off-road types; for DWI's approximately one-third of the accidents were of this type. While striking other vehicles was the predominant accident type for DWI's and normals, for HBD's road departures dominated, although by a small margin.

It should be noted that the effect of differential driving exposure among the driver classes will influence this type of analysis. That is, if one class of driver is more exposed to traffic conducive to multivehicle accidents, there will be a tendency to increase the likelihood of motor vehicles as targets thereby decreasing the relative frequency of road departures. However, in delineating the problems of a particular class of drivers, this is as it should be.

A final note is that it might appear, in ensuing analyses, that many of the effects can be explained by the propensity of drinkers for run-off-road accidents. However, it should be recognized that the target is the effect of accident generating behaviors; effects cannot explain things previous to their own occurrence. Thus, rather than using this propensity as an explanation, it is the propensity itself which needs to be understood.

Police Citations

Analyses were performed on rules-of-the-road violations in accidents, measured by police citations, as a function of drinking status. In order to provide a manageable summary of the data, citations were grouped into families involving similar behaviors. Drinking violations were not included. The results are in Table 38. For testing purposes, the low frequency categories were grouped together (viz., turning, stopping, starting, one-way, and other rules-of-the-road violations). Differences between the normals and the drinkers and those between the DWI's and HBD's were both statistically significant (X_8^2 = 572.96 and 29.85, respectively).*

Regarding the comparison between normals and drinkers, the major difference was that associated with whether any citation at all was received. Among the normals, seven percent were charged with a rules-of-the-road violations; for the drinkers, 23 percent were so charged. This difference was almost wholly accounted for by two categories: high speed or reckless driving, and failure to stay within the driving lane. The higher incidence of lane departures for drinkers is in agreement with earlier findings pertaining to road departures. The speeding problem will be discussed in more detail shortly.

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* Strictly speaking, these tests were not wholly valid because one driver could appear in more than one violation category, thus precluding complete independence of the data points. However, of the 7,892 data points in Table 38, there were 88, or approximately one percent, which reflected multiple citations. This is not sufficient to substantially change the values of the test statistics.

It should also be noted here that the citation analyses, unlike the previous ones, were not restricted to culpable drivers. One reason was that cited drivers had apparently broken the law even if they were not culpable. Secondly, at least in theory, citations given to drivers in multivehicle accidents should be independent from one driver to the next.

In comparing the DWI's to the HBD's, the first difference was that 25 percent of the HBD's received at least one citation, while 22 percent of the DWI's did. Among the citations, the largest difference was ten percent high speed or reckless driving charges for the HBD's versus six percent for the DWI's. Although the tabulated distribution for the DWI's was more similar to the HBD's than to the normals, the DWI's, rather than appearing at one of the extremities of the DWI-HBD-normal continuum, more often than not appeared between the HBD's and the normals.

One of the interesting findings pertains to citations for driving the wrong way on a one-way road. The data show there were 11 such charges in the sample. Of these, nine were associated with the drinkers and of those, all were associated with the DWI's. It is clear that the DWI's were more likely to have committed one-way violations than were either the HBD's or the normals; for example, in the samples, DWI's were more than ten times as likely to have such violations in accidents than were the normal drivers.

However, the data also imply that the frequency of one-way violations in accidents was quite limited: 0.5 percent of DWI's, 0.3 percent for all drinkers, and 0.04 percent for normals. For all accidents represented here, 0.06 percent involved one-way violations. Thus, the DWI's seem comparatively susceptible to one-way violations in accidents, but the problem itself occurred very infrequently.

During the conduct of this research, we received a request to investigate the relationship between driver status, speeding, and driver age.* Further impetus was provided for this analysis by the fact that one of the two major differences in citations for drinkers and normals was the combination of reckless driving and speeding. The results appear in Table 39.

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*Personal communication from Monroe Snyder, Office of Driver and Pedestrian Research, NHTSA.

TABLE 38

Police Citations by Driver Status

Police Citations	Drinking Status: DWI N	DWI %	HBD N	HBD %	Normal N	Normal %	Drinker N	Drinker %
Thru Sign or Signal	34	1.9	26	1.7	34	0.7	60	1.8
Right of Way at Intersection	39	2.2	16	1.0	99	2.2	55	1.6
Following too Closely	15	0.8	16	1.0	37	0.8	31	0.9
High Speed or Reckless Driving	115	6.4	159	10.2	57	1.3	274	8.2
Failure to Stay in Lane	118	6.6	132	8.5	44	1.0	250	7.5
Illegal Passing	40	2.2	25	1.6	18	0.4	65	1.9
Illegal Braking	6	0.3	6	0.4	12	0.3	12	0.4
Illegal Turning	3	0.2	10	0.6	8	0.2	13	0.4
Illegal Stopping	2	0.1	1	0.1	4	0.1	3	0.1
Illegal Starting	0	0.0	2	0.1	2	0.0	2	0.1
One-Way Violation	9	0.5	0	0.0	2	0.0	9	0.3
Other Rules-of-the-Road	9	0.5	3	0.2	9	0.2	12	0.4
No Rules-of-the-Road Violation	1404	78.3	1158	74.5	4218	92.8	2562	76.5
TOTAL	1794	100.0	1554	100.0	4544	100.0	3348	100.0

It might be noted here that speeding citations were of two types: exceeding the speed limit (usually excessively), and speed too fast for conditions. The table shows that in each of the drinking driver groups, speeding citations were most frequent in the 17 and 18 age group; in contrast, the highest rate for normals appeared in the below 17 group. The proportion receiving speeding citations decreased rather consistently with increasing age. The table also reflects for almost all age groups the greater likelihood of speeding charges for drinkers versus normals and, to a lesser extent, for HBD's versus DWI's.

Two sets of tests were run with these data; first drinkers were compared to normals, then DWI's were compared to HBD's. The results are shown in Table 40. (Due to limited observations, the youngest and the two oldest age groups were excluded.) All comparisons were statistically significant. Thus, whether comparing drinkers to nondrinkers or DWI's to HBD's, speeding citations could not be explained by age alone or drinking status alone, rather there was an interactive effect of age and drinking status upon speeding charges.

If one were to compute a ratio of the proportions of speeding charges for drinking versus normals within each of the tested age groups, he would obtain: (17-18) - 6.3, (19-20) - 5.6, (21-25) - 11.3, (26-35) - 7.6, and (36-55) - 4.8. This shows that drinking drivers in the 21 to 25 age group, in comparison to normals of the same age, were most susceptible to speeding citations. This statistic, however, fails to take into account the differential scope of the problem for the two groups. Therefore, the differences in proportions for drinkers and normals were calculated: (17, 18) - 15 percent, (19-20) - 11 percent, (21-25) - 9 percent, (26-35) - 5 percent, and (36-55) - 2 percent. Here, the speed problem associated with younger drinking drivers is obvious. Considering the comparison of DWI's and HBD's, it can be seen the differences were greatest for ages 19 and 20, although the effect for ages 21 through 25 was still notable.

TABLE 39

Speeding Violations by Driver Status as a Function of Driver Age

	Driver Status											
	DWI			HBD			Normals			Drinkers		
Driver Age	Cited	Not Cited	% Cited	Cited	Not Cited	% Cited	Cited	Not Cited	% Cited	Cited	Not Cited	% Cited
16 and Under	0	10	0.0	1	8	11.1	3	68	4.2	1	18	5.3
17, 18	14	71	16.5	24	106	18.5	11	378	2.8	38	177	17.7
19, 20	11	122	8.3	37	174	17.5	11	428	2.5	48	296	14.0
21- 25	23	285	7.5	43	293	12.8	7	784	0.9	66	578	10.2
26- 35	22	367	5.7	22	309	6.6	7	918	0.8	44	676	6.1
36- 55	14	599	2.3	10	363	2.7	6	1174	0.5	24	962	2.4
55- 65	3	154	1.9	1	91	1.1	2	335	0.6	4	245	1.6
66+	0	29	0.0	1	25	3.8	0	203	0.0	1	54	1.8

TABLE 40

Test Statistics for Speeding Citations by Age by Driver Status

Source	Degrees of Freedom	Chi-Square
Drinkers vs. Normals		
Age X Citations	4	99.69
Age X Driver Status	4	19.80
Citations X Driver Status	1	178.25
Age X Citations X Driver Status	4	67.30
Overall	13	365.04
DWI's vs. HBD's		
Age X Citations	4	97.46
Age X Driver Status	4	84.20
Citations X Driver Status	1	19.64
Age X Citations X Driver Status	4	13.15
Overall	13	214.45

Summarizing the data regarding speeding citations, an important part of the increased likelihood of police citations for drinkers was associated with speeding. These citations were also the most important contributor to the higher frequency of citations for HBD's versus DWI's. In general, for drivers 19 and older, speeding citations decreased with age. The groups most often cited for speeding were 17 and 18 year old HBD's (18 percent), 19 and 20 year old HBD's (18 percent), 17 and 18 year old DWI's (16 percent) and 21 through 25 year old HBD's (13 percent). Speeding among drinkers, particularly young drinkers, apparently constitutes a serious problem.

Other findings regarding police citations included the generally higher citation rates for drinkers (23 percent) versus normals (seven percent), and the higher incidence of failure to stay in the proper driving lane - eight percent for drinkers and one percent for normals. While one-way violations were not a major problem, accounting for less than one-tenth of a percent of the violations, it was estimated that DWI's were more than ten times more likely to have had such violations in accidents than were nondrinking drivers.

Critical Reasons

In the process of developing accident descriptions for this study, each driver was said to have a critical event. It is the last maneuver of his vehicle which led to involvement in an accident. The discussion that follows focuses on the reason for the critical event; it is called the critical reason. While the critical event specifies what the driver did, the critical reason denotes why he did it. Critical reasons are listed and discussed in Appendix D; the most frequent ones are information failures (he did not see it), control failures (he did not keep the vehicle on its intended path), external influence (the other guy pulled in front of him), driver breakdown (he could not provide inputs to the vehicle), vehicle breakdown (the vehicle responded abnormally), and logistic (he did it to get where he wanted to go).*

From one viewpoint, the critical reason may be thought of as the core of causes of accidents. Indeed such information can be extremely valuable. Unfortunately, it is just about the most difficult judgment the case analyst has to make. This is particularly true when using police data in the absence of a detailed driver interview. Because of this, the coding form contained provisions to record whether the critical reason was reported explicitly or inferred from the data. This was coded whenever the critical reason was an information failure, a control failure, a combination of the two, or logistic, since other categories were not used unless explicitly reported. Of the 7,489 times these codes were used in the full data set, 73 percent were inferred. This does not mean the data are unreliable; in most instances, valid inferences can be made from other information. For example, if a stopped vehicle pulls into crossing traffic, the critical reason, in the absence of contrary data, would be coded as an information failure; this would probably be correct in the vast majority of such cases.

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* Logistic reasons could apply to almost any behavior. Thus, it is given the lowest coding priority.

The two main critical reasons are information failures and control failures. A control failure, or the failure to guide the vehicle along the intended path, can be one of two types. It is an induced control failure if slippery road surfaces were at least partially responsible; otherwise, it is a primary control failure.

In some accidents, information failures could not be distinguished from primary control failures. This can result from insufficient information in the accident report, or it can reflect a failure of the driver's vehicle control input - information gathering feedback loop. To allow for this, the accident analysts could specify "information failure", "control failure", or an undifferentiated "information failure and/or control failure".

It was often felt, however, during the coding of the accident reports, that in several types of accidents the distinction between information failures and undifferentiated information/control failures was not readily made. For example, if it were reported that on a dry road surface, the vehicle simply went off the side of the road, the appropriate code would not be apparent. Another example is a vehicle crossing the centerline to strike an oncoming target. In order to alleviate this problem during analysis of the coded data, information failures and undifferentiated information/primary control failures were grouped together and referred to as tracking errors.

A distinction was maintained, however, between tracking errors and "pure" control failures, since the latter reflects (1) gross vehicle path deviations characteristic of a vehicle being "out of control" and (2) instances of explicitly reported control failures such as a driver reaching for a child and inadvertently turning the steering wheel.

The distribution of critical reasons for each driver status group is given in Table 41. Note that in this table and throughout the remainder of this report, information failure refers specifically to lack of information about the target, rather than surrounding conditions.

TABLE 41

Critical Reason by Driver Status for Culpable Drivers

Critical Reason	DWI		HDB		Normal		Drinker	
	N	%	N	%	N	%	N	%
Tracking Error	1169	72.7	676	53.8	991	62.1	1845	64.4
Primary Control Failure	187	11.6	245	19.5	114	7.1	432	15.1
Induced Control Failure	45	2.8	98	7.8	187	11.7	143	5.0
Information Failure or Induced Control Failure	81	5.0	48	3.8	62	3.9	129	4.5
External Influence (Other*)	22	1.4	42	3.3	55	3.4	64	2.2
External Influence (Target)	9	0.6	19	1.5	54	3.4	28	1.0
Vehicle Breakdown	18	1.1	34	2.7	68	4.3	52	1.8
Driver Breakdown	24	1.5	56	4.5	6	0.4	80	2.8
Other	52	3.2	38	3.0	60	3.8	90	3.1
TOTAL	1607	100.0	1256	100.0	1597	100.0	2863	100.0

*Pedestrian, bicycle, train, animal, on non-collision vehicle.

The results show that 64 percent of the culpable drinkers' involvements were due to tracking errors, fifteen percent were due to primary control failures, and five percent were due to induced control failures.

The drinkers were compared to the nondrinkers, and the differences were statistically significant ($X_8^2 = 210.04$). Clearly, however, the incidence of tracking errors did not contribute heavily to the drinker-nondrinker difference.

Differences were found regarding control failures. Specifically, the drinkers were more likely to have had primary control failures, while the nondrinkers were more likely to have had induced (slippery road effect) control failures ($X_1^2 = 116.80$). Note that this chi-square value accounts for over half the overall value. This agrees well with earlier findings that drinkers had fewer accidents on ice or snow covered roads.

Another contrast is between driver and vehicle breakdowns. Whereas the nondrinkers had relatively more vehicle breakdowns, the drinkers had more driver breakdowns ($X_1^2 = 53.74$). While this may reflect more successful claims of vehicle breakdowns by the nondrinkers, the overrepresentation of driver breakdowns for the drinkers is quite likely. Typically, driver breakdowns were coded on the basis of police reported blackouts or falling asleep.

The DWI versus HBD comparison was also statistically significant ($X_8^2 = 156.65$). Here, there was a large difference regarding tracking errors: 73 percent for the DWI's and 54 percent for the HBD's. Conversely, the HBD's had relatively more primary and induced control failures. Contrasting these "pure" control failures to the tracking errors yielded a chi-square (df = 1) of 95.24, the major part of the overall DWI versus HBD value.

Other differences between the DWI's and the HBD's were higher proportions of responses to external influences and, somewhat surprisingly, more driver breakdowns for the HBD's.

Finally, it can be noted that while the DWI's and the nondrinkers can be expected, on the average, to represent the extremes of the impairment continuum, the DWI-HBD-normal ordering did not exist for several of the critical reasons. For example, tracking errors were most frequent for the DWI's and least frequent for the HBD's. Primary control failures and driver breakdowns were similar in that both were most frequent among the HBD's, and least frequent among the normals; in these two instances, the DWI's looked more like the nondrinkers than the HBD's did.

Summarizing the critical reasons, the drinkers were troubled most by tracking errors and primary control failures. In comparison to the nondrinkers, they had more primary control failures and driver breakdowns, but fewer induced control failures. In comparing the DWI's and the HBD's, the DWI's had more tracking errors, but fewer driver breakdowns and control failures (primary and induced).

The Accident Configuration

The accident configuration consists of two components: the accident alignment and the critical event. The accident alignment is a composite variable reflecting the subject vehicle's path, the target's location and its path relative to that of the subject. The accident alignment describes the relationship of the subject vehicle and the target immediately before the situation became critical.

The critical event is that behavior of each accident unit which most directly leads to the accident involvement. Thus, by combining the accident alignment and the critical event, the resultant accident configuration describes the relationships among the accident units and the behavior of the subject vehicle which elicited its involvement in the accident.

The construction of the various accident configurations was a three step procedure. First, all combinations of the subject path, the target location, and the target path were analyzed to determine those which occurred with the highest frequencies. Using a two percent cutoff, eight accident alignments were defined. The same procedure was followed to determine the most frequently occurring critical events. Finally, this same method was used in analyzing all combinations of accident alignments and critical events. The result was nine accident configurations. They accounted for 80 percent of the culpable drinkers' involvements and 72 percent of the culpable nondrinkers' accident involvements. The configurations are defined in Table 42. Explanations and examples follow.

Class R accidents involve a vehicle moving forward on a straight or curved path. The target is stationary and located to the front of the subject vehicle and to the side of its path. The accident is precipitated by a lateral movement of the subject vehicle. (Lateral moves do not include attempted turning maneuvers). Class R accidents are typically run-off-road accidents (the basis for the Class R designation), but may, for example, include striking a parked vehicle which was not in the subject's path prior to the critical lateral move.

Rear end accidents involve a subject vehicle moving ahead on a straight or curved path. The target is ahead of the subject in the same path and is either moving forward or is temporarily stopped. (The designation "stationary", as applied to Class R targets, implies no imminent motion; examples are a parked vehicle, an inanimate object, or the road edge.) If the target is temporarily stopped, as in many rear end accidents, the target path is specified as the direction in which it is headed. Rear end accidents are precipitated by the continued motion of the subject vehicle. The rear end configuration does not include tailgating accidents where a deceleration by the lead vehicle is sufficient to immediately impose upon the following vehicle.

TABLE 42

Components of Accident Configurations

	Configuration Designation	Subject Path	Target Location	Target Path	Critical Event
1.	Class R	Forward	Front-Side	Stationary	Lateral Move
2.	Rear End	Forward	Forward	Same	Continue
3.	Stationary Target Ahead (STA)	Forward	Forward	Stationary	Continue
4.	Intersecting Path-Continue (IP-C)	Forward	Front-Side	Intersecting	Continue
5.	Intersecting Path - Start (IP-S)	Motion Imminent	Front-Side	Intersecting	Start
6.	Parallel Opposite - Lateral Move (PO-LM)	Forward	Left-Front	Parallel but Opposite	Lateral Move
7.	Parallel Opposite - Left Turn (PO-LT)	Forward	Left-Front	Parallel but Opposite	Left Turn
8.	Parallel Same - Lateral Move (PS-LM)	Forward	Side	Parallel and Same	Lateral Move
9.	Rearward	Rear	Rear or Rear Side	Stationary or Intersecting	Continue

Stationary target ahead accidents are quite similar to rear end accidents. The only difference is that the target is stationary; that is, motion is not imminent. Examples include continuing on a collision course with a parked vehicle which was in the subject's path before the situation became critical, and a road departure at a dead end road or T intersection.

The next configuration is an intersecting path-continue accident. Here, the subject vehicle is moving forward on a straight or curved path and is on a collision course with a target to the left-front moving right or to the right-front moving left. Both vehicles continue until a collision occurs. These are usually intersection accidents.

The intersecting path-start configuration is similar to the intersecting path-continue accident described above, but in the intersecting path-start configuration the subject vehicle has stopped and then precipitates the accident by starting. This typically represents an intersection accident where the subject vehicle had stopped for a traffic sign, or signal, prior to proceeding into cross traffic.

The next configuration, parallel opposite-lateral move, involves a subject vehicle moving forward on a straight or curved path and a target on an adjacent parallel path headed in the opposite direction. The accident is precipitated by a lateral move into the path of the approaching target or directly into the target itself. An example of a parallel opposite-lateral move accident is crossing the centerline to strike an oncoming vehicle.

The next configuration is a parallel opposite-left turn accident. This configuration differs from the parallel opposite-lateral move accident in that the parallel opposite-left turn accident results from a left turn at an intersection, rather than a mere deviation of the subject vehicle from its path.

The next configuration is a parallel same-lateral move. Again, the target and the subject have parallel paths; here, however, they are moving in the same direction. In the parallel same-lateral move configuration, the target is directly to either side of the subject vehicle before the situation becomes critical; that is, there is a longitudinal overlap between the subject and the target. The accident is precipitated by the subject's lateral move.* An example of a parallel same-lateral move accident is attempting a premature return to one's original lane after passing.

The rearward accident completes the list of the most frequent configurations. Here, the subject vehicle is moving to the rear and simply continues to do so. The target is either stationary or is moving on a path which intersects with that of the subject. Examples include parking lot accidents and backing out of a driveway into cross traffic. This configuration does not include those accidents in which the subject vehicle was stopped with motion imminent and then immediately precipitated a collision by starting to the rear.

Table 43 contains the frequencies and relative frequencies of the accident configurations for each of the driver status groups. It shows that the most frequent configuration for the culpable drinkers was the Class R accident, accounting for 42 percent of their involvements. Fourteen percent of the drinkers' accidents were rear end collisions. Following that were stationary object ahead (8%) and parallel opposite-lateral move (7%). Each of the remaining configurations constituted less than five percent of the accidents; in order of decreasing frequency they were: intersecting path-continue (4%), parallel opposite-left turn (3%), rearward (2%), parallel same-lateral move (2%) and intersecting path-start (1%).

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* Because of the lack of detail in police reports it is sometimes impossible in this accident alignment to distinguish between lateral moves and intended turns into an intersecting driveway. When differentiating information was unavailable, the behavior was coded as a lateral move.

TABLE 43

Accident Configurations by Driver Status for Culpable Drivers

Configuration	DWI N	DWI %	HBD N	HBD %	Normal N	Normal %	Drinker N	Drinker %
1. Class R	586	36.5	609	48.5	289	18.1	1195	41.7
2. Rear End	247	15.4	150	11.9	285	17.8	397	13.9
3. Stationary Target Ahead	156	9.7	62	4.9	65	4.1	218	7.6
4. Intersecting Path -Continue	81	5.0	35	2.8	136	8.5	116	4.1
5. Intersecting Path -Start	10	0.6	11	0.9	104	6.5	21	0.7
6. Parallel Opposite -Lateral Move	129	8.0	60	4.8	83	5.2	189	6.6
7. Parallel Opposite -Left Turn	42	2.6	30	2.4	94	5.9	72	2.5
8. Parallel Same -Lateral Move	23	1.4	20	1.6	37	2.3	43	1.5
9. Rearward	14	0.9	33	2.6	51	3.2	47	1.6
10. Other	319	19.9	246	19.6	453	28.4	565	19.7
Total	1607	100.0	1256	100.0	1597	100.0	2863	100.0

In comparing the drinkers and normals, the overall difference was significant (X_9^2 = 444.55). Similarly, there was a significant difference between the DWI's and the HBD's (X_9^2 = 85.73). The largest difference between the normals and drinkers was with regard to Class R accidents.

Regarding row two, the author had often speculated that rear end accidents, being one of the more inane types of accidents, must surely be due to drinking drivers. The data do not support this speculation. Indeed such involvements by HBD's were less than two-thirds that of the normals. Even if one chose to examine the data after removing Class R accidents, these rear end accidents would have accounted for 24 percent of the nondrinkers accidents and 26 percent for the drinkers. Again, this is hardly an indictment of the drinkers.

There is an interesting comparison between rows six and seven. In both instances, the target was to the left front traveling in a parallel but opposite direction. In row six, the critical event was a lateral move which can usually be considered, in this type of configuration, to be inadvertent; the drinkers were slightly more often involved this way in comparison to the normals. However, when the critical event was a left turn, a planned maneuver, the drinkers were considerably less often involved than the normals.

Another direct comparison is that between rows four and five. Both involve targets on intersecting paths, and both occurred more frequently for the normals (15%) than the drinkers (5%). When the vehicle merely continued along a collision course, the drinkers had a relative frequency near one-half that of the normals. In contrast, when the vehicle had first stopped, then started, the drinkers had a relative frequency near one-tenth that of the normals.

In comparing the DWI's to the HBD's, the primary difference was the greater proportion of Class R accidents for the HBD's. HBD's were also more frequently involved in rearward accidents than were the drivers charged with DWI. On the other hand, the DWI's generated rear end, stationary target ahead, intersecting path-continue, and parallel opposite-lateral move accidents more often.

It is well to note that whereas the drivers undoubtedly were increasingly impaired from normal to HBD to DWI, as with the critical reasons, their accident configuration frequencies often failed to reflect this ordering. That is, the DWI's sometimes looked more like the normals than did the HBD's. This was most notably true for Class R and rear end accidents. For the Class R accidents, the non-drinkers were low with eighteen percent, but the DWI's were lower than the HBD's by twelve percent. Similarly, the nondrinkers and the DWI's differed by only two percent regarding rear end accidents; in contrast, the nondrinkers and the HBD's differed by six percent. Thus, in terms of how accidents occur, increased impairment need not imply an increasing difference from nondrinking drivers.

As presented in Table 43, the data indicate some interesting differences, but it is difficult to see general conceptual effects, if any, implied therein. Thus, an attempt was made to reorganize the data to provide a more unified summary of the information. In order to do so, it was decided to characterize the referenced accidents in terms other than those explicitly contained in the causal structure. This was done by asking a number of questions about each of the tabulated configurations. The questions were:

1. Had the driver planned a change in activity?
   (Using intersecting path-start (IP-S) accidents - Yes)

2. Does the situation normally require increased caution?
   (IP-S - Yes)

3. Does the situation normally require a prior activity?
   (IP-S - Yes)

4. Would accident avoidance have required an interruption of current activity?
   (IP-S - No)

5. Would accident avoidance have required a change in plans implied in Item 1 above?
   (IP-S - Yes)

6. Would accident avoidance have required prior preparation?
   (IP-S - Yes)

These questions were designed to inquire into the active/passive nature of the situations, the demands placed upon the drivers, and whether the driver could have been alerted by the nature of the situation; this, in ways allowing answers on the basis of the causal structure. Note that the questions were designed to obtain the dichotomous answers: yes or no.

The following is a specification, with rationale, of answers to the six questions for each of the nine accident configurations. For readers primarily interested in the general findings, this discussion can be treated as a footnote.

Parallel Opposite-Left Turn: Here a left turn was planned; it required a deceleration; increased caution is generally required for intersection path changes; accident avoidance would have required scanning for moving vehicles, further deceleration or stopping, and delaying the planned turn.

Rearward: Stopping (before proceeding forward) was planned; there was a prior start-backward; the need for increased caution is generally recognized when backing; accident avoidance would have required scanning to the rear, and interruption of rearward travel. (This would have preceded the planned stop).

Intersecting Path-Start: A start was planned after a prior stop; increased caution was required for starting in traffic and at intersections; avoidance would have required scanning for other vehicles or delaying the planned start; no interruption of current action would have been required since the vehicle was stopped.

Intersecting Path-Continue: While the involvement was due to proceeding along a collision course (usually into an intersection), the intention of the driver may have been to go straight ahead or to turn -- the latter would have required a prior deceleration; that the driver was culpable in an intersection-type accident implies he did not have the right of way and that increased caution would have been normal; accident avoidance would have required scanning for other vehicles, deceleration or stopping, and, if turning were planned, a delay of plans would have been required.

Rear End: No change was planned nor prior activity involved (usually); increased caution might have been indicated if the situation was, for example, a busy intersection; accident avoidance would have required increased attention and deceleration or stopping.

Stationary Target Ahead: This is similar to the above situation, except that since the driver was generally unaware of the target until it was too late; there was no particular reason in his mind for increased caution.

Parallel Same-Lateral Move: If the move was inadvertent, the characterization is the same as that below. If the move was the initial part of a lane change, then there was a planned change, usually involving some increase in caution; accident avoidance would have required scanning for other vehicles and a delay in the planned lane change; current behavior (going straight ahead) would have been maintained.

Class R: Since the desired behavior was normally to maintain the current path, there was no planned change, prior activity, nor increase in caution; avoidance would have required continuation of current activity only.

<u>Parallel Opposite-Lateral Move:</u> Same as above.

In order to best organize the data, an attempt was made to order the configurations and the questions so that in terms of the answers to the questions, similar configurations were near each other and similar questions were near each other. That is, while ignoring the nature of the accident, questions with similar answers were placed together; then, while ignoring the nature of the question, configurations with similar answers were placed together. This approach was quite like that originally used in Gutmann scaling (Torgerson, 1958). The results appear in Table 44.

It can first be seen that aside from a few deviations, the data could be so arranged that positive and negative answers clustered and were separate from each other. The positive answers clustered to the top and right, while the negatives were toward the bottom and left. This has several implications. First, the questions, taken together, were able to discriminate the accident types. The accidents near the top of the table had the greatest frequency of affirmative answers, implying the driver was actively involved in his driving and decisions related thereto. Accidents near the bottom of the table, on the other hand, were those in which few active demands were placed upon the driver. The drivers reflected in the table, then, can be viewed as residing on an active/passive continuum.

The last two columns in the table contain values duplicated from the previous table; they give the distributions of configurations for the normal and the drinking culpable drivers. Comparison of the percentages show that toward the top of the table the accident types were overrepresented for the normals; toward the bottom, the accidents were overrepresented for the drinkers. In other words, accidents in which the driver was mentally and/or physically active were underrepresented among the drinkers in comparison to the normals;

TABLE 44

Characterization and Ordering of Accident Configuration

Configuration/Critical Event	Planned Change	Prior Activity	Increased Caution	Interrupt Behavior for Avoidance	Prior Preparation for Avoidance	Change Planned Activity for Avoidance	Percent Configuration Normal	Percent Configuration Drinker
Parallel Opposite-Left Turn	*	*	*	*	*	*	5.9	2.5
Rearward	*	*	*	*	*	*	3.2	1.6
Intersecting Path-Start	*	*	*	.	*	*	6.5	0.7
Intersecting Path-Continue	?	?	*	*	*	?	8.5	4.1
Rear End	.	.	?	*	*	-	17.8	13.9
Stationary Target Ahead	.	.	.	*	*	-	4.1	7.6
Parallel Same-Lateral Move	?	.	?	.	?	?	2.3	1.5
Class R	.	.	.	.	.	.	18.1	41.7
Parallel Opposite-Lateral Move	.	.	.	.	.	.	5.2	6.6

Legend: * - Yes
. - No
? - Depends on specific situation
- - Not applicable

those in which the driver was passive were overrepresented among the drinkers. The only configuration which apparently deviated from this pattern was the parallel same-lateral move. The preponderance of question marks here, however, precludes importance of the deviation.

In considering these findings, it is important to remember that they represent the problems of drinking drivers as weighted by exposure to the problems. Thus, the propensity of drinkers to the more passive condition accidents where demands upon them were low was the result of the combined effects of accident susceptibility and exposure.

These results show drinking drivers to have more often initiated accidents in passive ways in low demand conditions. Earlier, it had been shown that the situations which were overrepresented for drinkers had rural characteristics. These findings suggest a basic question. Recognizing that rural roads are less likely to place specific demands on drivers, were drinkers' accidents more often rural because they had low demand accidents, or were drinkers' accidents more often of a low demand type because they were rural? The analysis in Table 45 is an attempt to resolve this issue.

In the table, accident configurations are crossed with location for drinking and nondrinking drivers. The right-hand part of the table gives the proportion of the drivers who were drinking within each configuration by location combination. The nine accident configurations are ranked from high demand to low demand using the order developed above.

There are some irregularities in the table; for example, the erratic proportions for intersecting path-start accidents. Nonetheless, the table does serve to answer the question at hand. Looking within each of the three right hand columns, there is a definite trend toward increasing representation of the drinking driver for the passive involvement accidents.

TABLE 45

Drinking Status as a Function of Accident Type and Location

Accident Configuration	Drinkers			Normals			Proportion* Drinkers (%)		
	Urban	Sub.	Rural	Urban	Sub.	Rural	Urban	Sub.	Rural
Parallel Opposite - Left Turn	20	40	12	34	42	18	37.0	48.8	40.0
Rearward	20	15	12	31	11	9	39.2	57.7	57.1
Intersecting Path - Start	5	11	5	48	29	27	9.4	27.5	15.6
Intersecting Path - Continue	46	46	24	63	42	31	42.2	52.3	43.6
Rear End	147	175	75	120	106	59	55.1	62.3	56.0
Stationary Target Ahead	126	64	28	38	21	6	76.8	75.3	82.4
Parallel Same - Lateral Move	17	13	13	19	12	6	47.2	52.0	68.4
Class R	264	409	522	90	85	114	74.6	82.8	82.1
Parallel Opposite - Lateral Move	56	77	56	24	31	28	70.0	71.3	66.7

*These proportions were not corrected for sampling fractions and should not be used for population estimates.

Regarding location effects, the results were not quite so obvious, but it can be seen that the higher proportions of drinkers occurred in both suburban and rural accidents for almost all configurations. Be that as it may, the primary point here is that when location was held constant, the increasing propensity of drinkers for passive accident involvements was apparent.

In order to objectify this, correlation coefficients were computed for the proportion of drinkers versus accident configuration. To accomplish this, the values one, two, etc. were assigned to the ordered configurations. (While the imposition of interval status upon ordinal data is not wholly justified, the resultant correlation coefficients will, if anything, be conservative.) In order to remove the effect of location, three coefficients were obtained; one within each location. The results gave correlations for urban, suburban, and rural accidents of .73, .66, and .69, respectively. Squaring these values gives .54, .43, and .48, showing that approximately one-half of the variation in the proportion of drivers who were drinkers was accounted for by the high-demand/low-demand dimension; this, after the effects of location had been removed.

In order to measure the effects of location, a correlation ratio (η) was calculated for the proportion of drinkers as a function of location. The correlation ratio will tend to give high values compared to the correlation coefficient in that it involves "predictions" based on location means rather than from a best fitting line. Nonetheless, the value of the correlation ratio was .19. Only four percent ($\eta^2 = .1938^2 = .0376$) of the variation in the proportion of drivers who were drinkers was accounted for by location.

Thus, although the effect of the high-low demand dimension on the proportion of drinkers was measured conservatively and the effect of location on the proportion was measured liberally, the results show that, of the two, of the high-low demand dimension was the dominant factor.

Of some interest here is laboratory research done by Moskowitz (1971) showing split attention tasks are seriously degraded by alcohol. The apparent implication is that drinking drivers can be expected to have increased risk in complex situations. Yet the findings of the current study suggest increased risk in low demand situations. These views can be reconciled in terms of perceived risk. That is, in situations where perceived risk is low, the drinking driver might well respond by increasing his attention to nondriving factors. Under these circumstances, the result is a self-induced split attention task. This effect would bridge the gap between low demand and split attention, allowing the latter to at least partly explain high risk in low demand situations.

Summary of Accident Configurations

Nine accident configurations were defined in terms of the accident alignment and the critical event as they were specified for the culpable driver. Class R accidents were predominant for the drinkers, particularly for the HBD's. The drinkers had far more Class R accidents than did the nondrinkers. The next most frequent involvements for the drinkers were rear end accidents, intersecting path-continue, and parallel opposite-lateral move.

In comparing parallel opposite alignments for drinkers versus nondrinkers, the drinkers precipitated somewhat more accidents by lateral moves, but they generated considerably fewer by left turns. Similarly, a drinker-nondrinker comparison of intersecting path alignments showed the drinkers to have far fewer accidents in which they had stopped before proceeding into cross traffic. The results also showed that the expected normal-HBD-DWI ordering of configuration proportions was notably violated for three configurations.

In a separate analysis, it was found that, in comparison to nondrinkers, the drinkers tended to be more often involved in accidents whose configuations reflected low demands upon the driver. Finally, it was shown that this result could not be accounted for by accident location.

Context Factors

In the following, each of the nine major accident configurations is discussed separately. Background information is given for culpable drinkers' involvements; it includes the target, the behavior of the target if it was a motor vehicle, and the prior event and critical reason for the subject vehicle (i.e., the culpable drinker).

Following this background material, statistically determined drinking effects associated with several context factors are presented for each accident configuration. The context factors are accident location, road curvature, number of lanes, road surface condition, day versus night, roadway lighting for nighttime accidents, driver sex, driver age, and vehicle type.

It was originally planned to study context factors for accident configurations combined with specific critical reasons. This was limited, however, for either of two reasons. First, for many of the accident configurations, one critical reason was so predominant that the analysis of the configuration/critical reason combination gave essentially the same results as the analysis of the configuration alone. Second, the number of accidents in a configuration/critical reason group was often too small to allow meaningful analysis.

To minimize these problems, context variables were analyzed for selected critical reasons using two or three accident configurations at a time. Finally, certain critical reasons (primary control failures, induced control failures, and driver breakdowns), whose nature was thought to be relatively stable over configurations, were analyzed for all accidents.

Because the number of accidents for some of the accident configurations were limited, no differentiation was made between HBD's and DWI's. In the 4,460 accidents, 2,863 of culpable drivers were drinkers and 1,597 were classified as nondrinkers. The reader is reminded that the original sample included all accidents involving drinkers and one-ninth of those that did not. Where noted, adjustments were made for the differential sampling fractions.

It should be noted that, although these results will hopefully lend a better understanding of drinkers' underlying accident problems, the primary aim here is to delineate those context factors which are problematic to drinkers. Thus, the following results and related discussions are mostly descriptive, rather than inductive, in nature.

Class R Accidents

Class R accidents were defined as those in which the culpable vehicle was traveling ahead on a straight or curve path; the target was stationary and located toward the front and to the side (either right or left); the accident was precipitated by a lateral movement from the original path. (A lateral move reflects a change in path for which no intention to turn or change lanes is discernible.) Class R accidents can include run-off-road accidents, from which the "Class R" derives, and accidents in which the target was a parked vehicle. Altogether, the culpable drinkers had 1,195 Class R accidents; this constituted 42 percent of all the culpable drinkers' accidents and was, by far, their most frequent accident configuration. In contrast, Class R accidents constituted only eighteen percent of the culpable non-drinkers' accidents.

Of the 1,195 Class R accidents for culpable drinkers, the target was a road departure in 1,009 (84%). In 152 (13%), the target was a parked vehicle. There were three Class R accidents in which a stationary bicycle or pedestrian was the target. Finally, there were 31 such accidents in which the target was another object or was unknown.

The prior event is the behavior of the subject vehicle which precedes the critical event and may set the scene for the accident. It was coded in order to provide a more complete picture of the accident generation process. In the Class R accidents, 1,143 (96%) of the drinkers had no prior event. Of the prior events which were noted, the major ones were fourteen lane changes, twelve decelerations, and twelve lateral moves.*

Earlier, in the discussion of critical reasons, tracking errors were introduced as consisting of information failures and undifferentiated information failure and primary control failures. Thus, tracking errors include the driver's failure to recognize his desired path and/or lapses in vehicle guidance. At this point, two types of tracking errors can be recognized. A lateral tracking error is one which results in a lateral move; this is the type which can be applicable in Class R accidents. Lateral tracking errors can be contrasted with longitudinal tracking errors, where vehicles were allowed to continue too far along their original path. This will be discussed later as the need arises. Regarding Class R accidents, lateral tracking errors accounted for 45 percent of the culpable drinker's involvements.

A primary control failure, when specified singly, reflects some indication in the police report that the critical event resulted from the driver losing control of the vehicle rather than merely a lapse of control. The vehicular movements constituting a primary control failure are typically larger in magnitude than those associated with tracking errors. Twenty-seven percent of the drinkers' Class R accidents involved primary control failures.** Other critical reasons were induced control failures (9%) and driver breakdowns (5%).

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* The prior event, like the critical event, involves only overt behaviors of the subject vehicle. As such, it does not reflect behaviors of the driver which are not manifested in vehicular movements. In spite of this, it is likely that prior events, particularly in single vehicle accidents, are underrepresented in police data. When no prior behavior of consequence was noted, this was recorded as "no prior event".

** In some accidents, primary control failures may have resulted from earlier information failures. For example, a driver failing to recognize a curve ahead may enter it at too high a speed and then experience a primary control failure. In the coding of the accident description, the latter is associated with the critical event. If the initial information failure were known to the analyst, it would be associated with the prior event.

Next, Class R accidents were examined in terms of the context in which they occurred. The context variables include general location, road curvature, number of road lanes, road surface condition, time of day, road lighting, driver sex, driver age, and vehicle type. The results for all context variables are given in Table 46. Background results for all accidents, irrespective of accident configuration, appear in Appendix F.

- Accident Location - The culpable drinkers had the largest portion of their Class R accidents on rural roads (44%), and fewest on city streets (22%); approximately one-third (34%) occurred in suburban areas. This result, of course, is influenced by the distribution of city, suburban, and rural areas in the data collection area. By contrasting the culpable drinkers with the culpable nondrinkers, this influence can be minimized. In so doing, it was found that the drinkers had fewer (9%) Class R accidents in the cities, and more in the suburbs and rural areas (5 and 4 percent, respectively*). These differences are shown in Table 46 under the heading of simple effects. The relative magnitude of these percentages is also reflected in the proportion of drivers in each location who were drinkers (the computation of these values was adjusted for the sampling fractions.) The lowest proportion occurred in the city accidents (25%), and the highest in suburban accidents (35%), closely followed by rural accidents (34%).

The data show that while the drinkers had more of their Class R accidents in rural areas than in other areas, so did the nondrinkers. But since the nondrinkers had the smallest proportion of their Class R accidents in the suburbs, the relative overrepresentation of drinkers was slightly greater in suburban accidents.

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* Each value represents a difference in proportions between drinkers and nondrinkers; this, as opposed to a percentage change in proportions. That is, the value is $P_D - P_N$, not $(P_D - P_N)/P_N$. This method was used to avoid the excessively large values of $(P_D - P_N)/P_N$ which can result when P_N is small.

The analysis was carried further to measure two components of each simple effect. For example, while the drinkers had five percent more Class R accidents in the suburbs when compared to the nondrinkers, it is possible that this reflects a general propensity by drinkers for suburban accidents, irrespective of the accident configuration. Such general effects were calculated in Appendix F, and are listed in Table 46. It shows a small, general, suburban accident propensity for drinkers; that is, when considering all accidents, the drinkers had four percent more suburban accidents than did the nondrinkers. Finally, the table includes a specific effect, or the effect of drinkers versus nondrinkers on accident location for Class R accidents after adjusting for the general effect of drinkers versus nondrinkers on accident location for all accidents; it was computed as the simple effect minus the general effect. The resultant value specific to Class R accidents was only a one percent overrepresentation of suburban areas.* This procedure, then allows for the determination of two components of the simple comparative representation of accident location for drinkers versus nondrinkers. The first component reflects propensities associated with accidents in general, while the second component measures propensities specific to Class R accidents. In the above example, the five percent simple effect consisted of a four percent general effect and a one percent specific effect. This suggests that countermeasures to Class R drinking accidents in the suburbs would be better directed toward the general suburban accident problem for drinkers than toward Class R accidents in particular.

Because of the construction of the drinker effects, no distortion of the results is incurred if the effects within tabulated columns are added together. Thus, there were nine percent more suburban and rural accidents

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* Summing values over effects (simple, general, specific) or over context factor levels (e.g., cities, suburbs, rural) will yield a total of zero except for possible deviations due to rounding errors.

TABLE 46

Context Factors for Class R Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	264	22.1	90	31.1	24.6	-9	-11	2
Suburbs	409	34.2	85	29.4	34.8	5	4	1
Rural	522	43.7	114	39.4	33.7	4	7	-3
Total	1195	100.0	289	100.0				
		$X_2^2 = 10.58$ (S)						
Road Curvature								
Straight	693	67.0	162	68.1	32.2	-1	-12	10
Curve	342	33.0	76	31.9	33.3	1	12	-10
Total	1035	100.0	238	100.0				
		$X_1^2 = 0.11$ (NS)						
No. of Lanes								
Two Lane	829	86.9	170	81.7	35.1	5	7	-2
Multilane	125	13.1	38	18.3	26.8	-5	-7	2
Total	954	100.0	208	100.0				
		$X_1^2 = 3.78$ (NS)						
Road Condition								
Dry	796	67.9	146	51.8	37.7	16	8	8
Wet	278	23.7	71	25.2	30.3	-1	1	-3
Ice/Snow	99	8.4	65	23.0	14.5	-15	-9	-5
Total	1173	100.0	282	100.0				
		$X_2^2 = 52.35$ (S)						
Time of Day								
Day	161	13.9	124	45.4	12.6	-32	-43	12
Night	1000	86.1	149	54.6	42.7	32	43	-12
Total	1161	100.0	273	100.0				
		$X_1^2 = 138.19$ (S)						
Lighting								
Lighted	365	44.8	42	38.5	49.1	6	-6	13
Not Lighted	449	55.2	67	61.5	42.7	-6	6	-13
Total	814	100.0	109	100.0				
		$X_1^2 = 1.55$ (NS)						

TABLE 46 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Driver Sex								
Male	1073	89.9	222	76.8	34.9	13	17	-4
Female	120	10.1	67	23.2	16.6	-13	-17	4
Total	1193	100.0	289	100.0				
		X^2_1 = 36.35(S)						
Driver Age								
-16	10	0.8	12	4.2	8.5	-3	-2	-1
17-18	126	10.6	40	13.9	25.9	-3	-5	2
19-20	162	13.7	47	16.3	27.7	-3	-1	-2
21-25	258	21.8	58	20.1	33.1	2	3	-1
26-35	268	22.6	58	20.1	33.9	2	2	0
36-55	292	24.6	54	18.8	37.5	6	7	-1
56-65	58	4.9	11	3.8	36.9	1	0	1
66-	11	0.9	8	2.8	13.3	-2	-4	3
Total	1185	100.0	288					
		X^2_7 = 31.52(S)						
Vehicle Type								
Auto	1070	91.8	259	91.8	31.5	0	3	-3
Light Truck	90	7.7	6	2.1	62.5	6	1	4
Heavy Truck	5	0.4	17	6.0	3.2	-6	-4	-1
Total	1165	100.0	282	100.0				
		X^2_2 = 57.54(S)						

for drinkers than for nondrinkers. This simple effect was, in essence, wholly associated with general accident effects.

- Road Curvature - The culpable drinkers had 33 percent of their Class R accidents on curved roads. The nondrinking culpable drivers had 32 percent on curved roads. The difference was not statistically significant.* However, it should be noted that when considering all accidents, the proportion on curves was twelve percent higher for the drinkers. Controlling for these general effects, it can be seen that there was an underrepresentation of curves for drinkers which was specific to Class R accidents.

Thus, the simple drinker effect upon road alignment was negligible. However, after adjusting for the large general propensity for drinkers to have their accidents on curves, there was an overrepresentation of drinkers on straight roads (this is equivalent to an underrepresentation on curves) which was specific to Class R accidents.

- Number of Lanes - Because of restrictions in the data, the number of road lanes could be reliably discerned only for nonintersection accidents. The results show that the drinkers had 87 percent of their Class R accidents on two lane roads and thirteen percent on multilane roads. The contrasting figures for nondrinking drivers were not significantly different (82 and 18%, respectively). The observed overrepresentation of two lane roads (5%) was closely associated with general effects, rather than with effects specific to Class R accidents.

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* All testing of simple effects was conducted at the .05 level for two-sided hypotheses. Unless otherwise noted, chi-square tests were used. The reader is warned that due to the large number of tests performed, there is considerable opportunity for Type I error. Results which are not significant should be viewed as such; significant differences, however, are best viewed as passing a screening device, rather than being necessarily "real".

- Road Condition - The drinkers had most of their Class R accidents on dry roads (68%). They had 24 percent on wet roads and eight percent on roads covered with ice or snow. The distribution was significantly different for nondrinkers. Their relative frequencies were: dry - 52 percent, wet - 25 percent, and ice/snow - 23 percent. Thus, in comparing the drinkers to the nondrinkers, there was a 16 percent overrepresentation of dry roads and a 15 percent underrepresentation of ice or snow covered roads; there was no essential difference regarding wet roads. This ordering, of necessity, is also reflected in the decreasing proportion of drivers who were drinkers from dry, to wet, to wintry conditions.

The overrepresentation of drinkers on dry roads was equally attributable to general accident effects and specific Class R effects. Thus, in theory, a reduction in the dry road, Class R problem could be derived by both general dry road and specific dry road/Class R remedies.

- Time of Day - The majority of Class R, drinker accidents occurred at night (86%). In contrast, the nondrinkers had 55 percent of their Class R accidents at night. Thus, the drinkers were 32 percent more likely to have their Class R accidents in the nighttime. However, when considering all accidents, the drinkers had 43 percent more of their accidents at night. That is, nighttime Class R accidents reflect the general nighttime, drinker accident problem. As a result, the specific effect of drinking on Class R accidents was a 12 percent reduction at night. Clearly, the primary emphasis regarding Class R accidents by drinkers at night, should be devoted more to the nighttime aspect of drinkers' accidents, than to their "Class R-ness".

- Lighting - This analysis applies only to nighttime accidents. Of those culpable Class R accident involvements by drinkers where roadway lighting was known, 45 percent were on lighted roads. For nondrinkers, 39 percent were on lighted roads. Comparing the two percentages, a six percent overrepresentation of lighted roads was found for drinkers in Class R accidents; however, it was not statistically significant.

Nonetheless, a consideration of specific effects is of some value. This is because the simple overrepresentation of lighted roads occurred despite the fact that lighted roads were underrepresented when all accidents were considered. The result is a thirteen percent overrepresentation of lighted roads specific to Class R accidents.

- Driver Sex - Males constituted 90 percent of the drinkers in Class R accidents, but only 77 percent of the nondrinkers. This simple effect (13%) was more than accounted for by the (17%) overrepresentation of males in all of the drinkers' accidents.

- Driver Age - Drinkers in Class R accidents were overrepresented in the 21 to 65 age groups, and particularly so in the 36 to 55 group. This statement is also true when considering all accidents. Thus, remedial action would be best directed toward the 36 to 55 year old drinking drivers in terms of general accident problems rather than those specific to Class R accidents.

- Vehicle Type - Ninety-two percent of the drinkers in Class R accidents were driving automobiles. This was also true for the nondrinkers. The significant interaction between vehicle type and driver status was wholly accounted for by differences between light and heavy trucks ($X_1^2 = 57.53$). The simple effects show that in comparing drinkers and nondrinkers, light trucks were overrepresented among the drinkers in Class R accidents. This was primarily attributed to effects specific to Class R accidents.

Table 47 summarizes accident context factors which were overrepresented for drinking versus nondrinking culpable drivers in Class R accidents.

TABLE 47

Summary of Context Factors for Class R Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Class R Accidents	Both
Suburban and rural	X		
Dry roads			X
Nighttime	X		
Male drivers	X		
Ages 36 to 55	X		
Light trucks		X	
Other Large Specific Overrepresentations			
Straight roads			
Daytime			
Lighted roads			

Thus, major simple overrepresentations for drinkers in Class R accidents occurred for suburban and rural areas, dry roads, nighttime, male drivers and drivers in the 36 to 55 age group. Major overrepresented context factors specific to Class R accidents were dry roads, light trucks, straight roads, daytime accidents and among nighttime accidents, those occurring on lighted roads.

Class R Accidents With Lateral Tracking Errors

The subset of Class R accidents in which the critical reason was a lateral tracking error was analyzed separately. There were 538 drinkers in this group which constitutes nineteen percent of all culpable drinkers. Context factors were analyzed in Table 48. Note that general effects still pertain to all accidents rather than all Class R accidents.

The results of this analysis and those which follow are explicitly discussed only if (1) the simple effects were statistically significant, (2) the specific effects were large*, or (3) there was some other noteworthy result involved. It should also be noted that primary attention is given to factors for which drinkers were overrepresented in order to identify problem areas. This is not to imply, however, that underrepresented factors are not useful in attempting to understand drinker effects.

There were no significant simple effects nor large specific effects for location, curvature, number of lanes, and vehicle type. The overrepresentation of males was due to general accident effects.

- Road Condition - While the comparison of drinkers and nondrinkers in terms of road condition was not statistically significant, dry roads were underrepresented by ten percent regarding effects specific to Class R accidents. Conversely, the combination of wet and wintry surfaces were overrepresented by ten percent.**

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* Ten percent or larger.

** The chi-square computation for these data could be questioned if it involves an expected value less than five. However, since a small expected value tends to inflate the value of chi-square, its nonsignificant status remains. This convention of accepting a "not significant" determination, even when small expected values are involved, will be followed in the remaining analyses.

TABLE 48

Context Factors for Lateral Tracking Errors in Class R Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	143	26.6	18	31.6	46.9	-5	-11	6
Suburbs	187	34.8	22	38.6	48.6	-4	4	-7
Rural	208	38.7	17	29.8	57.6	9	7	2
Total	538	100.0	57	100.0				
		$X_2^2 = 1.76$ (NS)						
Road Curvature								
Straight	318	69.9	31	72.1	53.3	-2	-12	9
Curve	137	30.1	12	27.9	55.9	2	12	-9
Total	455	100.0	43	100.0				
		$X_1^2 = 0.09$ (NS)						
No. of Lanes								
Two Lane	350	82.2	35	77.8	52.6	4	7	-3
Multilane	76	17.8	10	22.2	45.8	-4	-7	3
Total	426	100.0	45	100.0				
		$X_1^2 = 0.52$ (NS)						
Road Condition								
Dry	417	78.4	46	80.7	50.2	-2	8	-10
Wet	103	19.4	8	14.0	58.9	5	1	4
Ice/Snow	12	2.3	3	5.3	30.8	-3	-9	6
Total	532	100.0	57	100.0				
		$X_2^2 = 2.64$ (NS)						
Time of Day								
Day	68	13.0	19	33.9	28.5	-21	-43	22
Night	454	87.0	37	66.1	57.7	21	43	-22
Total	522	100.0	56	100.0				
		$X_1^2 = 17.28$ (S)						
Lighting								
Lighted	178	51.1	13	46.4	60.3	5	-6	11
Not Lighted	170	48.9	15	53.6	55.7	-5	6	-11
Total	348	100.0	28	100.0				
		$X_1^2 = 0.23$ (NS)						

TABLE 48 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	475	88.5	43	75.4	55.1	13	17	-4
Female	62	11.5	14	24.6	33.0	-13	-17	4
Total	537	100.0	57	100.0				
	$X_1^2 = 7.82$ (S)							
Driver Age								
-16	4	0.8	1	1.8	30.8	-1	-2	1
17-18	43	8.1	6	10.5	44.3	-2	-5	3
19-20	45	8.5	13	22.8	27.8	-14	-1	-13
21-25	102	19.2	9	15.8	55.7	3	3	1
26-35	132	24.9	13	22.8	53.0	2	2	0
36-55	166	31.3	11	19.3	62.9	12	7	5
56-65	31	5.8	2	3.5	63.3	2	0	2
66-	8	1.5	2	3.5	30.8	-2	-4	2
Total	531	100.0	57	100.0				
	$X_5^2 = 14.24$ (S)							
Vehicle Type								
Auto	487	92.2	53	94.6	50.0	-2	3	-5
Light Truck	39	7.4	2	3.6	68.4	4	1	3
Highway Truck	2	0.4	1	1.8	18.2	-1	-4	3
Total	528	100.0	56	100.0				
	$X_1^2 = 0.42$ (NS)							

• Time of Day - Nighttime involvements were overrepresented for drinkers in lateral tracking error, Class R accidents. However, the degree of overrepresentation was far less than that expected on the basis of accidents in general. As a result, the effect specific to these lateral tracking error, Class R accidents was a large underrepresentation of accidents at night and a complementary overrepresentation during the day.

• Light Conditions - A somewhat similar effect was found for lighting conditions in nighttime accidents. While the simple effects were not significant, they were diametrically opposed to the general effects. Hence, there was an overrepresentation of accidents on lighted roads specific to lateral tracking error, Class R accidents. It is not known whether lighted road effects derive from visual conditions or from the fact that they are usually higher volume roads.

• Driver Age - There were significant differences in driver age between the drinkers and nondrinkers in lateral tracking error Class R accidents. Ages 21 to 65 were overrepresented among the drinkers. The composite simple effect was 20 percent as compared to a composite general effect of thirteen percent. Thus, both general and specific effects contributed to the overrepresentation of this age group.

These results for lateral tracking error, Class R accidents, are summarized in Table 49.

TABLE 49

Summary of Context Factors for Lateral Tracking Error, Class R Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Class R Accidents	Both
Nighttime	X		
Males	X		
Ages 21 to 65			X
Other Large Specific Overrepresentations			
Wet and Icy or Snowy Roads			
Daytime			
Lighted Roads			

Class R Accidents With Primary Control Failures

Of all culpable drinkers, 321 (11%) were involved in Class R accidents due to primary control failures. For the nondrinkers, there were only 63 (4%). The analysis of context factors appears in Table 50.

The only significant simple effects were overrepresentations for drinkers of nighttime, males, and the 19 to 65 age group. The overrepresentation of males was wholly accounted for by general accident effects.

- Road Curvature - While the distributions of straight and curved road accident sites were virtually identical for drinkers and nondrinkers, because this was not true for accidents in general, the drinkers had an eleven percent overrepresentation of primary control failure, Class R accidents on straight roads.

TABLE 50

Context Factors for Primary Control Failures in Class R Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	63	19.6	18	28.6	28.0	-9	-11	2
Suburbs	109	34.0	17	27.0	41.6	7	4	3
Rural	149	46.4	28	44.4	37.2	2	7	-5
Total	321	100.0	63	100.0				
	$X_2^2 = 2.82$ (NS)							
Road Curvature								
Straight	159	57.6	30	57.5	37.1	0	-12	11
Curve	117	42.4	22	42.3	37.1	0	12	-11
Total	276	100.0	52	100.0				
	$X_1^2 = 0.00$ (NS)							
No. of Lanes								
Two Lane	231	91.7	39	90.7	39.7	1	7	-6
Multilane	21	8.3	4	9.3	36.8	-1	-7	6
Total	252	100.0	43	100.0				
	$X_1^2 = 0.04$ (NS)							
Road Condition								
Dry	245	77.8	50	79.4	35.3	-2	8	-9
Wet	55	17.5	11	17.5	39.7	0	1	-1
Ice/Snow	15	4.8	2	3.2	45.5	2	-9	11
Total	315	100.0	63	100.0				
	$X_2^2 = 0.31$ (NS)							
Time of Day								
Day	54	17.3	28	50.9	17.6	-34	-43	10
Night	258	82.7	27	49.1	51.5	34	43	-10
Total	312	100.0	55	100.0				
	$X_1^2 = 30.43$ (S)							
Lighting								
Lighted	91	42.5	4	22.2	71.7	20	-6	27
Not Lighted	123	57.5	14	77.8	49.4	-20	6	-27
Total	214	100.0	18	100.0				
	$X_1^2 = 2.83$ (NS)							

TABLE 50 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	296	92.2	52	82.5	38.7	10	17	-8
Female	25	7.8	11	17.5	20.2	-10	-17	8
Total	321	100.0	63	100.0				
	X_1^2 = 5.80 (S)							
Driver Age								
-16	3	0.9	7	11.1	4.5	-10	-2	-8
17-18	50	15.8	14	22.2	28.4	-6	-5	-1
19-20	57	18.0	7	11.1	47.5	7	-1	8
21-25	74	23.3	13	20.6	38.7	3	3	0
26-35	68	21.5	8	12.7	48.6	9	2	6
36-55	54	17.0	11	17.5	35.3	0	7	-8
56-65	11	3.5	1	1.6	55.0	2	0	2
66	0	0.0	2	3.2	0.0	-3	-4	1
Total	317	100.0	63	100.0				
	X_4^2 = 11.18 (S)							
Vehicle Type								
Auto	284	92.2	56	93.3	36.0	-1	3	-4
Light Truck	21	6.8	1	1.7	70.0	5	1	4
Highway Truck	3	1.0	3	5.0	10.0	-4	-4	0
Total	308	100.0	60	100.0				
	X_1^2 = 0.09 (NS)							

- Road Condition - As with road curvature, small simple effects and large general effects resulted in an overrepresentation of wintry roads specific to these accidents.

- Time of Day - There was a significant overrepresentation of primary control failure, Class R accidents at night. There was an even greater over-representation of all accidents at night. As a result, there was a specific overrepresentation of daytime accidents.

- Lighting - While the simple comparison of drinkers to nondrinkers, in terms of lighting conditions, was not significant (Note the limited number of nondrinkers.), the magnitude of the difference was large. The results show this was associated with effects specific to primary control failure, Class R accidents.

- Driver Age - Drivers in the 19 to 65 age range were overrepresented among the drinkers; there was a large underrepresentation of younger drivers. The analysis of this into general and specific components was hampered by the limited number of nondrinkers in the group and a resultant absence of orderly specific effects.

- Vehicle Type - The chi-square value for vehicle type was based on combining light and heavy trucks and was not significant. However, a Fisher test for light versus heavy trucks was significant (p=.044).* This was largely attributable to an overrepresentation of light trucks specific to the primary control failure, Class R accidents. These findings are summarized in Table 51.

TABLE 51

Summary of Context Factors for Primary Control Failure, Class R Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Class R Accidents	Both
Nighttime	X		
Males	X		
Ages 19 to 65		(Mixed)	
Light Trucks		X	
Other Large Specific Overrepresentations			
Straight Roads			
Wintry Surfaces			
Daytime			
Lighted Roads			

Class R Comparisons

The basic distributions of context factors for drinking drivers were examined for all Class R accidents and the two subsets thereof. Differences were noted for accident location, in which the lateral tracking error group had the highest incidence of accidents in the cities and the lowest incidence in rural areas. This might reflect the greater likelihood of information failures in complex city driving and a greater likelihood of control failures in higher speed, rural areas.

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* The Fisher test is responsive to the significance of interactions in a two by two table; it is not invalidated by small cell frequencies.

Regarding road alignment, the primary control failure group had the highest incidence of accidents on curves. The road condition comparison showed fewer dry road accidents and more wet, icy, or snowy road accidents for the general Class R group. This simply reflects the fact that the general Class R group includes induced control failures, while the two subgroups do not.

The lateral tracking error group had the highest incidence of accidents on lighted roads and on multilane roads. This may reflect their higher incidence of city accidents noted above.

Finally, these comparisons showed that the drinkers in the primary control failure, Class R accidents were younger than those in the lateral tracking error Class R's. This is in agreement with an earlier report (Perchonok, 1975) showing that older drivers have fewer control failures and more information failures than younger drivers.

Rear End Accidents

This accident configuration was defined as one in which the culpable driver was proceeding ahead on a straight or curved path; the target was ahead on the same path and was either moving along or was temporarily stopped, but not parked; the critical event for the culpable driver was a simple continuation along his path until it was too late to avoid a collision. This configuration does not involve the tailgating situation where the following vehicle is culpable for violating the legitimate "operating space" expectations of the lead vehicle driver, and the action immediately precipitating the critical situation is a deceleration of the lead vehicle.

There were 397 rear end accidents which constituted fourteen percent of the culpable drinkers' involvements; this was their second most frequent accident type. Rear end accidents constituted eighteen percent of the non-drinkers' accidents.

For the drinkers, 99 percent of the rear end accidents involved another motor vehicle as the target. Three involved bicycles, and one target was not classifiable. Of the 393 target vehicles, 212 (54%) were stopped and 64 (16%) had decelerated before the situation became critical. Most often (197 cases), these lead vehicles were responding to a traffic sign or signal, a vehicle ahead or a combination of the two; in 46 cases, the lead vehicle had decelerated before attempting a turn. For 114 of the 393 target vehicles, no prior event was reported. While these cases, taken at face value, suggest the following vehicle simply ran into the rear end of a vehicle proceeding normally ahead, previous experience in in-depth studies suggests that this type of accident is much less likely than current results suggest. Rather, it is likely that some portion of them (the proportion remaining unknown) reflect the failure to report prior deceleration of the lead vehicles. A close examination of these accidents did show that these lead vehicles had not stopped prior to impact.

Earlier, we had defined a lateral tracking error as one in which a path departure was attributed to an information failure or an information failure in combination with a primary control failure. We now consider "longitudinal tracking errors" as the same grouping of critical reasons associated with insufficient control of speed or forward motion. This is applicable to rear end accidents where 88 percent of the drinkers' critical reasons were longitudinal tracking errors. Two percent of the critical reasons for the culpable drinkers were induced control failures and six percent were coded as undifferentiated between induced control failures or information failures. Because the proportion of longitudinal tracking errors was so high, the following results (Table 52) for rear end accidents in toto are essentially equivalent to those for tracking errors in rear end accidents.

The simple effects were not significant for location, road curvature, number of lanes, and lighting. The simple overrepresentation for drinkers of nighttime accidents, male drivers, drivers in the 21 to 65 age range, and automobiles were all associated with general accident effects, rather than rear end accidents in particular.

TABLE 52

Context Factors for Rear End Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	147	37.0	120	42.1	12.0	-5	-11	6
Suburbs	175	44.1	106	37.2	15.5	7	4	3
Rural	75	18.9	59	20.7	12.4	-2	7	-9
Total	397	100.0	285	100.0				
	X_2^2 = 3.28 (NS)							
Road Curvature								
Straight	287	96.0	222	96.9	12.6	-1	-12	11
Curve	12	4.0	7	3.1	16.0	1	12	-11
Total	299	100.0	229	100.0				
	X_1^2 = 0.34(NS)							
No. of Lanes								
Two Lane	68	60.7	43	57.3	14.9	3	7	-4
Multilane	44	39.3	32	42.7	13.3	-3	-7	4
Total	112	100.0	75	100.0				
	X_1^2 = 0.21							
Road Condition								
Dry	262	67.5	181	64.6	13.9	3	8	-5
Wet	107	27.6	60	21.4	16.5	6	1	5
Ice/Snow	19	4.9	39	13.9	5.1	-9	-9	0
Total	388	100.0	280	100.0				
	X_2^2 = 17.94(S)							
Time of Day								
Day	91	24.5	175	65.3	5.5	-41	-43	2
Night	281	75.5	93	34.7	25.1	41	43	-2
Total	372	100.0	268	100.0				
	X_1^2 = 106.95(S)							
Lighting								
Lighted	139	75.1	53	79.1	22.6	-4	-6	2
Not Lighted	46	24.9	14	20.9	26.7	4	6	-2
Total	185	100.0	67	100.0				
	X_1^2 = 0.43(NS)							

TABLE 52 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	General	Specific
Driver Sex								
Male	359	90.4	212	74.4	15.8	16	17	-1
Female	38	9.6	73	25.6	5.5	-16	-17	1
Total	397	100.0	285	100.0				
	$X^2_1 = 31.33(S)$							
Driver Age								
-16	{ 1	0.3	4	1.4	2.7	-1	-2	1
17-18	{ 11	2.8	34	12.2	3.5	-9	-5	-4
19-20	27	6.9	36	12.9	7.7	-6	-1	-5
21-25	71	18.0	43	15.5	15.5	3	3	0
26-35	85	21.6	54	19.4	14.9	2	2	0
36-55	156	39.6	79	28.4	18.0	11	7	4
56-65	37	9.4	16	5.8	20.4	4	0	3
66-	6	1.5	12	4.3	5.3	-3	-4	2
Total	394	100.0	278	100.0				
	$X^2_6 = 45.48(S)$							
Vehicle Type								
Auto	375	96.2	254	91.7	14.1	4	3	1
Light Truck	{ 15	3.8	15	5.4	10.0	-2	1	-3
Heavy Truck	{ 0	0.0	8	2.9	0.0	-3	-4	1
Total	390	100.0	277	100.0				
	$X^2_1 = 5.99(S)$							

- Road Curvature - Only four percent of the drinkers' rear end accidents occurred on curves versus three percent for the nondrinkers. This reflects the fact that most rear end accidents occurred near intersections, which tend to be comprised of straight legs. The drinker/nondrinker difference was not significant. On the other hand, there was an eleven percent overrepresentation of straight roads for drinkers which was specific to rear end accidents.

- Road Condition - The drinkers had approximately two-thirds of their rear end accidents on dry roads; just over one-quarter were on wet roads, and five percent were on wintry surfaces. In comparison, the nondrinkers had fewer dry and wet road accidents and had fourteen percent of their rear end accidents on icy or snowy surfaces. The differences were statistically significant, and were attributable to the dry plus wet versus ice or snow comparison ($X_1^2 = 16.73$). The overrepresentation of wet roads for the drinkers was largely specific to rear end accidents, while the minor overrepresentation of dry roads was associated with accidents in general. The underrepresentation of wintry roads for rear end accidents was wholly a general accident effect.

- Driver Age - Drinkers in the 21 to 65 age group were overrepresented in rear end accidents. While this was primarily attributable to general accident effects, the results do show an increasing specific component with driver age.

- Vehicle Type - Drivers of automobiles had 96 percent of the drinkers' rear end accidents. This was significantly greater than the corresponding 92 percent for nondrinkers. However, the effect was primarily associated with general, rather than specific, effects. A Fisher test was performed to compare light and heavy trucks; the difference was significant (p=.020) reflecting the complete absence of heavy trucks among the drinkers. A separate analysis of trucks (excluding automobiles), showed a 35 percent simple overrepresentation of light trucks; this was associated with a 42 percent general overrepresentation of light trucks.

A summary of the rear end accident analyses appears in Table 53 below.

TABLE 53

Summary of Context Factors for Rear End Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Rear End Accidents	Both
Dry Roads	X		
Wet Roads		X	
Nighttime	X		
Males	X		
Ages 21 to 65	X		
Automobiles	X		
Light Trucks	X		
Other Large Specific Overrepresentation			
Straight Roads			

Stationary Target Ahead (STA) Accidents

Stationary target ahead accidents are those in which the culpable vehicle simply continues along a straight or curved path, and by so doing strikes a target in its path. By definition, the target is stationary; that is, the target is neither moving nor is motion imminent. For example, striking a vehicle which is stopped ahead for a red light was considered a rear end accident; striking a vehicle ahead which is parked was classified as a stationary target accident. Thus, stationary target ahead accidents involve (1) a stationary target, (2) which is in the subject vehicle's path, and (3) a collision as a result of the subject vehicle's continued forward motion. STA accidents were the third most frequent configuration for culpable drinkers, accounting for eight percent of their accident involvements. They accounted for four percent of the culpable nondrinkers' accidents.

Of the 218 stationary target ahead accident involvements by culpable drinkers, the target was a parked vehicle in 195 (89%) of them. One involved a bicycle or pedestrian and 20 involved objects. This later grouping consists mainly of accidents occurring off the road where objects in a vehicle's path are not unusual. Finally, in two of these accidents, the target was a road departure; these were accidents involving road discontinuities such as dead-end roads or "T" intersections. It should be noted that when the target is a parked vehicle, STA accidents are differentiated from Class R accidents in that the target in a STA accident is in the subject vehicle's path, while in Class R's the target is out of his path and is struck as a result of a lateral move.

In 93 percent of the culpable drinkers' STA's, the subject vehicle had no prior event. In two percent, there was a lateral move prior to proceeding ahead to the collision. Each of three prior events occurred in one percent of the STA's; they were lane changes, turns, and starting.

Eighty-seven percent of the critical reasons were longitudinal tracking errors; four percent were undifferentiated information failures or induced control failures; three percent were primary control failures; and three percent were driver breakdowns. Again, due to the high incidence of a single critical reason, no separate analyses of context factors were performed for critical reasons within the STA configuration.

The analysis of context factors for STA accidents appears in Table 54. No significant simple effects were found for location, road alignment, number of lanes, road lighting, or driver age. Male drivers were overrepresented among the drinkers, but this was due to general accident effects.

- Location - A chi-square test showed no significant difference between drinkers and nondrinkers regarding the distribution of accident locations for STA accidents. Both groups had almost 60 percent in the cities, approximately 30 percent in the suburbs, and about 10 percent in rural areas. However, after adjustment for the general accident effects, drinkers in STA accidents were overrepresented in the cities and underrepresented in suburban and rural areas.

- Number of Lanes - Both the drinkers and nondrinkers had approximately 60 percent of their STA's on two lane roads and 40 percent on multilane roads. However, because there were differences between drinkers and nondrinkers regarding the general effects of all accidents, the specific STA effect was an overrepresentation of multilane roads for the drinkers.

- Road Condition - Both drinkers and nondrinkers had approximately 70 percent of their STA accidents on dry roads. There was, however, a significant interaction between driver status and road condition. It was essentially wholly due to wet roads versus ice/snow covered roads ($X_1^2 = 7.65$). The simple effects show wet roads were overrepresented and wintry roads were underrepresented among the drinkers' STA accidents. The wintry road effect was largely associated with general accident effects, while the wet road effect was parimarily specific to STA accidents.

TABLE 54

Context Factors for Stationary Target Ahead Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	126	57.8	38	58.5	26.9	-1	-11	10
Suburbs	64	29.4	21	32.3	25.3	-3	4	-7
Rural	28	12.8	6	9.2	34.1	4	7	-4
Total	218	100.0	65	100.0				
	$X_2^2 = 0.69$(NS)							
Road Curvature								
Straight	116	94.3	42	97.7	23.5	-3	-12	8
Curve	7	5.7	1	2.3	43.8	3	12	-8
Total	123	100.0	43	100.0				
	$X_1^2 = 0.79$(NS)							
No. of Lanes								
Two Lane	93	58.1	27	62.8	27.7	-5	7	-12
Multilane	67	41.9	16	37.2	31.8	5	-7	12
Total	160	100.0	43	100.0				
	$X_1^2 = 0.31$(NS)							
Road Condition								
Dry	150	71.4	44	69.8	27.5	2	8	-6
Wet	48	22.9	9	14.3	37.2	9	1	7
Ice/Snow	12	5.7	10	15.9	11.8	-10	-9	-1
Total	210	100.0	63	100.0				
	$X_2^2 = 7.93$(S)							
Time of Day								
Day	22	10.5	21	33.3	10.4	-23	-43	20
Night	187	89.5	42	66.7	33.1	23	43	-20
Total	209	100.0	63	100.0				
	$X_1^2 = 18.92$(S)							
Lighting								
Lighted	79	85.9	22	88.0	28.5	-2	-6	4
Not Lighted	13	14.1	3	12.0	32.5	2	6	-4
Total	92	100.0	25	100.0				
	$X_2^2 = 0.08$(NS)							

TABLE 54 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Driver Sex								
Male	198	90.8	51	79.7	30.1	11	17	-6
Female	20	9.2	13	20.3	14.6	-11	-17	6
Total	218	100.0	64	100.0				
	X_1^2 = 5.94(S)							
Driver Age								
-16	{ 1	0.5	1	1.6	10.0	-1	-2	1
17-18	} 8	3.7	4	6.3	18.2	-3	-5	3
19-20	14	6.5	7	10.9	18.2	-4	-1	-3
21-25	33	15.4	13	20.3	22.0	-5	3	-8
26-35	41	19.2	16	25.0	22.2	-6	2	-8
36-55	73	34.1	15	23.4	35.1	11	7	3
56-65	{ 37	17.3	3	4.7	57.8	13	0	12
66-	} 7	3.3	5	7.8	13.5	-5	-4	0
Total	214	100.0	64	100.0				
	X_5^2 = 7.55(NS)							
Vehicle Type								
Auto	204	94.9	56	91.8	28.8	3	3	0
Light Truck	{ 10	4.7	1	1.6	52.6	3	1	2
Heavy Truck	} 1	0.5	4	6.6	2.7	-6	-4	-2
Total	215	100.0	61	100.0				
	X_1^2 = 0.83(NS)							

- Time of Day - As is true for all accident configurations, there was a significant day-night difference as a function of drinking status for stationary target ahead accidents. The drinkers had almost 90 percent of their STA's at night; this is contrasted with 67 percent for the nondrinkers. However, the overrepresentation of nighttime accidents for drinkers in STA's was much smaller than that for accidents in general. As a result, there was a large specific underrepresentation of nighttime accidents and a complementary specific overrepresentation of daytime accidents. Were it not for this, the simple overrepresentation of nighttime STA accidents for drinkers would have been far greater.

- Driver Age - There was no significant interaction between driver age and drinking status in STA accidents. The results are limited by the number of observations in the nondrinking group spread over several age ranges. For example, if it had been planned to compare drivers younger than 36 years to those 36 and older, the test results would have easily been significant ($X_1^2 = 6.92$). It is thought that notice should be taken of the rather large overrepresentation of drinkers in the 36 to 65 age range. In this regard, the 36 to 55 year old drinker effect was supported primarily by general effects, while the overrepresentation of the 56 to 65 range was wholly due to specific STA effects.

- Vehicle Type - A chi-square test showed no significant difference between drinkers and nondrinkers in terms of the relative frequencies of cars versus trucks. (Light and heavy trucks were grouped together for this test.) A Fisher test was applied to compare light versus heavy trucks, and it was significant (P=.026). Analyzing trucks separately showed a 71 percent simple overrepresentation of light trucks; this was associated with a 42 percent general effect and a 29 percent simple effect.

A summary of stationary target ahead accidents appears in Table 55 below.

TABLE 55

Summary of Context Factors for Stationary Target Ahead Accidents

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	Stationary Target Ahead Accidents	Both
Wet Roads		X	
Nighttime	X		
Males	X		
Light Trucks			X
Other Large Specific Overrepresentations			
Cities			
Multilane Roads			
Daytime			
Ages 56-65			

Parallel Opposite - Lateral Move (PO-LM) Accidents

In this configuration, the culpable driver was moving ahead in a straight or curved path; the target was in a parallel path, usually an adjacent lane, but headed in the opposite direction; the accident was precipitated when the culpable vehicle moved to the left either into the path of the target or to strike the target directly. This configuration is distinguished from another one, discussed later, in which the culpable vehicle initiated a turn to the left and thereby collided with the oncoming target. In the PO-LM accidents, the subject vehicle was not attempting a turn onto another road or driveway, but rather moved to the left with no turn intended.* PO-LM accidents accounted for seven percent of the drinkers' involvements and five percent of the nondrinkers'.

Of the 189 parallel opposite-lateral move involvements by culpable drinkers, the target was another vehicle in 186 (98%). The remaining three involved a pedestrian or bicycle. In 172 cases, the target vehicle had no prior event; it was simply proceeding ahead when it was imposed upon by the culpable vehicle. In the remainder of the accidents where the target was a motor vehicle, it had temporarily stopped (for a traffic control, waiting to turn, etc.) before it was struck by the subject vehicle.

Regarding the subject vehicle, 98 percent had no prior event. The remaining four cases involved a deceleration, a lane change, a lateral move, and a prior turn. Regarding reasons for the critical event, 76 percent were lateral tracking errors; eight percent were undifferentiated information failures or induced control failures; seven percent were primary control failures; two percent were induced control failures; and two percent were driver breakdowns.

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* It should be noted that theoretically these PO-LM accidents should not include situations where the culpable vehicle crossed the centerline and then continued on a collision course with an oncoming target; such accidents should be included only if the lane departure occurred sufficiently near the collision point that the situation immediately became critical. Since this distinction was not always readily available, the PO-LM designation was used unless the subject unit had clearly entered the opposing lane well before the collision.

The analysis of context factors appears in Table 56. Nonsignificant simple effects (i.e., direct differences between drinkers and nondrinkers regarding context factors) were found for location, number of lanes, roadway lighting, and vehicle type. Curved roads, nighttime accidents, and male drivers were significantly overrepresented, but this was due to general accident effects.

- Location - The drinkers had 41 percent of their parallel opposite-lateral move accidents in the suburbs, with the remainder evenly split between rural and urban areas. In contrast to the nondrinkers, the drinking drivers were mildly overrepresented in the suburbs and underrepresented in rural areas; however, these differences were not statistically significant. After adjusting for general effects, PO-LM accident drinkers were overrepresented in the cities and underrepresented in rural areas. Thus, the drinkers appeared to have increasing difficulties specifically related to PO-LM accidents with increasing urbanization.

- Number of Lanes - With approximately 70 percent of the PO-LM accidents on two lane roads, there was no significant difference between the drinking and nondrinking drivers. There was, however, a ten percent overrepresentation of multilane roads for the drinkers after adjusting for general accident effects.

- Road Condition - The drinkers had two-thirds of their PO-LM accidents on dry roads, 23 percent on wet roads, and 10 percent on icy or snowy roads. In contrast to the nondrinkers, this involved a significant overrepresentation of dry and wet roads and a corresponding underrepresentation of wintry surfaces. The dry and wet road overrepresentation was primarily due to effects specific to PO-LM accidents, although there was a notable general effect regarding dry roads. The underrepresentation of wintry surfaces had both general and specific contributory components, with the emphasis on the latter.

TABLE 56

Context Factors for Parallel Opposite - Lateral Move Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	56	29.6	24	28.9	20.6	1	-11	12
Suburbs	77	40.7	31	37.3	21.6	3	4	0
Rural	56	29.6	28	33.7	18.2	-4	7	-11
Total	189	100.0	83	100.0				
		$X^2_2 = 0.49$(NS)						
Road Curvature								
Straight	92	66.7	57	82.6	15.2	-16	-12	-4
Curve	46	33.3	12	17.4	29.9	16	12	4
Total	138	100.0	69	100.0				
		$X^2_1 = 5.80$(S)						
No. of Lanes								
Two Lane	94	68.1	43	70.5	19.5	-2	7	-10
Multilane	44	31.9	18	29.5	21.4	2	-7	10
Total	138	100.0	61	100.0				
		$X^2_1 = 0.11$(NS)						
Road Condition								
Dry	123	67.6	37	45.7	27.0	22	8	14
Wet	41	22.5	13	16.0	25.9	6	1	5
Ice/Snow	18	9.9	31	38.3	6.1	-28	-9	-19
Total	182	100.0	81	100.0				
		$X^2_2 = 29.80$(S)						
Time of Day								
Day	41	22.9	50	61.7	8.4	-39	-43	4
Night	138	77.1	31	38.3	33.1	39	43	-4
Total	179	100.0	81	100.0				
		$X^2_1 = 36.95$(S)						
Lighting								
Lighted	42	49.4	9	45.0	34.1	4	-6	11
Not Lighted	43	50.6	11	55.0	30.3	-4	6	-11
Total	85	100.0	20	100.0				
		$X^2_1 = 0.13$(NS)						

TABLE 56 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Driver Sex								
Male	163	86.7	64	77.1	22.1	10	17	-8
Female	25	13.3	19	22.9	12.8	-10	-17	8
Total	188	100.0	83	100.0				
	$X^2_1 = 3.90(S)$							
Driver Age								
-16	0	0.0	1	1.2	0.0	-1	-2	1
17-18	8	4.3	13	15.9	6.4	-12	-5	-6
19-20	9	4.8	7	8.5	12.5	-4	-1	-3
21-25	33	17.6	19	23.2	16.2	-6	3	-8
26-35	41	21.8	17	20.7	21.1	-1	2	-1
36-55	78	41.5	17	20.7	33.8	21	7	14
56-65	17	9.0	4	4.9	32.1	4	0	4
66-	2	1.1	4	4.9	5.3	-4	-4	-1
Total	188	100.0	82	100.0				
	$X^2_5 = 20.83(S)$							
Vehicle Type								
Auto	175	93.6	76	93.8	20.4	0	3	-3
Light Truck	11	5.9	3	3.7	28.9	2	1	1
Heavy Truck	1	0.5	2	2.5	5.3	-2	-4	2
Total	187	100.0	81	100.0				
	$X^2_1 = 0.01(NS)$							

- Lighting - There was no significant drinker/nondrinker difference in terms of road lighting. However, after adjustments were made for general effects, there was an eleven percent overrepresentation of lighted roads for drinkers which was specific to PO-LM accidents.

- Driver Age - There was an overrepresentation of drinkers in the 36 to 65 age group which was focused primarily in the 36 to 55 range. The dominant component was specific to PO-LM accidents although there also was a contributory general effect.

Table 57 gives a summary of these findings.

TABLE 57

Summary of Context Factors for Parallel Opposite - Lateral Move Accidents

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	Parallel Opposite-Lateral Move Acc.	Both
Curves	X		
Dry and Wet Roads		X	
Nighttime	X		
Males	X		
Ages 36 to 55		X	
Other Large Specific Overrepresentations			
Cities			
Multilane Roads			
Lighted Roads			

An analysis of those parallel opposite - lateral move accidents precipitated by lateral tracking errors was attempted. However, because there were only 34 nondrinking drivers in this group, results were not very reliable and are not reproduced here. Rather, an analysis of context factors for lateral tracking errors based on the grouping of three accident configurations is presented later.

Parallel Opposite - Left Turn (PO-LT) Accidents

This accident configuration is closely related to the parallel opposite - lateral move accidents just discussed. The primary difference is that while the PO-LM's were precipitated by a lateral move, the parallel opposite - left turn accidents were precipitated by an attempted left turn to another road, driveway, etc. The culpable drinkers had 72 such accidents, or three percent of their total. These accidents constituted six percent of the culpable nondrinkers' total.

In all 72 of the drinkers' parallel opposite - left turn accidents, the target was another motor vehicle. Furthermore, in all 72, no prior event was noted for the target vehicles; that is, according to the police report, the target vehicle was simply proceeding ahead and was imposed upon by the subject vehicle.

Regarding the prior event for the subject vehicle, two were recorded as having stopped prior to the turning. The remaining 70 drinkers had no prior event, although a prior deceleration is usually implied before turning.

Rather than using the critical reason groupings previously described as tracking errors, it is more direct to specify that 97 percent of the critical reasons for the culpable drinkers' PO-LT accident were information failures. These may have been failures to observe the oncoming target vehicle or speed/distance misjudgments. Of the two remaining PO-LT's, one was attributed to a primary control failure, and the second was undifferentiable between an information failure and a primary control failure. Again, this distribution did not justify a separate critical reason analysis; the results, of necessity, would be essentially the same as those given in Table 58 which contains all PO-LT accidents.

Simple effects associated with location, road condition, lighting, and vehicle type were not significant. Neither road curvature, nor number of lanes was analyzed due to the lack of a reliable determination of these factors

TABLE 58

Context Factors for Parallel Opposite - Left Turn Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	20	27.8	34	36.2	6.1	-8	-11	2
Suburbs	40	55.6	42	44.7	9.6	11	4	7
Rural	12	16.7	18	19.1	6.9	-2	7	-10
Total	72	100.0	94	100.0				
		$X^2_2 = 2.00$(NS)						
Road Curvature								
Straight	54	-	76	-	-			
Curve	3	-	0	-	-			
Total	57	-	76	-	-			
No. of Lanes								
Two Lane	0	-	0	-	-	-	-	-
Multilane	0	-	1	-	-	-	-	-
Total	0		0					
Road Condition								
Dry	48	67.6	65	73.9	7.6	-6	8	-14
Wet	18	25.4	17	19.3	10.5	6	1	5
Ice/Snow	5	7.0	6	6.8	8.5	0	-9	9
Total	71	100.0	88					
		$X^2_2 = 0.87$(NS)						
Time of Day								
Day	16	23.9	62	70.5	2.8	-47	-43	-3
Night	51	76.1	26	29.5	17.9	47	43	3
Total	67	100.0	88	100.0				
		$X^2_1 = 33.01$(S)						
Lighting								
Lighted	25	78.1	15	83.3	15.6	-5	-6	1
Not Lighted	7	21.9	3	16.7	20.6	5	6	-1
Total	32	100.0	18	100.0				
		$X^2_1 = 0.20$(NS)						

TABLE 58(Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Driver Sex								
Male	63	88.7	61	64.9	10.3	24	17	6
Female	8	11.3	33	35.1	2.6	-24	-17	-6
Total	71	100.0	94	100.0				
	$X^2_1 = 12.31$ (S)							
Driver Age								
-16	0	0.0	4	4.3	0.0	-4	-2	-2
17-18	3	4.2	6	6.4	5.3	-2	-5	3
19-20	4	5.6	8	8.5	5.3	-3	-1	-2
21-25	5	6.9	14	14.9	3.8	-8	3	-11
26-35	13	18.1	24	25.5	5.7	-7	2	-10
36-55	37	51.4	19	20.2	17.8	31	7	24
56-65	8	11.1	9	9.6	9.0	2	0	1
66-	2	2.8	10	10.6	2.2	-8	-4	-3
Total	72	100.0	94	100.0				
	$X^2_4 = 18.48$ (S)							
Vehicle Type								
	68	97.1	89	94.7	7.8	2	3	-1
Light Truck	2	2.9	4	4.3	5.3	-1	1	-3
Heavy Truck	0	0.0	1	1.1	0.0	-1	-4	3
Total	70	100.0	94	100.0				
	$X^2_1 = 0.60$ (NS)							

in police reports of intersection accidents. Nighttime accidents and male drivers were significantly overrepresented among the drinkers, but this was attributable to general accident effects.

- Location - Although there were some notable differences in accident location for drinkers versus nondrinkers, the number of observations was low and the differences were not statistically significant. The differences involved an eleven percent overrepresentation of suburban accidents for which the specific effect was the main contributor. After correcting for general accident effects, there was a ten percent specific overrepresentation of city and suburban accidents.

- Road Condition - Test results were not significant for this factor. There was, however, a fourteen percent overrepresentation of wet and wintry surfaces specific to parallel opposite - lateral move accidents.

- Driver Age - The major difference here was a 31 percent overrepresentation of drinkers in the 36 to 55 age range. This was primarily associated with effects specific to PO-LT accidents.

A summary of PO-LT accidents is given in Table 59.

TABLE 59

Summary of Context Factors for Parallel Opposite - Left Turn Accidents

Overrepresented Context Factors	Accidents in General	Parallel Opposite-Left Turn Accidents	Both
Nighttime	X		
Males	X		
Ages 36 to 55		X	
Other Large Specific Overrepresentations			
Cities and Suburbs			

Intersecting Path - Continue (IP-C) Accidents

In this accident configuration, the subject vehicle was proceeding ahead on a straight or curved path; the target was to the right front headed left or to left front headed right; both vehicles continued along the collision course to impact. The IP-C configuration does not include accidents in which one of the vehicles stopped at an intersection and then precipitated an accident by starting into it. (That is an intersecting path-start configuration which will be discussed later.) Intersecting path-continue accidents accounted for four percent of the culpable drinkers accidents and nine percent of the culpable nondrinkers' accidents.

Of the 116 drinker-generated IP-C accidents, the target was a motor vehicle in 112. In two instances, the target was a pedestrian or bicyclist, and in the remaining two it was a train.

Among the culpable drinkers, 94 percent had no prior event. Of the remainder, four had stopped and started prior to the critical event. An example of a prior stop and start would be waiting in a queue at a stop sign, and then starting ahead and continuing without stopping before entering the intersection.

Ninety-two percent of the drinkers' reasons for failing to stop were information failures.* The remaining critical reasons included information failure/primary control failure (2 cases), information failure/induced control failure (2), vehicle breakdown (2), primary control failure (1), induced

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* In using police reports, the findings regarding information failures were usually inferred by deduction. Hence, it was impossible to distinguish between failing to see a traffic control which might have been present and failing to see the target; however, it can be reasonably assumed that if the driver had been aware of the target and the relevant speed/distance relationships, he would, most likely, have stopped. Thus, while it may not be clear whether the driver failed to see any traffic controls, in almost all such cases a failure to see the target or to properly judge the speed/distance relationships was likely.

control failure (1), and other or unknown (1). Because of this distribution, no separate analyses of context factors for individual critical reasons were conducted.

Because of the nature of the intersecting path - continue accidents, it was of interest to examine the role of stop signs, stop lights, and yield signs. While police forms generally call for a specification of traffic controls, the location of the control can be found only on the accident diagram; unfortunately, in some instances the investigating officer failed to provide this information. Additionally, traffic control information may be obtained from violations when they are reported. As a result, there is some underestimation of the traffic control involvement for the culpable vehicle. With this in mind, the data showed that 49 percent of the drinkers failed to respond to a traffic control; for the nondrinkers precipitating IP-C accidents, the figure was 51 percent. We know of no reason to believe this near-equality was influenced by the general estimation of traffic controls noted above.

Results pertaining to context factors appear in Table 60. For IP-C accidents, simple effects were not significant for location, road condition, lighting, and vehicle type. Road curvature and number of lanes were not analyzed due to insufficient information on these variables for intersection accidents. Nighttime accidents and male drivers were overrepresented due to general effects.

- Lighting - While there was a large (19%) overrepresentation of lighted road accidents for the drinkers, this result was not statistically significant. On the other hand, because of a general underrepresentation of drinkers in lighted road accidents, the net effect was a 25 percent overrepresentation specific to intersecting path - continue accidents.

- Driver Age - The significant difference between drinkers and nondrinkers reflected an overrepresentation of the drinkers in the 21 to 55 age range. However, only the effect associated with drivers in the 26 to 35 group was mainly specific to intersecting path - continue accidents.

TABLE 60

Context Factors for Intersecting Path-Continue Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	46	39.7	63	46.3	7.5	-7	-11	4
Suburbs	46	39.7	42	30.9	10.8	9	4	5
Rural	24	20.7	31	22.8	7.9	-2	7	-9
Total	116	100.0	136	100.0				
		X_2^2 = 2.15 (NS)						
Road Curvature								
Straight	90	--	110	--	--			
Curve	0	--	0	--	--			
Total	90	--	110	--				
No. of Lanes								
Two Lane	2	--	2	--	--			
Multilane	1	--	0	--	--			
Total	3	--	2	--				
Road Condition								
Dry	74	64.3	84	62.7	8.9	2	8	-6
Wet	35	30.4	33	24.6	10.5	6	1	4
Ice/Snow	6	5.2	17	12.7	3.8	-7	-9	2
Total	115	100.0	134	100.0				
		X_2^2 = 4.53 (NS)						
Time of Day								
Day	28	25.5	89	69.0	3.4	-44	-43	0
Night	82	74.5	40	31.0	18.6	44	43	0
Total	110	100.0	129	100.0				
		X_2^2 = 45.04 (S)						
Lighting								
Lighted	48	85.7	16	66.7	25.0	19	-6	25
Not Lighted	8	14.3	8	33.3	10.0	-19	6	-25
Total	56	100.0	24	100.0				
		X_1^2 = 3.81 (NS)						

TABLE 60 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Driver Sex								
Male	109	94.0	95	69.9	11.3	24	17	7
Female	7	6.0	41	30.1	1.9	-24	-17	-7
Total	116	100.0	136	100.0				
	X_1^2 = 23.61 (S)							
Driver Age								
-16	1	0.9	8	5.9	1.4	-5	-2	-3
17-18	4	3.5	15	11.0	2.9	-7	-5	-2
19-20	8	7.1	12	8.8	6.9	-2	-1	-1
21-25	15	13.3	14	10.3	10.6	3	3	0
26-35	31	27.4	24	17.6	12.6	10	2	7
36-55	43	38.1	40	29.4	10.7	9	7	1
56-65	10	8.8	10	7.4	10.0	1	0	1
66-	1	0.9	13	9.6	0.8	-9	-4	-6
Total	113	100.0	136	100.0				
	X_4^2 = 13.34 (S)							
Vehicle Type								
Auto	108	96.4	119	90.2	9.2	6	3	3
Light Truck	3	2.7	8	6.1	4.0	-3	1	-4
Heavy Truck	1	0.9	5	3.8	2.2	-3	-4	1
Total	112	100.0	132	100.0				
	X_1^2 = 3.68 (NS)							

Table 61 summarizes these results.

TABLE 61

Summary of Context Factors for Intersecting Path-Continue Accidents

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	Intersecting Path-Continue Accident	Both
Dry and Wet Roads	X		
Nighttime	X		
Males	X		
Ages 26-55	X		X (26-35 only)
Other Large Specific Overrepresentations			
Lighted roads			

Intersecting Path - Start (IP-S) Accidents

While the previous accident configuration involved two units continuing along an intersecting collision course, intersecting path-start accidents differ in that the subject vehicle first stopped and then created a critical condition by starting. Typical of this accident configuration is a vehicle stopping at a traffic control and then starting up in to cross traffic. The drinkers had less than one percent of their culpable accident involvements in this way; this, versus seven percent for the nondrinkers.

Of the 21 IP-S accidents for culpable drinkers, the target was another motor vehicle in 20 of them; in one, the target was a pedestrian or bicyclist. By definition of the accident configuration, all subject vehicles had a prior stop. The reasons for the critical start were information failure (19 cases), driver breakdown (1) and "Other or unknown" (1).

Analyses of context factors for IP-S accidents are given in Table 62. There were no significant simple effects for location, road condition, driver sex, driver age, lighting, or vehicle type. Road curvature and number of lanes were not analyzed due to insufficient information for intersection accidents.

TABLE 62

Context Factors for Intersecting Path-Start Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	5	23.8	48	46.2	1.1	-22	-11	-12
Suburbs	11	52.4	29	27.9	4.0	24	4	21
Rural	5	23.8	27	26.0	2.0	-2	7	-9
Total	21	100.0	104	100.0				
		$X_2^2 = 5.37$ (NS)						
Road Curvature								
Straight	0	--	0	--	--			
Curve	0	--	0	--	--			
Total	0	--	0	--				
No. of Lanes								
Two Lane	0	--	0	--	--			
Multilane	1	--	0	--	--			
Total	1	--	0	--				
Road Condition								
Dry	15	75.0	53	54.1	3.0	21	8	13
Wet	4	20.0	33	33.7	1.3	-14	1	-15
Ice/Snow	1	5.0	12	12.2	0.9	-7	-9	2
Total	20	100.0	98	100.0				
		$X_1^2 = 2.98$ (NS)						

TABLE 62 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Time of Day								
Day	4	20.0	82	79.6	0.5	-60	-43	-16
Night	16	80.0	21	20.4	7.8	60	43	16
Total	20	100.0	103	100.0				
	$X_1^2 = 28.30$ (S)							
Lighting								
Lighted	12	85.7	14	93.3	8.7	-8	-6	-1
Not Lighted	2	14.3	1	6.7	18.2	8	6	1
Total	14	100.0	15	100.0				
	Fisher Test (NS)							
Driver Sex								
Male	16	76.2	59	56.7	2.9	19	17	2
Female	5	23.8	45	43.3	1.2	-19	-17	-2
Total	21	100.0	104	100.0				
	$X_1^2 = 2.76$ (NS)							
Driver Age								
-16	0	0.0	3	2.9	0.0	-3	-2	-1
17-18	0	0.0	9	8.7	0.0	-9	-5	-4
19-20	1	4.8	10	9.7	1.1	-5	-1	-4
21-25	5	23.8	13	12.6	4.1	13	3	10
26-35	8	38.1	15	14.6	5.6	24	2	21
36-55	4	19.0	31	30.1	1.4	-11	7	-18
56-65	1	4.8	11	10.7	1.0	-6	0	-6
66-	2	9.5	11	10.7	2.0	-1	-4	3
Total	21	100.0	103	100.0				
	$X_1^2 = 2.29$ (NS)							
Vehicle Type								
Auto	19	95.0	96	93.2	2.2	2	3	-1
Light Truck	1	5.0	5	4.9	2.2	0	1	-1
Heavy Truck	0	0.0	2	1.9	0.0	-2	-4	2
Total	20	100.0	103	100.0				
	Fisher Test (NS)							

- Location - Although the simple effects were large, they were not statistically significant. This was mainly due to the watering down effects of the rural accidents. Had they been excluded from the analysis, the overrepresentation of suburbs relative to cities would have been significant ($X_1^2 = 5.22$). The measured overrepresentation of the suburbs was associated, almost wholly, with effects specific to intersecting path-start accidents.

- Road Condition - Dry roads were overrepresented in the drinking sample by 21 percent. However, the effect was not statistically significant.

- Time of Day - Nighttime accidents were overrepresented among the drinkers; the effect depended largely on the general component although it also contained a sixteen percent specific component.

- Driver Sex - While the males had a nineteen percent overrepresentation among the drinkers, it was not statistically significant. No large specific effects were evident.

- Driver Age - Simple effects were not significant. Regarding effects specific to intersecting path-start accidents, a ten percent and a twenty-one percent overrepresentation were measured for ages 21 to 25 and 26 to 35, respectively.

IP-C results are summarized in Table 63.

TABLE 63

Summary of Context Factors for Intersecting Path-Start Accidents

Overrepresented Context Factors	Accidents in General	Intersecting Path-Start Accidents	Both
	Primarily Associated With:		
Nighttime			X
Other Large Specific Overrepresentations			
Suburbs			
Dry roads			
Ages 21 to 35			

Rearward Accidents

Included in this accident configuration are those accidents in which the subject vehicle was moving to the rear and continued to do so until it collided with a stationary or intersecting target. Two percent of the culpable drinkers' accidents were of this type. Three percent of the culpable non-drinkers' accidents were of this type.

Forty-three of the 47 rearward configurations for the drinkers involved other motor vehicles as targets. In three of these configurations, the target was a road departure, and in one, the target was unclassifiable. Of the 43 targets which were motor vehicles, 36 were parked, five were continuing along their paths, and two were temporarily stopped.

Regarding the subject vehicles, the prior event was starting backwards; this, by definition of the configuration. The critical reason was a longitudinal tracking error in 45 accidents, a primary control error in one, and an undifferentiated information failure or induced control failure in one.

The context factor results are given in Table 65 and summarized in Table 66. Simple effects were not statistically significant for location, road condition, driver age or vehicle type. Road curvature and number of lanes were not analyzed since a large portion of these accidents involved driveways or lots.

Indeed, driveways and lots (parking lots, service stations, etc.) were so prevalent in these rearward accidents that a separate analysis was performed for them. The results are in Table 64.

TABLE 64

Driveways and Lots as Context Factors in Rearward Accidents

REARWARD ACCIDENTS

	Drinker		Normal			Drinker Effects (%)		
Context	N	%	N	%	Percent Drinkers	Simple	General	Specific
Driveway	10	21.3	31	60.8	3.5	-40	-4	-35
Lot	15	31.9	8	15.7	17.2	16	-1	17
Neither	22	46.8	12	23.5	4.6	23	5	18
TOTAL	47	100.0	51	100.0				

$X_2^2 = 15.69$ (S)

ALL ACCIDENTS

	Drinker		Normal			Drinker Effects (%)		
Context	N	%	N	%	Percent Drinkers	Simple	General	Specific
Driveway	52	1.8	97	6.1	5.6	-4		
Lot	68	2.4	46	2.9	14.1	-1		
Neither	2,737	95.8	1,449	91.0	17.3	5		
TOTAL	2,857	100.0	1,592	100.0				

$X_2^2 = 59.25$ (S)

TABLE 65

Context Factors for Rearward Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Location								
Cities	20	42.6	31	60.8	6.7	-18	-11	-7
Suburbs	15	31.9	11	21.6	13.2	10	4	7
Rural	12	25.5	9	17.6	12.9	8	7	1
Total	47	100.0	51	100.0				
	X_2^2 = 3.26 (NS)							
Road Curvature								
Straight	0	--	0	--	--			
Curve	0	--	0	--	--			
Total	0	--	0	--	--			
No. of Lanes								
Two Lane	7	--	2	--	--			
Multilane	2	--	0	--	--			
Total	9	--	2	--				
Road Condition								
Dry	37	80.4	32	64.0	11.4	16	8	9
Wet	7	15.2	10	20.0	7.2	-5	1	-6
Ice/Snow	2	4.3	8	16.0	2.7	-12	-9	-2
Total	46	100.0	50	100.0				
	X_1^2 = 3.20 (NS)							
Time of Day								
Day	13	28.3	26	53.1	5.3	-25	-43	18
Night	33	71.7	23	46.9	13.8	25	43	-18
Total	46	100.0	49	100.0				
	X_1^2 = 6.03 (S)							
Lighting								
Lighted	18	78.3	8	47.1	20.0	31	-6	38
Not Lighted	5	21.7	9	52.9	5.8	-31	6	-38
Total	23	100.0	17	100.0				
	X_1^2 = 4.18 (S)							

TABLE 65 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	43	91.5	29	56.9	14.1	35	17	17
Female	4	8.5	22	43.1	2.0	-35	-17	-17
Total	47	100.0	51	100.0				
	$X_1^2 = 15.05$ (S)							
Driver Age								
-16	0	0.0	2	4.0	0.0	-4	-2	-2
17-18	2	4.4	2	4.0	10.0	0	-5	6
19-20	4	8.9	4	8.0	10.0	1	-1	2
21-25	7	15.6	7	14.0	10.0	2	3	-1
26-35	7	15.6	12	24.0	6.1	-8	2	-11
36-55	19	42.2	15	30.0	12.3	12	7	5
56-65	5	11.1	6	12.0	8.5	-1	0	-1
66-	1	2.2	2	4.0	5.3	-2	-4	3
Total	45	100.0	50	100.0				
	$X_4^2 = 2.10$ (NS)							
Vehicle Type								
Auto	44	93.6	47	95.9	9.4	-2	3	-5
Light Truck	3	6.4	0	0.0	100.0	6	1	5
Heavy Truck	0	0.0	2	4.1	0.0	-4	-4	0
Total	47	100.0	49	100.0				
	$X_1^2 = 0.26$ (NS)							

TABLE 66

Summary of Context Factors for Rearward Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Rearward Accidents	Both
Nighttime	X		
Lighted areas		X	
Males			X
Lots		X	

Other Large Specific Overrepresentations

Daytime

The results for rearward accidents show that there were considerable differences between drinkers and nondrinkers regarding driveways and lots for rearward accidents. Drinkers had 40 percent fewer rearward accidents in or emerging from driveways and sixteen percent more in lots. The lower portion of the table shows that when all accident configurations were considered, the differences were significant, but not large. Subtracting these differences, which constitute general effects, from the simple effects in the upper portion of the table gives the specific effects for rearward accidents. It can be seen that the drinkers' underrepresentation of driveway accidents and their overrepresentation of accidents in lots were clearly specific to rearward accidents.

- Time of Day - Nighttime accidents were overrepresented for this configuration. However, there was a large (18%) overrepresentation of daytime accidents specific to rearward accidents.

- Lighting - Lighted conditions were overrepresented among the drinkers in rearward accidents. This effect was wholly specific to this configuration. This is compatible with the drinkers' overrepresentation in lots.

- Driver Sex - Males were overrepresented in rearward accidents. This effect was equally associated with both general and specific components.

Parallel Same - Lateral Move Accidents

In this configuration, the subject vehicle and the target were in adjacent, parallel paths with both headed in the same direction. The target was to the right or left side of the subject vehicle and there was a longitudinal overlap between the two units. The accident was precipitated by a lateral move.* This configuration constituted less than two percent of the culpable drinkers' accident involvements; it accounted for a bit over two percent of the nondrinkers' accidents.

The target was a motor vehicle in all 43 of the drinkers' PS-LM accidents. Thirty-eight of the targets had no prior event; three of them had changed lanes to pass, one had stopped in response to another vehicle (not involved in the accident), and one had just turned onto a path parallel to that of the subject vehicle.

Considering the prior behavior of the subject vehicle, 24 had no recorded prior event and 16 had changed lanes. Of the remaining three, one had executed a lateral move, one had just turned from an intersecting path, and for one the prior event was not classifiable.

The major critical reason for the lateral move which precipitated the accidents was a lateral tracking error (29 cases). There were two cases each of primary control failures, responses to nonaccident vehicles, and undifferentiated induced control failures or information failures; and one case each of an induced control failure, a vehicle breakdown, and a driver breakdown. In five accidents, the critical reason was unclassified.

Context factor results are given in Table 67. There were no significant simple effects except for overrepresented nighttime accidents and male drivers. Both of these effects were attributable to general accident effects. Because of the limited number of observations for this configuration, no other findings are considered noteworthy.

* In some of these accidents, it was likely that the lateral move was the initiation of a lane change or a turn into an intersecting driveway.

TABLE 67

Context Factors for Parallel Same - Lateral Move Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	17	39.5	19	51.4	9.0	-12	-11	-1
Suburbs	13	30.2	12	32.4	10.7	-2	4	-6
Rural	13	30.2	6	16.2	19.4	14	7	7
Total	43	100.0	37	100.0				
	$X_2^2 = 2.29$ (NS)							
Road Curvature								
Straight	32	94.1	26	100.0	12.0	-6	-12	6
Curve	2	5.9	0	0.0	100.0	6	12	-6
Total	34	100.0	26	100.0				
	Fisher Test (NS)							
No. of Lanes								
Two Lane	14	51.9	9	50.0	14.7	2	7	-5
Multilane	13	48.1	9	50.0	13.8	-2	-7	5
Total	27	100.0	18	100.0				
	$X_1^2 = 0.01$ (NS)							
Road Condition								
Dry	33	78.6	23	62.2	13.8	16	8	9
Wet	{ 6	14.3	10	27.0	6.3	-13	1	-14
Ice/Snow	{ 3	7.1	4	10.8	7.7	-4	-9	6
Total	42	100.0	37	100.0				
	$X_1^2 = 2.57$ (NS)							
Time of Day								
Day	13	30.2	26	72.2	5.3	-42	-43	1
Night	30	69.8	10	27.8	25.0	42	43	-1
Total	43	100.0	36	100.0				
	$X_{12}^2 = 13.82$ (S)							
Lighting								
Lighted	19	73.1	4	57.1	34.5	16	-6	22
Not Lighted	7	26.9	3	42.9	20.6	-16	6	-22
Total	26	100.0	7	100.0				
	Fisher Test (NS)							

TABLE 67 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Driver Sex								
Male	42	97.7	27	73.0	14.7	25	17	7
Female	1	2.3	10	27.0	1.1	-25	-17	-7
Total	43	100.0	37	100.0				
	$X_1^2 = 10.23$ (S)							
Driver Age								
-16	1	2.3	1	2.7	10.0	0	-2	2
17-18	5	11.6	7	18.9	7.4	-7	-5	-2
19-20	5	11.6	4	10.8	12.2	1	-1	2
21-25	11	25.6	6	16.2	16.9	9	3	7
26-35	9	20.9	2	5.4	33.3	16	2	13
36-55	10	23.3	10	27.0	10.0	-4	7	-11
56-65	2	4.7	6	16.2	3.6	-12	0	-12
66-	0	0.0	1	2.7	0.0	-3	-100	2
Total	43	100.0	37	100.0				
	$X_3^2 = 7.56$ (NS)							
Vehicle Type								
Auto	40	93.0	29	85.3	13.3	8	3	5
Light Truck	3	7.0	2	5.9	14.3	1	1	0
Heavy Truck	0	0.0	3	8.8	0.0	-9	-4	-5
Total	43	100.0	34	100.0				
	$X_1^2 = 1.22$ (NS)							

Results are summarized in Table 68.

TABLE 68

Summary of Context Factors for Parallel Same-Lateral Move Accidents

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	PS-LM Accidents	Both
Nighttime	X		
Males	X		
Other Large Specific Overrepresentations			
Lighted roads			
Ages 21 to 35			

Lateral Tracking Errors

In this set of analyses, and in the two that follow, context factors are analyzed for selected critical reasons for a group of accident configurations. For example, lateral tracking errors were defined for three configurations: Class R, parallel opposite - lateral move, and parallel same - lateral move. In the analysis that follows, the data set consists of the culpable drivers who were involved in any one of these three accident configurations due to a lateral tracking error. These lateral tracking error involvements accounted for 25 percent of the culpable drivers' accidents, but only seven percent of the culpable nondrinkers' accidents. The results are in Table 69.

The only simple drinker-nondrinker differences reaching statistical significance were for time of day, driver sex, and driver age. Of these, the nighttime and male driver overrepresentations were primarily attributable to general accident effects, rather than specifically to lateral tracking error involvements.

TABLE 69

Context Factors for Lateral Tracking Errors

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	Drinker Effect (%) General	Drinker Effect (%) Specific
Location								
Cities	197	27.7	41	36.6	34.8	-9	-11	2
Suburbs	253	35.6	42	37.5	40.1	-2	4	-5
Rural	260	36.6	29	25.9	49.9	11	7	3
Total	710	100.0	112	100.0				
		X_2^2 = 5.88 (NS)						
Road Curvature								
Straight	415	71.7	67	77.9	40.8	-6	-12	5
Curve	164	28.3	19	22.1	49.0	6	12	-5
Total	579	100.0	86	100.0				
		X_1^2 = 1.46 (NS)						
No. of Lanes								
Two Lane	428	78.4	54	69.2	46.8	9	7	2
Multilane	118	21.6	24	30.8	35.3	-9	-7	-2
Total	546	100.0	78	100.0				
		X_1^2 = 3.26 (NS)						
Road Condition								
Dry	548	78.5	88	79.3	40.9	-1	8	-9
Wet	127	18.2	19	17.1	42.6	1	1	0
Ice/Snow	23	3.3	4	3.6	39.0	0	-9	9
Total	698	100.0	111	100.0				
		X_2^2 = 0.10 (NS)						
Time of Day								
Day	108	15.7	60	54.1	16.7	-38	-43	5
Night	579	84.3	51	45.9	55.8	38	43	-5
Total	687	100.0	111	100.0				
		X_1^2 = 84.49 (S)						
Lighting								
Lighted	221	51.9	19	51.4	56.4	1	-6	7
Not Lighted	205	48.1	18	48.6	55.9	-1	6	-7
Total	426	100.0	37	100.0				
		X_1^2 = 0.00 (NS)						

TABLE 69 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	625	88.3	88	78.6	44.1	10	17	-8
Female	83	11.7	24	21.4	27.8	-10	-17	8
Total	708	100.0	112	100.0				
	X_1^2 = 8.03 (S)							
Driver Age								
-16 {	5	0.7	2	1.8	21.7	-1	-2	1
17-18 {	51	7.3	13	11.7	30.4	-4	-5	1
19-20	53	7.5	16	14.4	26.9	-7	-1	-6
21-25	132	18.8	22	19.8	40.0	-1	3	-4
26-35	169	24.0	20	18.0	48.4	6	2	4
36-55	238	33.9	25	22.5	51.4	11	7	4
56-65 {	46	6.5	9	8.1	36.2	-2	0	-2
66- {	9	1.3	4	3.6	20.0	-2	-4	2
Total	703	100.0	111	100.0				
	X_5^2 = 15.83 (S)							
Vehicle Type								
Auto	644	92.1	100	92.6	41.7	0	3	3
Light Truck {	52	7.4	4	3.7	59.1	4	1	3
Heavy Truck {	3	0.4	4	3.7	7.7	-3	-4	1
Total	699	100.0	108	100.0				
	X_1^2 = 0.03 (NS)							

- Driver Age - Drinkers in the 26-55 age group were overrepresented in lateral tracking error accidents. This was essentially equally attributable to general and specific effects.

- Vehicle Type - While the overall chi-square reflected no significant differences regarding this factor, low expected frequencies required that light and heavy trucks be grouped for the analysis. When comparing the two truck categories using a Fisher test, light trucks were found to be overrepresented among the drinkers (p=.007). This effect, however, was associated with accidents in general, not specifically with lateral tracking error accidents.

The summary of these results is given in Table 70.

TABLE 70

Summary of Context Factors for Lateral Tracking Errors

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	Lateral Tracking Errors	Both
Nighttime	X		
Males	X		
Ages 26-55			X
Light Trucks	X		
Other Large Specific Overrepresentations			
None			

Information Failures

Drivers having information failures in intersecting path - continue, intersecting path - start, and parallel opposite - left turn accidents were grouped together. While these accident involvements accounted for nineteen percent of the nondrinkers' accidents, they accounted for only seven percent of the drinkers' accidents. The results of the analysis of context factors for this group appears in Table 71. Note that the preponderance of intersection accidents limited the value of the road curvature and number of lanes analyses.

Significant simple effect differences between drinkers and nondrinkers were found for location, time of day, driver sex, and driver age. Of these, the overrepresentations of nighttime, and males were primarily due to general effects.

- Location - Drinkers in accidents generated by information failures were overrepresented in suburban areas. This was primarily due to specific, rather than general, effects.

- Driver Age - The simple overrepresentation of drinkers is the 26 to 55 age group was attributable to both accidents in general and information failure accidents.

TABLE 71

Context Factors for Information Failures

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Location								
Cities	63	32.1	130	42.2	5.1	-10	-11	1
Suburbs	93	47.4	107	34.7	8.8	13	4	9
Rural	40	20.4	71	23.1	5.9	-3	7	-10
Total	196	100.0	308	100.0				
	X_2^2 = 8.42 (S)							
Road Curvature								
Straight	133	97.8	167	100.0	8.1	-2	-12	9
Curve	3	2.2	0	0.0	100.0	2	12	-9
Total	136	100.0	167	100.0				
	Fisher Test (NS)							
No. of Lanes								
Two Lane	3	--	2	--				
Multilane	1	--	1	--				
Total	4	--	3	--				
Road Condition								
Dry	132	68.4	196	66.2	7.0	2	8	-6
Wet	51	26.4	75	25.3	7.0	1	1	0
Ice/Snow	10	5.2	25	8.4	4.3	-3	-9	6
Total	193	100.0	296	100.0				
	X_2^2 = 1.88 (NS)							
Time of Day								
Day	43	23.2	217	73.3	2.2	-50	-43	-7
Night	142	76.8	79	26.7	16.6	50	43	7
Total	185	100.0	296	100.0				
	X_1^2 = 114.91 (S)							
Lighting								
Lighted	81	83.5	43	81.1	17.3	2	-6	9
Not Lighted	16	16.5	10	18.9	15.1	-2	6	-9
Total	97	100.0	53	100.0				
	X_1^2 = 0.13 (NS)							

TABLE 71 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	176	90.3	198	64.3	9.0	26	17	9
Female	19	9.7	110	35.7	1.9	-26	-17	-9
Total	195	100.0	308	100.0				
		$X_1^2 = 42.23$ (S)						
Driver Age								
-16	1	0.5	15	4.9	0.7	-4	-2	-2
17-18	7	3.6	26	8.5	2.9	-5	-5	0
19-20	12	6.2	29	9.4	4.4	-3	-1	-2
21-25	22	11.4	35	11.4	6.5	0	3	-3
26-35	51	26.4	55	17.9	9.3	9	2	6
36-55	78	40.4	84	27.4	9.4	13	7	6
56-65	17	8.8	29	9.4	6.1	-1	0	-1
66-	5	2.6	34	11.1	1.6	-8	-4	-4
Total	193	100.0	307	100.0				
		$X_7^2 = 34.05$ (S)						
Vehicle Type								
Auto	182	95.3	281	92.7	6.7	3	3	0
Light Truck	6	3.1	14	4.6	4.5	-1	1	-3
Heavy Truck	3	1.6	8	2.6	4.0	-1	-4	3
Total	191	100.0	303	100.0				
		$X_2^2 = 1.32$ (NS)						

A summary of accidents generated by information failures is given in Table 72 below.

TABLE 72

Summary of Context Factors for Information Failure Accidents

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Information Failures	Both
Suburbs		X	
Nighttime	X		
Male Driver	X		
Ages 26 to 55			X

Longitudinal Tracking Errors

Context factors were analyzed for accidents generated by longitudinal tracking errors. The accidents included in this set of analyses were those rear end and stationary target ahead accidents in which the culpable driver's critical reason was a longitudinal tracking error. Nineteen percent of the culpable drinkers and sixteen percent of the nondrinkers were included in this group. The results are in Table 73.

For these accidents, no significant differences between drinkers and nondrinkers were found for location, road curvature, number of lanes, or lighting. Significant differences, which were attributable to general accident effects, were found for time of day, driver sex, and vehicle type. The overrepresented factors were nighttime, males, and automobiles; when considering only trucks, light trucks were also overrepresented.

- Location - While the simple effects were not significant, they differed sufficiently from general effects that there were notable drinker-nondrinker differences specific to longitudinal tracking errors; in particular, urban accidents were overrepresented for the drinkers.

TABLE 73

Context Factors for Longitudinal Tracking Errors

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Location								
Cities	239	44.3	97	38.3	21.5	6	-11	17
Suburbs	215	39.9	104	41.1	18.7	-1	4	-5
Rural	85	15.8	52	20.6	15.4	-5	7	-12
Total	539	100.0	253	100.0				
	$X_2^2 = 3.80$ (NS)							
Road Curvature								
Straight	343	95.3	192	97.0	16.6	-2	-12	10
Curve	17	4.7	6	3.0	23.9	2	12	-10
total	360	100.0	198	100.0				
	$X_1^2 = 0.93$ (NS)							
No. of Lanes								
Two Lane	137	57.6	50	56.2	23.3	1	7	-6
Multilane	101	42.4	39	43.8	22.3	-1	-7	6
Total	238	100.0	89	100.0				
	$X_1^2 = 0.05$ (NS)							
Road Condition								
Dry	385	73.6	198	80.5	17.8	-7	8	-15
Wet	120	22.9	33	13.4	28.8	10	1	8
Ice/Snow	18	3.4	15	6.1	11.8	-3	-9	7
Total	523	100.0	246	100.0				
	$X_2^2 = 11.43$ (S)							
Time of Day								
Day	99	19.5	141	59.5	7.2	-40	-43	3
Night	409	80.5	96	40.5	32.1	40	43	-3
Total	508	100.0	237	100.0				
	$X_1^2 = 118.44$ (S)							
Lighting								
Lighted	183	78.2	51	76.1	28.5	2	-6	9
Not Lighted	51	21.8	16	23.9	26.2	-2	6	-9
Total	234	100.0	67	100.0				
	$X_1^2 = 0.13$ (NS)							

TABLE 73 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Driver Sex								
Male	485	90.1	191	75.5	22.0	15	17	-3
Female	53	9.9	62	24.5	8.7	-15	-17	3
Total	538	100.0	253	100.0				
	$X_1^2 = 29.74$ (S)							
Driver Age								
-16	2	0.4	4	1.6	5.3	-1	-2	1
17-18	12	2.3	26	10.2	4.9	-8	-5	-3
19-20	37	7.0	39	15.2	9.5	-8	-1	-7
21-25	90	16.9	45	17.6	18.2	-1	3	3
26-35	114	21.4	54	21.1	19.0	0	2	-2
36-55	204	38.3	59	23.0	27.8	15	7	8
56-65	63	11.8	17	6.6	29.2	5	0	5
66-	10	1.9	12	4.7	8.5	-3	-4	2
Total	532	100.0	256	100.0				
	$X_6^2 = 59.50$ (S)							
Vehicle Type								
Auto	505	95.5	225	91.5	20.0	4	3	1
Light Truck	23	4.3	11	4.5	18.9	0	1	-1
Heavy Truck	1	0.2	10	4.1	1.1	-4	-4	0
Total	529	100.0	246	100.0				
	$X_1^2 = 4.91$ (S)							

- Road Curvature - Again, simple effects were not significant, but specific effects were noted; straight roads had a specific overrepresentation for the drinkers.

- Road Condition - For accidents generated by longitudinal tracking errors, wet roads were overrepresented for drinkers. This was almost wholly associated with specific effects, rather than with accidents in general.

- Driver Age - Drinkers in the 36 to 65 age group were overrepresented in these accidents. This was primarily due to effects specific to longitudinal tracking errors.

The results are summarized in Table 74.

TABLE 74

Summary of Context Factors for Longitudinal Tracking Errors

	Primarily Associated With:		
Overrepresented Context Factors	Accidents in General	Longitudinal Tracking Errors	Both
Wet Roads		X	
Nighttime	X		
Males	X		
Ages 36-65		X	
Cars	X		
Light Trucks	X		
Other Large Specific Overrepresentations			
Cities			
Straight Roads			

Primary Control Failures

Context factors were analyzed for accidents generated by primary control failures irrespective of the accident configuration. The results are in Table 75. From Table 41, it can be seen that fifteen percent of the culpable drinkers precipitated their accidents due to primary control failures. Among the culpable nondrinkers, seven percent did so.

The only significant simple effects were those associated with time of day, driver sex, and driver age. The overrepresentations of nighttime accidents and male drivers were both due to general effects.

The overrepresentation of drinkers in the 19 to 65 age groups was neither consistently attributable to general nor specific effects. If, however, this is viewed as a single group of drivers, the simple effects were essentially equally attributable to both general and specific effects.

The only other effect specific to primary control failures was the overrepresentation of lighted roads. These results are summarized in Table 76.

TABLE 75

Context Factors for Primary Control Failures

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Location								
Cities	102	23.6	30	26.3	27.4	-3	-11	8
Suburbs	147	34.0	42	36.8	28.0	-3	4	-6
Rural	183	42.4	42	36.8	32.6	6	7	-2
Total	432	100.0	114	100.0				
		$X_2^2 = 1.15$ (NS)						
Road Curvature								
Straight	208	58.4	63	68.5	26.8	-10	-12	1
Curve	148	41.6	29	31.5	36.2	10	12	-1
Total	356	100.0	92	100.0				
		$X_1^2 = 3.09$ (NS)						
No. of Lanes								
Two Lane	282	90.1	54	83.1	36.7	7	7	0
Multilane	31	9.9	11	16.9	23.8	-7	-7	0
Total	313	100.0	65	100.0				
		$X_1^2 = 2.68$ (NS)						
Road Condition								
Dry	326	76.7	87	77.7	29.4	-1	8	-9
Wet	79	18.6	18	16.1	32.8	3	1	1
Ice/Snow	20	4.7	7	6.3	24.1	-2	-9	8
Total	425	100.0	112	100.0				
		$X_2^2 = 0.74$ (NS)						
Time of Day								
Day	76	18.1	59	57.8	12.5	-40	-43	3
Night	344	81.9	43	42.2	47.1	40	43	-3
Total	420	100.0	102	100.0				
		$X_1^2 = 67.62$ (S)						

TABLE 75 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	General	Specific
Lighting								
Lighted	124	44.6	11	37.9	55.6	7	-6	13
Not Lighted	154	55.4	18	62.1	48.7	-7	6	-13
Total	278	100.0	29	100.0				
		$X_1^2 = 0.47$ (NS)						
Driver Sex								
Male	395	91.4	85	74.6	34.1	17	17	-1
Female	37	8.6	29	25.4	12.4	-17	-17	1
Total	432	100.0	114	100.0				
		$X_1^2 = 24.17$ (S)						
Driver Age								
-16	3	0.7	9	7.9	3.6	-7	-2	-5
17-18	61	14.3	30	26.3	18.4	-12	-5	-7
19-20	75	17.6	16	14.0	34.2	4	-1	5
21-25	101	23.7	24	21.1	31.9	3	3	0
26-35	86	20.1	13	11.4	42.4	9	2	6
36-55	82	19.2	18	15.8	33.6	3	7	-4
56-65	18	4.2	1	0.9	66.7	3	0	3
66-	1	0.2	3	2.6	3.6	-2	-4	2
Total	427	100.0	114	100.0				
		$X_5^2 = 22.90$ (S)						
Vehicle Type								
Auto	382	92.3	90	94.7	32.0	-2	3	-5
Light Truck	25	6.0	2	2.1	58.1	4	1	3
Heavy Truck	7	1.7	3	3.2	20.6	-1	-4	3
Total	414	100.0	95	100.0				
		$X_1^2 = 0.70$ (NS)						

TABLE 76

Summary of Context Factors for Primary Control Failures

Overrepresented Context Factors	Primarily Associated With: Accidents in General	Primary Control Failures	Both
Night	X		
Male	X		
Ages 19 to 65			X
Other Large Specific Overrepresentations			
Lighted Roads			

Induced Control Failures

The analysis of context factors for accidents generated by induced control failures appears in Table 77. Recall that an induced control failure is one which is at least partially attributable to slippery road surfaces. Among the drinkers, five percent had induced control failures. In contrast, twelve percent of the nondrinkers had their accidents due to induced control failures.

No significant simple effects nor any large specific effects were found for location, road curvature, lighting, or driver age. Two lane roads, nighttime accidents, and male drivers were overrepresented but this was due to general accident effects.

- Road Condition - First, it can be noted that both drinkers and nondrinkers were recorded as having a small number of induced control failures on dry roads. This apparent contradiction is due to control failures induced by gravel road surfaces, gravel on hard surfaces, freshly oiled roads, etc. The simple effects show drinkers were overrepresented on wet surfaces and that this was specific to induced control failures, rather than accidents in general.

TABLE 77

Context Factors for Induced Control Failures

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effect (%) Simple	General	Specific
Location								
Cities	37	25.9	65	34.8	5.9	-9	-11	2
Suburbs	45	31.5	56	29.9	8.2	2	4	-2
Rural	61	42.7	66	35.3	9.3	7	7	0
Total	143	100.0	187	100.0				
	$X_2^2 = 3.27$ (NS)							
Road Curvature								
Straight	83	67.5	124	77.5	6.9	-10	-12	2
Curve	40	32.5	36	22.5	11.0	10	12	2
Total	123	100.0	160	100.0				
	$X_1^2 = 3.55$ (NS)							
No. of Lanes								
Two lane	90	90.9	81	80.2	11.0	11	7	3
Multilane	9	9.1	20	19.8	4.8	-11	-7	-3
Total	99	100.0	101	100.0				
	$X_1^2 = 4.63$ (S)							
Road Condition								
Dry	9	6.4	5	2.7	16.7	4	8	-4
Wet	66	47.1	47	25.5	13.5	22	1	20
Ice/Snow	65	46.4	132	71.7	5.2	-25	-9	-16
Total	140	100.0	184	100.0				
	$X_2^2 = 21.55$ (S)							
Time of Day								
Day	16	11.5	102	58.0	1.7	-46	-43	-3
Night	123	88.5	74	42.0	15.6	46	43	3
Total	139	100.0	176	100.0				
	$X_1^2 = 71.51$ (S)							
Lighting								
Lighted	46	43.8	33	55.0	13.4	-11	-6	-5
Not Lighted	59	56.2	27	45.0	19.5	11	6	5
Total	105	100.0	60	100.0				
	$X_1^2 = 1.92$ (NS)							

TABLE 77 (Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	Drinker Effects (%) Simple	Drinker Effects (%) General	Drinker Effects (%) Specific
Driver Sex								
Male	128	90.1	136	72.7	9.5	17	17	0
Female	14	9.9	51	27.3	3.0	-17	-17	0
Total	142	100.0	187	100.0				
		$X_1^2 = 15.44$ (S)						
Driver Age								
-16 {	2	1.4	7	3.7	3.1	-2	-2	0
17-18 {	16	11.3	26	13.9	6.4	-3	-5	3
19-20	26	18.3	29	15.5	9.1	3	-1	4
21-25	28	19.7	25	13.4	11.1	6	3	4
26-35	26	18.3	39	20.9	6.9	-3	2	-5
36-55	38	26.8	42	22.5	9.1	4	7	-3
56-65 {	6	4.2	12	6.4	5.3	-2	0	-2
66- {	0	0.0	7	3.7	0.0	-4	-4	1
Total	142	100.0	187	100.0				
		$X_5^2 = 8.31$ (NS)						
Vehicle Type								
Auto	129	94.2	158	90.3	8.3	4	3	1
Light Truck {	8	5.8	8	4.6	10.0	1	1	0
Heavy Truck {	0	0.0	9	5.1	0.0	-5	-4	-1
Total	137	100.0	175	100.0				
		$X_1^2 = 1.57$ (NS)						

- Vehicle Type - While the test statistic did not reach the critical level, its computation involved grouping light and heavy trucks together. A Fisher test comparing the two truck types was significant (p=.024). This difference was primarily due to general accident effects.

A summary of induced control failure accidents is given in Table 78 below.

TABLE 78

Summary of Context Factors for Induced Control Failures

Context Factors	Primarily Associated With: Accidents in General	Induced Control Failures	Both
Two Lane Roads	X		
Nighttime	X		
Male	X		
Wet Roads		X	
Light Trucks	X		

Driver Breakdown

Driver breakdowns are defined as the inability of the driver to provide control inputs to the vehicle. This does not refer to inappropriate inputs as might occur in a control failure but rather to inputs, per se. In practice, this critical reason was used when the police form contained an explicit statement, or an item listed under "driver condition" was checked, which indicated the driver fell asleep, blacked out, etc.

Earlier analyses contained data showing that three percent of the culpable drinkers' accident involvements were due to driver breakdowns. While this is correct, the proportion stated for nondrinkers has limited meaning. This is because the nondrinker group had been restricted to "normal" drivers; thus, those with abnormal conditions were excluded from the nondrinker group. For this reason, the analysis of context factors for driver breakdowns, shown in Table 79, is somewhat different from previous analyses. Rather than comparing drinkers to nondrinkers, only drinking drivers were included, and comparisons were made between drinking drivers with breakdowns versus drinking drivers in general.*

The only significant differences were those associated with location, time of day, and driver age.

- Location - Driver breakdowns occurred disproportionately more frequently in suburban and rural areas than in the cities. Indeed only ten percent of the breakdowns occurred in cities; in contrast, 31 percent of all culpable drinkers' involvements occurred in the cities. Generally speaking, although the suburban-rural difference was small, driver breakdowns occurred with increasing likelihood from urban to suburban to rural areas.

- Time of Day - Ninety-four percent of the driver breakdowns occurred at night. They were three times more likely to occur in nighttime accidents than in daytime accidents.

- Driver Age - The data show that the incidence of driver breakdowns decreased with increasing driver age. Thirty-seven percent of the culpable drinkers were 25 years old, or younger, but this group accounted for 59 percent of the driver breakdowns leading to accidents.

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* The chi-square values were based on drinking drivers with breakdowns versus those without breakdowns.

TABLE 79

Context Factors for Driver Breakdowns

Context	Drinking Driver Breakdowns N	Drinking Driver Breakdowns %	Drinking Drivers N	Drinking Drivers %	Percent Breakdowns
Location					
Cities	8	10.0	886	30.9	0.9
Suburbs	36	45.0	1,058	37.0	3.4
Rural	36	45.0	919	32.1	3.9
Total	80	100.0	2,863	100.0	
		X_2^2 = 17.38 (S)			
Road Curvature					
Straight	50	79.4	1,625	76.7	3.1
Curve	13	20.6	495	23.3	2.6
Total	63	100.0	2,120	100.0	
		X_1^2 = 0.27 (NS)			
No. of Lanes					
Two Lane	58	86.6	1,272	78.3	4.6
Multilane	9	13.4	352	21.7	2.6
Total	67	100.0	1,624	100.0	
		X_1^2 = 2.80 (NS)			
Road Condition					
Dry	60	76.9	1,940	69.4	3.1
Wet	14	17.9	660	23.6	2.1
Ice/Snow	4	5.1	196	7.0	2.0
Total	78	100.0	2,796	100.0	
		X_2^2 = 2.15 (NS)			
Time of Day					
Day	5	6.4	499	18.1	1.0
Night	73	93.6	2,254	81.9	3.2
Total	78	100.0	2,753	100.0	
		X_1^2 = 7.42 (S)			
Lighting					
Lighted	29	47.5	940	57.2	3.1
Not Lighted	32	52.5	703	42.8	4.6
Total	61	100.0	1,643	100.0	
		X_1^2 = 2.42 (NS)			

TABLE 79 (Continued)

Context	Drinking Driver Breakdowns N	Drinking Driver Breakdowns %	Drinking Drivers N	Drinking Drivers %	Percent Breakdowns
Driver Sex					
Male	74	92.5	2,580	90.2	2.9
Female	6	7.5	279	9.8	2.2
Total	80	100.0	2,859	100.0	
		$X_1^2 = 0.48$ (NS)			
Driver Age					
-16	{ 1	1.3	18	0.6	5.6
17-18	{ 7	8.8	192	6.8	3.6
19-20	15	18.8	297	10.5	5.1
21-25	24	30.0	547	19.3	4.4
26-35	17	21.3	626	22.1	2.7
36-55	11	13.8	883	31.2	1.2
56-65	{ 5	6.3	220	7.8	2.3
66-	{ 0	0.0	47	1.7	0.0
Total	80	100.0	2,830	100.0	
		$X_5^2 = 19.88$ (S)			
Vehicle Type					
Auto	75	94.9	2,621	93.7	2.9
Light Truck	{ 4	5.1	162	5.8	2.5
Heavy Truck	{ 0	0.0	14	0.5	0.0
Total	79	100.0	2,797	100.0	
		$X_1^2 = 0.21$ (NS)			

Summary of Context Factors

Context factors were studied for each of the nine accident configurations, for various combinations of configurations and critical reasons, and for selected critical reasons alone. The purpose of these analyses was to provide information regarding the driver, the vehicle, and the environment for the various involvement modes, so as to further delineate the problems of drinking drivers. Because of the large number of analyses and the detailed nature of the results, the individual findings will not be reviewed here; individual summary tables were presented for that purpose.

It should be pointed out, however, that the results discussed in this section reflect only part of the meaning of the data. Primary emphasis was given to the drinker effect upon context factors within configurations. An example of another approach is to emphasize accident configurations within context factors. Table 80 gives the distribution of the nine accident configurations for different values of four context factors (driver age and sex, time of day, and location); only results for culpable drinkers are given. Thus, these results represent the accident generation problems for drinkers in various accident context conditions. Note that the proportions given are all based on the raw data appearing in previously presented tabulations of context factors.

The results show that Class R accidents were the most frequent configuration regardless of the context variable. Within context factors, Class R accidents were a greater problem for young drinkers, for drinkers at night, and for drinkers in rural areas.

Rear end accidents constituted the second most frequent accident configuration within each context factor. Rear end accidents were considerably more frequent for drinkers over 20, and for drinkers in urban and suburban areas. The lower frequency of rear end accidents in rural settings was probably due to fewer traffic perturbations on rural roads. Drinkers also had relatively fewer rear end accidents during the nighttime. This may suggest either greater

TABLE 80

Accident Configurations Within Selected Context Factors for Drinkers

Configuration	Driver Age		Driver Sex		Time		Location		
	-20	21+	Male	Female	Day	Night	Urban	Sub.	Rural
Class R	58.8	38.2	41.6	43.0	32.3	44.4	29.8	38.7	56.8
Rear End	7.7	15.3	13.9	13.6	18.2	12.5	16.6	16.5	8.2
Stationary Target Ahead	4.5	8.2	7.7	7.2	4.4	8.3	14.2	6.0	3.0
Parallel Opposite-Lateral Move	3.4	7.4	6.3	9.0	8.2	6.1	6.3	7.3	6.1
Parallel Opposite-Left Turn	1.4	2.8	2.4	2.9	3.2	2.3	2.3	3.8	1.3
Intersecting Path-Continue	2.6	4.3	4.2	2.5	5.6	3.6	5.2	4.3	2.6
Intersecting Path-Start	0.2	0.9	0.6	1.8	0.8	0.7	0.6	1.0	0.5
Rearward	1.2	1.7	1.7	1.4	2.6	1.5	2.3	1.4	1.3
Parallel Same-Lateral Move	2.2	1.4	1.6	0.4	2.6	1.3	1.9	1.2	1.4
Other	18.1	19.9	19.9	18.3	22.0	19.3	20.9	19.7	18.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No. of Observations	507	2,323	2,580	279	499	2,254	886	1,058	919

opportunity during daytime rush hours, or it may imply that rear lighting on vehicles ahead is more effective at night than during the day.

Accidents involving stationary targets ahead were similar to rear end accidents in that they occurred relatively less often for young drinkers and showed no difference regarding driver sex. Not unexpectedly, they occurred frequently in urban settings where the incidence of parked cars is highest. Finally, drinkers had relatively more stationary target ahead accidents at night than during the day. This may well reflect the decreased attention-getting value of parked cars at night.

The next configuration, parallel opposite-lateral move, was relatively more frequent for females, for drinkers over 20, and for daytime accidents. While this pattern may suggest this configuration was a problem for shoppers, the reasons for these findings are unknown.

The next three configurations all reflect intersection accidents, and a tendency for low frequencies in rural areas is evident. Each of these configurations was also infrequent for young drivers. This may be due to the propensity of the young drinkers for rural accidents, it may reflect that young drinkers were less callous regarding the hazards of intersections, or it may simply be due to the high proportion of Class R accidents for the young suppressing the relative frequencies of other configurations.

Rearward accidents were notable for their higher relative frequency during the day as opposed to night, and their greater likelihood in urban versus suburban or rural areas. The latter effect could result from a greater incidence of backing maneuvers, in general, in urban settings.

Finally, parallel same-lateral move accidents occurred much more frequently for males as compared to females. Since these accidents often involved passing maneuvers, a possible explanation is that the men were more aggressive drivers.

Because of the preponderance of Class R accidents, the analysis above was extended to examine Class R accidents as a function of the four context factors taken jointly, rather than separately. Table 81 gives these results in terms of the proportion of accidents which were Class R's. Note that because all four context factors had known values for inclusion in this table, the number of observations is less than in the table above. The denominators for this table appear in Table 27, and the numerators are given in Appendix E. Proportions were computed only if the denominators contained at least 20 observations. The lower part of the table shows proportions after collapsing over driver variables in the same format used in Table 27.

In the lower right, it can be seen that when considering the full set of 2,503 accidents, 41 percent were of the Class R type. The conditions in which Class R accidents constituted the largest proportion of accidents for drinkers were rural nighttime accidents by young male DWI's; the proportion was 71 percent. For rural accidents, including both day and night for the same drivers, the proportion was 70 percent; the change was small because less than 20 of those drivers had their accidents during the daytime. For the HBD's among young, culpable males, 67 percent of the rural nighttime accidents were in Class R; for all rural accidents for these drivers, the proportion was 65 percent.

Therefore, looking at the third block down where DWI's and HBD's are combined, we have 68 percent of the rural, nighttime accidents and 66 percent of the all rural accidents by young men were of Class R. Furthermore, because there were so few young women in this data set, their contribution was small. Thus, for all young drinking, culpable drivers in rural nighttime accidents, 68 percent were of Class R. Finally, for all young drinking, culpable drivers in all rural accidents, 66 percent were of Class R.

TABLE 81

Class R Accidents by Driver and Situational Variables

Driver Variables			Situational Variables											
			Day				Night				Day Plus Night			
Age	Sex	Driver Status	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total
Young	Male	DWI	-	-	-	-	21.7	52.5	71.4	54.7	20.8	50.0	69.7	53.4
Old			18.4	28.4	40.5	29.0	20.5	28.4	51.7	32.3	20.0	28.4	49.0	31.7
Young	Female		-	-	-	-	-	-	-	-	-	-	-	-
Old			-	-	-	-	-	37.2	60.0	43.8	38.1	33.3	50.0	38.5
Young	Male	HBD	-	-	-	46.9	45.0	64.4	66.7	63.7	42.9	61.2	64.6	61.4
Old			20.0	27.3	44.6	31.8	31.7	43.8	59.9	47.5	29.1	40.5	57.1	44.4
Young	Female		-	-	-	-	-	-	-	63.3	-	-	-	61.3
Old			-	-	-	-	-	35.9	48.3	39.1	27.3	33.3	52.9	38.6
Young	Male	-	-	-	55.2	44.9	32.6	58.2	68.3	59.8	31.1	55.6	66.3	58.0
Old			19.0	27.9	42.3	30.2	24.3	34.2	55.9	38.6	23.1	33.1	53.0	36.9
Young	Female		-	-	-	-	-	-	-	61.9	-	-	-	61.4
Old			-	-	-	23.3	36.1	36.6	53.1	41.3	32.6	33.3	51.7	38.6
-	Male	-	18.6	28.6	44.7	31.9	25.1	39.1	59.0	42.8	23.8	37.4	56.2	40.8
-	Female	-	-	-	-	25.0	38.6	41.4	56.1	45.5	35.3	38.1	54.5	42.7
Young	-	-	-	-	54.8	45.1	35.3	58.8	67.9	60.0	34.0	56.4	66.0	58.3
Old			18.7	26.5	42.4	29.6	25.3	34.5	55.6	38.9	23.8	33.1	52.9	37.1
TOTAL			18.4	27.3	44.7	31.4	26.3	39.4	58.8	43.0	24.7	37.5	56.1	41.0

Therefore, young people who drive on rural roads would be a valid target group for countermeasures applicable to Class R accidents. In this data set of 2,503 accidents with 1,025 Class R accidents, the young drivers in rural accidents numbered 215; of these, 142 were of Class R.

Looking for a broader target group, it can be seen that in every row of Table 81, the highest proportions are for rural nighttime accidents, and the second highest were for all rural accidents. The difference between the two was small because of the few drinking accidents in the daytime. There were 718 rural nighttime accidents, of which 422 were Class R; there were 888 rural accidents (both day and night), of which 498 were Class R.

Generally speaking, the differences between young and old drivers exceeded that between males and females. For the young drivers, nighttime Class R accidents were also a problem in the suburbs, but of a somewhat lesser magnitude than in rural areas; for them, the day/night dimension had little effect.

While accidents of Class R were almost always the largest problem for the drinkers, the table shows that in some conditions the problem was much less than that discussed above. Of all daytime drinking accidents, Class R constituted 31 percent. In urban accidents at night, it accounted for 26 percent of the accidents, and during the day, 18 percent. Another relatively low figure was obtained for suburban daytime accidents -- 27 percent. Thus, Class R accidents constituted a relatively small problem for drinkers in urban areas and during the daytime, with the lowest relative frequency occurring in the combination of the two factors. In daytime accidents, the young males had a relatively high Class R rate, but there were sufficiently few young men in daytime accidents that the overall effect was small.

It is important to remember that these results are based on proportions computed within each cell of Table 81, and therefore, reflect the extent of the Class R problem given an accident defined by the cell descriptions. As noted earlier, the simple frequencies of Class R accidents appear in Appendix E. These frequencies show that simply because the older males constitute a larger group than young ones, most Class R accidents involved drinking males above 20 years of age.

Returning to the general analysis of context factors, while it was not emphasized in the discussion, results were presented giving the percent of culpable drivers who were drinkers in the various configuration by context factor combinations. The highlights of those results are summarized here.

First, it should be noted that seventeen percent of the drivers in the population reflected by the sample were drinkers. Somewhat surprisingly, there was a considerable number of conditions in which drinkers constituted over fifty percent of the drivers.

The largest single group for which the proportion of drinkers exceeded fifty percent consisted of drivers in Class R accidents due to lateral tracking errors. Of these drivers, fifty-one percent were drinkers. Within this group, over sixty percent of the drivers were drinkers for lighted roads, for drivers in the 36 to 65 age range, and for light trucks.

Overall, the highest proportion of drinkers was observed for drivers generating Class R accidents due to primary control failures on lighted roads; seventy-two percent of them were drinkers. The second highest proportion was observed for drivers of light trucks in the same configurations by critical reason group; seventy percent were drinkers, although the total number of drinkers was only 21.

Other conditions with high proportions of drinkers are listed in Table 82 below. Only conditions in which there were at least 25 drinkers have been included. (Note that the rows in the table are not necessarily mutually exclusive.)

TABLE 82

Summary of Accidents With High Proportions of Drinkers

Configuration and/or Critical Reason	Context Factor	Condition	Number of Drinkers	Proportion of Drinkers (%)
Class R	Vehicle Type	Light Truck	90	63
Class R due to Primary Control Failures	Time	Night	258	51
Stationary Object Ahead	Age	56-65	37	58
Lateral Tracking Error	Time	Night	579	56
	Light	Lighted	221	56
	Light	Not Lighted	205	56
	Age	36-55	238	51
	Vehicle Type	Light Truck	52	59
Primary Control Failure	Light	Lighted	124	56
	Vehicle Type	Light Truck	25	58

In contrast, there were also conditions in which the proportion of drinkers was quite low. If we limit our interest to those in which the number of nondrinkers was at least 25 (225 in the population), two factors were most notable when considering all accidents. First, among all drivers 16 years old or younger, only four percent of the drivers were drinkers. Second, as noted earlier, only two percent of the heavy truck drivers were drinkers. Finally, the proportion of drinkers in all intersection path-start accidents was only two percent. The remainder of the low drinker proportion (five percent or less) groups appear in Table 83, below.

TABLE 83

Summary of Accidents With Low Proportions of Drinkers

Configuration and/or Critical Reason	Context Factor	Condition	Number of Drinkers	Proportion of Drinkers (%)
Rear End	Age	17-18	11	3
	Road Condition	Ice/Snow	19	5
	Time	Day	91	5
	Sex	Female	38	5
Parallel Opposite - Left Turn	Time	Day	16	3
	Sex	Female	8	3
	Age	Up to 25	12	4
Intersecting Path - Continue	Time	Day	28	3
	Sex	Female	7	2
Rearward	--	Lots	10	3
	Time	Day	13	5
Parallel Same - Lateral Move	Time	Day	13	5
Information Failure	Location	Cities	63	5
	Road Condition	Ice/Snow	10	4
	Time	Day	43	2
	Sex	Female	19	2
	Age	Up to 20	20	3
	Age	66, plus	5	2
Longitudinal Tracking Error	Age	Up to 18	14	5
Induced Control Failure	Road Condition	Ice/Snow	65	5
	Time	Day	16	2
	Sex	Female	14	3

These two tables show the extremes of the drinker problem. They also demonstrate the very wide range the drinker problem can assume.

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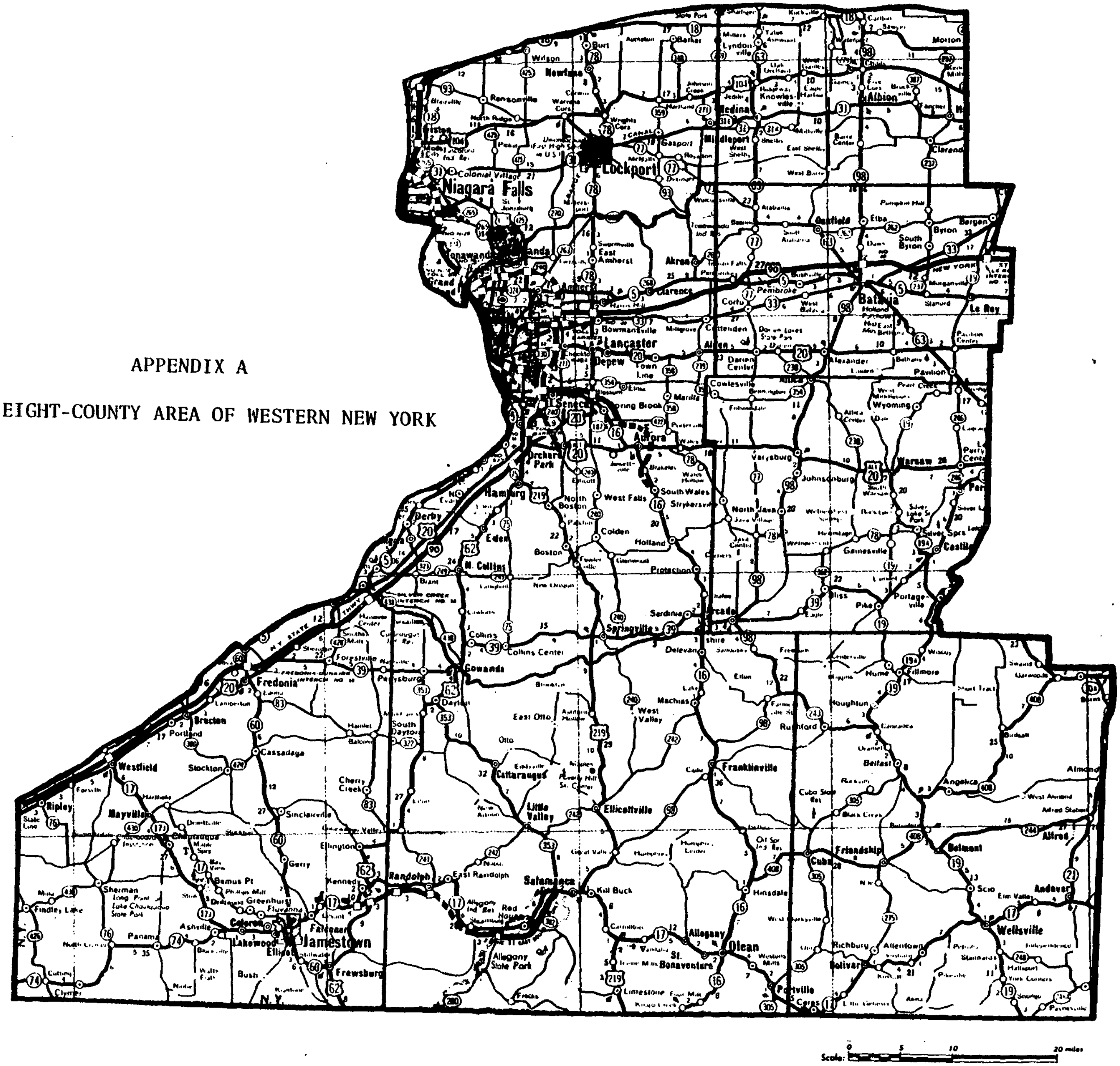
APPENDIX A

EIGHT-COUNTY AREA OF WESTERN NEW YORK



ZS-5547-V-1

APPENDIX B

INTERVIEW FORM

I N T E R V I E W

Alcohol Study

Ax. No. _ _ _ _

Driver No. _

Driver Age _ _

Driver Sex _ M-1, F-2, Unk.-3

Interview Status 1 Completed

2 Refused Interview

3 Unable to Contact

NAME:

PHONE:

Accident Information

Vehicle Type

Auto:	Sports	01
	Subcompact	02
	Compact	03
	Intermediate	04
	Standard	05
	Luxury	06
	Jeep	07
	Unknown Auto	08
Truck:	Light, Van, MH	09
	Heavy, Bus, Special	10
	Unknown Truck	11
Motorcycle		12
Unknown		13

Foreign Car?

Yes	1
No	2
Not car	3
Unknown	4

Vehicle Model Year

	Code
1972	72
1965	65
'	'
'	'

Accident Trip

To (Intended Destination)

		W	H	Sh	R or S	U
FROM:	Work	01	02	03	04	05
	Home	06	07	08	09	10
	Shopping	11	12	13	14	15
	Recreation or social	16	17	18	19	20
	Unknown	21	22	23	24	25

Business trip	26
Emergency	27
Other	28
Unknown	29

Accident Trip (continued)

How long had you been driving before the accident occurred? (Since last out of car.)

Parked or just starting	1
1-7 minutes	2
8-12 minutes ————	3
13-19 minutes	4
20, 25 minutes	5
30, 55 minutes ————	6
1 hour, but less than 2	7
More than 2 hours	8
Unknown	9

How far were you from your home when the accident occurred?

1 mile or less	1
2 or 3 miles	2
4 or 5 miles ————	3
6 to 10 miles	4
10 to 50 miles ————	5
More than 50 miles	6
Unknown	7

How often had you driven on that road before the accident occurred?

Never before	1
A few times ————	2
One or more times/year	3
One or more times/month	4
One or more times/week or daily ————	5
Unknown	6

Had you been drinking before the accident?

Yes	1
No ————	2
Refused	3
Unknown	4

Accident Trip (continued)

How much?

Amount	
Beer-	1_
Wine-	2_
Liquor-	3_
None	44
Refused	55
Unknown	66

Over what period of time?

1/2 hour or less	1
1 hour	2
1 1/2 hours	3
2 hours	4
3, 4 hours	5
More than 4 hours	6
Not drinking	7
Refused	8
Unknown	9

Had you been using prescription or other drugs before the accident?

Yes	1
No	2
Refused	3
Unknown	4

Driver Education

Type:	High school	1
	Military	2
	Commercial driving school	3
	Industrial training	4
	Other	5
	No formal training	6

When?	After 1973	8
	1973 (2 years ago)	1
	1972 (3 " ")	2
	1971 (4 " ")	3
	66-70 (5-9 years ago)	4
	61-65 (10-14 years ago)	5
	51-60 (15-24 years ago)	6
	1950 or earlier (25 or more years ago)	7
	No driver education	8
	Unknown	9

General Education (highest level)

Completed high school?	No	1
	Yes	2
Vocational training beyond high school		3
Attended college		3
Bachelor's degree		4
Graduate degree		5

Drinking Habits

How often do you drink any alcoholic beverages?

Never	1
Few times/year	2
Few times/month	3
Few times/week	4
Refused	5
Unknown	6

How much do you usually drink?

(Fill in one)

Amount

Beer-	1_
Wine-	2_
Liquor-	3_
Doesn't drink	44
Refused	55
Unknown	66

When you drink more than your usual amount, how much do you drink?

(Fill in one)

Amount

Beer-	1_
Wine-	2_
Liquor-	3_
Doesn't drink	44
Refused	55
Unknown	66

Drinking Habits (continued)

About how many drinks do you think the average driver can have without impairing his driving?

(Fill in one)

	Amount	
Beer-		1_
Wine-		2_
Liquor-		3_
None		44
Refused		55
Unknown		66

Have you ever used marijuana?

One or more times/week	1
" " " " /month	2
Seldom	3
Never	4
Refused	5
Unknown	6

APPENDIX C

ACCIDENT AND VEHICLE FORMS FOR ROUTINE CODING

ACCIDENT CARD

1. Acc. No. 1 2 3 4

2. Month (5-6)

Jan	01
Feb	02
Mar	03
Apr	04
May	05
June	06
July	07
Aug	08
Sept	09
Oct	10
Nov	11
Dec	12

3. Date 7 8

4. Day (9)

Sun	1
Mon	2
Tue	3
Wed	4
Thur	5
Fri	6
Sat	7
Unk	8

5. Hr. (10-11)

1:00- 1:59	01
2:00- 2:59	02
3:00- 3:59	03
4:00- 4:59	04
5:00- 5:59	05
6:00- 6:59	06
7:00- 7:59	07
8:00- 8:59	08
9:00- 9:59	09
10:00-10:59	10
11:00-11:59	11
12:00-12:59	12

6. AM/PM (12)

AM	1	1
PM	2	2
Unk	3	3

7. Location (13)

Buff	1
Alleg	2
Catt	3
Chaut	4
Erie	5
Gen	6
Niag	7
Orleans	8
Wym	9

8. Loc. Class (14)

City or Village	1
Town	2
Unk	3

9. Area Type (15)

Urban	1
Rural	2
Unk	3

10. Traffic Control (16)

None	1
Police	2
Stop Lite	3
Stop Sign	4
Yield	5
Other	6
Unk	7

11. Lighting (17)

Day	1
Dawn or Dusk	2
Nite: Lites	3
No Lites	4
Unk	5
Unk	6

12. Weather (18)

Clear	1
Rain	2
Fog	3
Snow	4
Other	5
Unk	6

13. Road Cond. (19)

Dry	1
Wet	2
Ice/Snow	3
Other	4
Unk	5

14. Horizontal Alignment (20)

Straight	1
Curve	2
Unk	3

15. Vertical Alignment (21)

Level	1
Grade	2
Hillcrest	3
Unk	4

16. Intersection Related? (22)

Yes	1
No	2
Unk	3

17. Minor Cross Road (23)

Road	1
Ramp	2
Driveway	3
Alley	4
No inter.	5
Unknown	6

18. Major Road Type (24-25)

Ramp	01
Lim. Access	02
Other Divided	03
1-Way	04
Multi Lane	05
2 Lane	06
Unk Lane	07
Dway/Alley	08
Park Lot	09
Unk	10

19. Severity (26)

No injury	1
Injury	2
Fatal	3
Unk	4

20. No. of Vehicles (27)

	1
	2
	3
	4
	5
	6
	7
8 or More	8
Unk	9

21. Investigated at Scene

Yes	1
No	2
Unk	3

VEHICLE CARD

1. Acc. No. 1 2 3 4

2. Vehicle No. (Police) 5

3. Driver Age 6 7

4. Driver Sex (8)
   - M 1
   - F 2
   - Unk 3

5. License Type (9)
   - Oper/Chauf 1
   - Learner 2
   - Interim 3
   - None 4
   - Unk 5

6. Driver Cond. (10)
   - Normal 1
   - Ill 2
   - Defect 3
   - Sleep 4
   - HBD 5
   - Unk 6

7. Vehicle Type (11-12)
   - Auto 01
   - Truck
     - Light 02
     - Van/MH 03
     - Heavy 04
     - Special 05
     - Unk 06
   - Recreation 07
   - Motorcycle 08
   - Unk, Not Auto 09
   - Unk 10

8. Body Style (13-14)

10, 19	Sports	01
4,9,18	Subcomp	02
6,8	Compact	03
1,7,17	Intermed	04
2	Standard	05
3,5	Luxury	06
14, 17	Jeep	07
	Unk Auto	08
	Not Auto	09
	Unk if Auto	10

9. Foreign Make? (15)
   - Yes 1
   - No 2
   - Unk 3

10. Model Year 16 17

11. Towed? (18)
    - Yes 1
    - No 2
    - Unk 3

12. Driver Injury (19)
    - None 1
    - Injured 2
    - Killed 3

13. Vehicle Injury (20)
    - None 1
    - Injured 2
    - Killed 3

14. DWI Violation (21)
    - 1192-1 1
    - 1192-2 2
    - 1192-3 3
    - 1192-4 4
    - 1192-5 5
    - 1192 6
    - None 7

Other Charges
- H&R No Charges 7777
- No Charges 8888
- Unknown Charge 9999

15. 22 — — 25

16. 26 — — 29

17. 30 — — 33

18. Road Type (34)
    - Ramp 1
    - Driveway 2
    - Alley 3
    - 1-Way 4
    - None of above 5
    - Unk 6

19. Calspan No. 35

APPENDIX D

CODING FORM FOR CAUSAL STRUCTURE AND DESCRIPTION OF CAUSAL ELEMENTS

The Causal Structure

The causal structure is a description of the conditions and events leading to each accident, coded in such a way as to be computer readable. The elements of the causal structure, or causal elements, are coded for each motor vehicle in the accident; this, then, allows statistical analyses to be performed either by driver/vehicle unit or by accident. While the causal structure cannot provide complete detail for each accident, it does allow for the description of the essentials of the accident generation process. The coding sheet used appears after the description of the elements of the causal structure. The coding sheet consists of several checklists; in describing a vehicle's accident involvement, one element is selected from each listing.

The driver-vehicle unit being coded at any point in time is called the subject vehicle.

Target

This is the thing struck or the event that defines the occurrence of an accident for the subject vehicle.

(01-09) Vehicle number ____. Each vehicle contacted in the accident is assigned a number with the first striking vehicle being number one, etc.

10. Pedestrian or bike
11. Train
12. Animal
13. Road departure
14. Rollover
15. Other
16. Unknown

Target Location

The location of the target (or target event) relative to the vehicle's path immediately prior to the occurrence of subject critical event.* (On a curved road, a target in the travel lane ahead is coded as forward).

1. Forward
2. Right Front
3. Right
4. Right Rear
5. Rear
6. Left Rear
7. Left
8. Left Front
9. Other
10. Unknown

Target Path

The path of the target relative to that of the subject vehicle's path immediately prior to the occurrence of the critical event. (On curved road, a vehicle ahead moving in the same direction is coded as same. If the target is stopped with motion imminent, its path is the direction which it is facing.)

1. Same
2. Opposite - same lane, opposite direction
3. Parallel path, same direction
4. Parallel path, opposite direction
5. Right Front
6. Right
7. Right Rear

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* See discussion below preceding the critical event codes.

8. Left Rear
9. Left
10. Left Front
11. None - The target is immobile or a parked vehicle
12. Other
13. Unknown

Subject Path

The subject vehicle's path to the critical event. If the vehicle is proceeding in a traffic lane, the subject path describes that lane. If it is turning at an intersection, or driveway, etc., that is described. In a parking lot, the path describes the effective steering angle.

1. Forward
2. Right Curve
3. Right Turn
4. Left Curve
5. Left Turn
6. Curve, direction unknown
7. Rear
8. Right Rear
9. Left Rear
10. Path ends - For example, a "T" intersection or lane drop
11. Motion imminent - stopped but not parked
12. Motion imminent/forward - couldn't determine if vehicle came to full stop
13. None - stopped with no motion imminent (usually parked)
14. Other
15. Unknown

Thus, the target location and target path give the relative locations and directions of movement of the vehicles involved before the situation became critical. The subject path describes, in absolute terms, the motion of the subject vehicle.

A situation is said to be critical when an accident is essentially inevitable; that is, when normally practiced driving maneuvers will not prevent its occurrence. The behavior of the subject vehicle which elicits a critical situation is called the critical event. Accidents can be generated in one of two ways: (1) An existing collision course is maintained; or (2) When no relevant collision course exists, a vehicle can act so as to create one which is immediately critical. Thus, a vehicle can be involved in an accident in one of three ways: (1) Continuing along an existing collision course, (2) Precipitating an immediately critical collision course, or (3) Being imposed upon by the precipitating action of another vehicle or agent.

Critical Event

What the subject unit did to produce a critical condition.

1. Imposed upon - Another agent acted upon the subject unit to create a critical condition; there was no relevant collision course prior to that activity.
2. Continue - There was a collision course, which was not disrupted, so that a collision ensued.
3. Continue steer angle - The subject unit maintained its effective steer angle, while the road configuration changed. (Usually a vehicle going straight while the road curved.)
4. Change speed - A critical condition resulted when this vehicle changed speed (Choose specifics below.)
5. Change direction - A critical condition resulted when this vehicle changed direction (Choose specifics below.).

6. Continue/Imposition - Used when choice is not clear.
7. Continue/Change speed - Used when choice is not clear.
8. Continue/Change direction - Used when choice is not clear.
9. Other
10. Unknown

Change Speed (To give specific type)

1. Start
2. Stop
3. Accelerate
4. Decelerate
5. Start backward
6. Other
7. Unknown
8. Not applicable (No speed change)

Change Direction (To give specific type)

1. Normal turn (at intersection, driveway, etc.)
2. Wide turn (at intersection, driveway, etc.)
3. Cut turn short (at intersection, driveway, etc.)
4. Protracted turn (at intersection, driveway, etc.)
5. Other or unknown turn (at intersection, driveway, etc.)
6. Move
7. Parallel path (usually lane change)
8. Other
9. Unknown
10. Not applicable (no direction change)

Direction (For direction change)

1. Right
2. Left
3. Unknown
4. Not applicable (no direction change)

Critical Reason That event or condition which most directly elicited the critical event.

1. External influence - Critical event was in response to external demands. Also used when critical event was "imposed upon".
2. Secondary - Target was already involved in previous collision, road departure, or rollover.
3. External Influence/Passive - Used when the critical event equals continue/imposition.
4. Vehicle breakdown - A sudden malfunction of the vehicle so that it would no longer respond normally to control inputs.
5. Driver breakdown - A sudden malfunction of the driver so that he can no longer provide intended inputs to the vehicle.
6. Information failure - Accident would not have occurred if the driver had validly processed information about the vehicles, objects, and roadway in his vicinity. (Chose specifics below.)
7. Information failure - Control failure combination - similar to control failure below, but involved apparent breakdown of visual/control system; basically sloppy control as opposed to loss of control. (This code was experimental and received little use.)
8. Control Failure - Driver failed to guide his vehicle along his currently intended path. (Choose specifics below.)

9. Information failure/control failure - Used when choice is not clear.

10. Logistic - Subject's behavior was based solely on reasons relating to where he was going and how he wanted to get there (Choose specifics below).

11. Other

12. Unknown

<u>Information Failure</u>[1] (To give specific type)

1. Presentation error - Information was obscured and therefore not available to the driver.

2. Sensing error - Information was transmitted to the general area of the driver, but did not reach the appropriate sensory receptors. (E.g., driver didn't look in required direction.)

3. Recognition error - Information was sensed but driver remained unaware of the source conditions.

4. Projection error - Driver was aware of external conditions but did not appropriately process the information to draw valid conclusions about ensuing events. (Usually speed/distance misjudgments.)

5. Conflict error - The driver's action was based on existing but misleading conditions.

6. Other

7. Unknown

8. Not applicable (No information failure).

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[1] In using police data, as opposed to in-depth reports, the particular type of information failure is often unknown thus leading to frequent use of code 7. Codes 1 through 6 remain available for use in the event they are reported.

Control Failure (To give specific type)

1. Primary control failure - as stated under critical reason.
2. Induced control failure - as above, but induced at least in part by a slippery road surface or other roadway condition; i.e., accident would not have occurred if the road had been free of ice, snow, etc.
3. Unknown whether primary or induced.
4. Not applicable (No control failure).

Logistic (To give specific type)

1. Proceed - Passively continue along path with no relevant collision course.
2. Before turn (Usually refers to deceleration).
3. To pass (Usually refers to direction change: Parallel path.)
4. Park - Either vehicle was parked or reason for critical event was pre-parking or parking maneuver.
5. Other
6. Not applicable (Reason was not logistic.).

Category

When critical reasons were information failures, control failure, or logistic. This list was used to specify whether the information was reported on inferred. Codes 3 and 4 were used if a combination information failure/control failure required it.

1. Reported
2. Inferred
3. Information failure was reported, control failure was inferred.
4. Control failure was report, information failure was inferred.
5. Not applicable.

When the critical reason is external influence, a critical source is also given; it specifies the external agent to which the subject vehicle responded. When the critical reason is secondary, the source is coded "target". Whenever the critical reason is information failure, a critical source is also given; it specifies the source of the information which was not properly processed. Thus, a critical source is given if, and only if, the critical reason is external influence, secondary, or information failure.

Critical Source

(01-09). Vehicle number ____. A vehicle involved in the accident but not the target for the subject vehicle.
10. Target - The critical source is the same as the target.
11. Non-accident vehicle
12. Pedestrian or bike
13. Train
14. Animal
15. Traffic control signal
16. Traffic control sign
17. Road
18. Other
19. Unknown
20. Not applicable (Critical reason is not external influence, secondary or information failure.)

These codes, starting with critical event and ending with critical source, describe the critical phase of the accident. These codes can also be used to describe a prior phase if it helps to better describe the accident. For example, a driver might decelerate to avoid a stopped vehicle, then lose control on ice and slide off the road to the right. In this instance the codes would reflect in the prior phase deceleration (prior event), external influence (prior reason), and non-accident vehicle (prior source). The target is road departure, its location is right front, the subject path is forward. The critical phase reflects a move to the right (critical event) due to an induced control failure (critical reason); no critical source is required.

Thus, as stated above, a prior phase is coded if it produces a more complete description of the accident. The codes used are the same as those given above for the critical phase, with the following exception. The code, imposed upon, cannot be used in the prior phase since it implies a situation which is immediately accident producing.

The final set of elements to be coded relates to responsibility for the accident. The coding here is based on the concept of an abnormal situation; this is defined to be a condition where the expectations of a hypothetical, normal driver would be violated.

Culpability

1. Culpable - A driver/vehicle unit is said to be culpable if it is the first unit to create an abnormal situation.
2. Culpable/contributory - Used when choice is not clear.
3. Contributory - The situation is already abnormal, but the subject could have avoided involvement in the accident by normally practiced maneuvers.
4. Contributory/Not culpable - Used when choice is not clear.
5. Not culpable
6. Unknown

Culpable Behavior

1. PE/CE - The behavior inducing the abnormal situation is that specified by the prior event or the critical event.
2. Police chase
3. Excessive speed or acceleration
4. Low or erratic speed
5. Erratic direction changes or wrong side of road
6. Turn from wrong lane

7. Wrong way driving
8. Thru stop sign or signal, or early start from signal
9. Driving on shoulder or median
10. Tailgating
11. Driving without headlights
12. Stopped or parked in dangerous location
13. Other
14. Not applicable (Not culpable)

Culpable Phase

1. Prior event - The culpable behavior was the prior event.
2. Critical event - The culpable behavior was the critical event.
3. Prior phase - The culpable behavior was not the prior event, but occurred before the critical event.
4. Critical phase - The culpable behavior was not the critical event but occurred at the same time.
5. Not applicable.

Other Data Elements

The following listings specify the data elements to be used in addition to those given above. They are grouped according to the source of the information. The data elements were selected to achieve the following. Environmental characteristics were chosen to allow the determination of specific problems for drinking drivers (curves, intersections, slippery roads, reduced visibility, etc.); in addition, combinations of such factors can yield analyses measuring the adaptability of drinking drivers to more demanding situations. Driver data will, in conjunction with interview data, characterize the driver in terms of socioeconomic status and drinking status; in addition, some factors relating to the accident trip are included. Accident reports will provide injury information in addition to information on the accident generation process.

Acc. No. 1 2 3 4
Sample 5
Acc. Mo. 6 7
Acc. Date 8 9
County 10
Sub. No. 11
D. Age 12 13
D. Sex 14

Prior Event (15-6)
- Continue 02
- Cont. S.A. 03
- Ch. Speed 04
- Ch. Direction 05
- Cont./C.S. 07
- Cont./C.D. 08
- Other 09
- Unk. 10

Ch. Speed (17)
- Start 1
- Stop 2
- Accel. 3
- Decel. 4
- Start - Back 5
- Other 6
- Unk. 7
- NA 8

Ch. Direction (18-9)
- Turn
  - Normal 01
  - Wide 02
  - Cut short 03
  - Protracted 04
  - Other/Unk. 05
- Move 06
- Parallel path 07
- Other 08
- Unk. 09
- NA 10

Direction (20)
- Right 1
- Left 2
- Unk. 3
- NA 4

- - - - - - - - - - -

Prior Reason (21-2)
- Ext. infl. 01
- Secondary 02
- EI/Pass. 03
- Veh. breakdown 04
- Dr. breakdown 05
- Info. failure 06
- IF-CF comb. 07
- Cont. failure 08
- IF/CF 09
- Logistic 10
- Other 11
- Unk. 12

Info. Failure (23)
- Pres. 1
- Sense 2
- Rec. 3
- Proj. 4
- Conflict 5
- Other 6
- Unk. 7
- NA 8

Cont. Failure (24)
- Primary 1
- Induced 2
- Unk. 3
- NA 4

Logistic (25)
- Proceed 1
- Before turn 2
- To pass 3
- Park 4
- Other 5
- NA 6

Category (26)
- Reported 1
- Inferred 2
- IF-R, CF-I 3
- CF-R, IF-I 4
- NA 5

Prior Source (27-8)
- Veh. No. 0_
- Target 10
- Nonacc. veh. 11
- Ped. or bike 12
- Train 13
- Animal 14
- T. signal 15
- T. sign 16
- Road 17
- Other 18
- Unk. 19
- NA 20

- - - - - - - - - - -

Target (29-30)
- Veh. No. 0_
- Ped. or bike 10
- Train 11
- Animal 12
- Road Dep. 13
- Roll 14
- Other 15
- Unk. 16

Target Location (31-2)
- Front 01
- Right front 02
- Right 03
- Right rear 04
- Rear 05
- Left rear 06
- Left 07
- Left front 08
- Other 09
- Unk. 10
- NA 11

Target Path (33-4)
- Same 01
- Opposite 02
- Par - Same 03
- Par - Opp. 04
- Right front 05
- Right 06
- Right rear 07
- Left rear 08
- Left 09
- Left front 10
- None 11
- Other 12
- Unk. 13
- NA 14

Subject Path (35-6)
- Forward 01
- R. curve 02
- R. turn 03
- L. curve 04
- L. turn 05
- Curve, dir., unk. 06
- Rear 07
- Right rear 08
- Left rear 09
- Ends 10
- Mot. imm. 11
- MI/For - Rr 12
- None 13
- Other 14
- Unk. 15

Critical Event (37-8)
- ~~Imposed upon~~ 01
- Continue 02
- Cont. S.A. 03
- Ch. speed 04
- Ch. direction 05
- Cont./Imp. 06
- Cont./C.S. 07
- Cont./C.D. 08
- Other 09
- Unk. 10

Ch. Speed (39)
- Start 1
- Stop 2
- Accel. 3
- Decel. 4
- Start - Back 5
- Other 6
- Unk. 7
- NA 8

Ch. Direction (40-1)
- Turn
  - Normal 01
  - Wide 02
  - Cut short 03
  - Protracted 04
  - Other/Unk. 05
- Move 06
- Par. path 07
- Other 08
- Unk. 09
- NA 10

Direction (42)
- Right 1
- Left 2
- Unk. 3
- NA 4

- - - - - - - - - - -

Critical Reason (43-4)
- Ext. Infl. 01
- Secondary 02
- EI/Pass. 03
- Veh. breakdown 04
- Dr. breakdown 05
- Info. failure 06
- IF-CF comb. 07
- Cont. failure 08
- IF/CF 09
- Logistic 10
- Other 11
- Unk. 12

Info. Failure (45)
- Pres. 1
- Sense 2
- Rec. 3
- Proj. 4
- Conflict 5
- Other 6
- Unk. 7
- NA 8

Cont. Failure (46)
- Primary 1
- Induced 2
- Unk. 3
- NA 4

Logistic (47)
- Proceed 1
- Before turn 2
- To pass 3
- Park 4
- Other 5
- NA 6

Category (48)
- Reported 1
- Inferred 2
- IF-R, CF-I 3
- CF-R, IF-I 4
- NA 5

Critical Source (49-50)
- Veh. No. 0_
- Target 10
- Nonacc. veh. 11
- Ped. or bike 12
- Train 13
- Animal 14
- T. signal 15
- T. sign 16
- Road 17
- Other 18
- Unk. 19
- NA 20

- - - - - - - - - - -

Culpability (51)
- Culpable 1
- Culp./Contrib. 2
- Contributory 3
- Cont./Non-culp. 4
- Non-culpable 5
- Unk. or NAC 6

Culp. Behavior (52-3)
- PE/CE 01
- Police chase 02
- High-speed acc. 03
- Low or erratic speed dec. 04
- Erratic dir., wrong side 05
- Wrong lane turn 06
- Wrong way 07
- Disobey stop sign, yield or signal 08
- On shoulder mdn. 09
- Tailgating 10
- No headlights 11
- Park or stop 12
- Other 13
- NA 14

Culp. Phase (54)
- PE 1
- CE 2
- P. phase 3
- C. phase 4
- Unk. 5
- NA 6

APPENDIX E

CLASS R ACCIDENT FREQUENCIES BY DRIVER AND SITUATIONAL VARIABLES

Driver Variables			Situational Variables											
			Day				Night				Day Plus Night			
Age	Sex	Driver Status	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total	Urban	Sub.	Rural	Total
Young	Male	DWI	0	1	6	7	5	42	40	87	5	43	46	94
Old			14	19	30	63	54	105	123	282	68	124	153	345
Young	Female		0	0	1	1	1	2	4	7	1	2	5	8
Old			1	1	0	2	7	16	12	35	8	17	12	37
Young	Male	HBD	0	5	10	15	9	47	74	130	9	52	84	145
Old			8	15	25	48	44	98	148	290	52	113	173	338
Young	Female		0	0	0	0	3	9	7	19	3	9	7	19
Old			0	1	4	5	6	14	14	34	6	15	18	39
Young	Male	-	0	6	16	22	14	89	114	217	14	95	130	239
Old			22	34	55	111	98	203	271	572	120	237	326	683
Young	Female		0	0	1	1	4	11	11	26	4	11	12	27
Old			1	2	4	7	13	30	26	69	14	32	30	76
-	Male	-	22	40	71	133	112	292	385	789	134	332	456	922
	Female		1	2	5	8	17	41	37	95	18	43	42	103
Young	-	-	0	6	17	23	18	100	125	243	18	106	142	266
Old			23	36	59	118	111	233	297	641	134	269	356	759
TOTAL			23	42	76	141	129	333	422	884	152	375	498	1025

APPENDIX F

CONTEXT FACTORS

Distributions of context factors for culpable drinkers and non-drinkers are given and simple effects are calculated for all 4,460 accidents. These simple effects are the general effects used in the study of context factors for accident configurations and critical reasons. They reflect much of the same data presented in the discussion of accident situations and driver and vehicle characteristics.

Context Factors for All Accidents

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	General Drinker Effects (%)
Location						
Cities	886	30.9	667	41.8	12.9	-11
Suburbs	1,058	37.0	533	33.4	18.1	4
Rural	919	32.1	397	24.9	20.5	7
Total	2,863	100.0	1,597	100.0		
	X_2^2 = 56.36 (S)					
Road Curvature						
Straight	1,625	76.7	895	88.2	16.8	-12
Curve	495	23.3	120	11.8	31.4	12
Total	2,120	100.0	1,015	100.0		
	X_1^2 = 57.83 (S)					
No. of Lanes						
Two Lane	1,272	78.3	377	71.0	27.3	7
Multilane	352	21.7	154	29.0	20.3	-7
Total	1,624	100.0	531	100.0		
	X_1^2 = 11.96 (S)					
Road Condition						
Dry	1,940	69.4	949	61.5	18.5	8
Wet	660	23.6	342	22.2	17.7	1
Ice/Snow	196	7.0	251	16.3	8.0	-9
Total	2,796	100.0	1,542	100.0		
	X_2^2 = 92.89 (S)					
Time of Day						
Day	499	18.1	931	61.3	5.6	-43
Night	2,254	81.9	587	38.7	29.9	43
Total	2,753	100.0	1,518	100.0		
	X_1^2 = 820.10 (S)					
Lighting						
Lighted	940	57.2	254	63.7	29.1	-6
Not Lighted	703	42.8	145	36.3	35.0	6
Total	1,643	100.0	399	100.0		
	X_1^2 = 5.49 (S)					

(Continued)

Context	Drinkers N	Drinkers %	Normal N	Normal %	Percent Drinkers	General Drinker Effects (%)
Driver Sex						
Male	2,580	90.2	1,162	72.8	19.8	17
Female	279	9.8	434	27.2	6.7	-17
Total	2,859	100.0	1,596	100.0		
	$X_1^2 = 231.59$ (S)					
Driver Age						
-16	18	0.6	44	2.8	4.3	-2
17-18	192	6.8	188	11.9	10.2	-5
19-20	297	10.5	181	11.5	15.4	-1
21-25	547	19.3	261	16.6	18.9	3
26-35	626	22.1	310	19.7	18.3	2
36-55	883	31.2	378	24.0	20.6	7
56-65	220	7.8	119	7.6	17.0	0
66-	47	1.7	95	6.0	5.2	-4
Total	2,830	100.0	1,576	100.0		
	$X_7^2 = 150.89$ (S)					
Vehicle Type						
Auto	2,621	93.7	1,397	90.7	17.3	3
Light Truck	162	5.8	72	4.7	20.0	1
Heavy Truck	14	0.5	71	4.6	2.1	-4
Total	2,797	100.0	1,540	100.0		
	$X_2^2 = 88.85$ (S)					