THE ROLE OF DRIVER DISTRACTION IN TRAFFIC CRASHES

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FOREWORD

This study was funded by the AAA Foundation for Traffic Safety. Founded in 1947, the AAA Foundation is a not-for-profit, publicly supported charitable research and educational organization dedicated to saving lives and reducing injuries by preventing traffic crashes.

This peer-reviewed report documents the relative reported frequency of serious crashes caused by various forms of driver distraction. It should be of interest to legislators, licensing agencies, law enforcement, and traffic safety organizations. It is available in published paper format and as an electronic file on the AAA Foundation for Traffic Safety's web site at http://www.aaafoundation.org.

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EXECUTIVE SUMMARY

Driver inattention is a major contributor to highway crashes. The National Highway Traffic Safety Administration estimates that at least 25% of police-reported crashes involve some form of driver inattention. Driver distraction is one form of inattention and is a factor in over half of these crashes. Distraction occurs when a driver "is delayed in the recognition of information needed to safely accomplish the driving task because some event, activity, object, or person within or outside the vehicle compels or induces the driver's shifting attention away from the driving task." The presence of a triggering event distinguishes a distracted driver from one who is simply inattentive or "lost in thought."

The AAA Foundation for Traffic Safety awarded a contract to the University of North Carolina Highway Safety Research Center to conduct research on the role of driver distraction in traffic crashes. The goal of the project is to identify the major sources of distraction to drivers and the relative importance of the distractions as potential causes of crashes. This report presents the results of Phase I of the project. Included is a descriptive analysis of five years of the National Accident Sampling System (NASS) Crashworthiness Data System (CDS) data, along with an analysis of narratives for two years for both CDS and North Carolina data. The descriptive analyses and the narrative analysis were done to provide input for developing a more comprehensive taxonomy of driver distractions; the taxonomy will guide future field data collection efforts.

The CDS is an annual probability sample of approximately 5,000 police-reported crashes involving at least one passenger vehicle that has been towed from the crash scene. Data are collected by trained, professional crash investigation teams that collect information at the scene of the crash, from an examination of the crash-involved vehicles, directly from interviews with the crash victims and other witnesses, as well as from available medical records. Beginning in 1995, a variable for coding the "Driver's Distraction/Inattention to Driving" was added to the CDS. The variable contains codes for attentive, looked but did not see, and sleepy, along with more than a dozen specific distractions (eating or drinking, other occupants, moving object in vehicle, talking on cellular phone, etc.).

For the current analyses two variables were defined – one identifying the attention status of the driver (attentive, distracted, looked but did not see, sleepy/asleep, or unknown), and the second the specific distracting event for those drivers identified as distracted. The CDS driver distraction data is vehicle rather than crash oriented and consequently it underestimates the role of distraction in actual crashes.

For the overall 1995-1999 CDS data, 48.6% of the drivers were identified as attentive at the time of their crash; 8.3% were identified as distracted, 5.4% as "looked but did not see," and 1.8% as sleepy or asleep. The remaining 35.9% were coded either as unknown or no driver present. This high percentage of drivers with unknown attention status has the effect of diluting the percentages in the other categories. Without the unknowns, the percentage of drivers identified as distracted increases to 12.9%. The percentage of actual *crashes* involving driver distraction would be still higher.

The specific sources of distraction among distracted drivers were:

Specific Distraction	% of Drivers
Outside person, object or event	29.4
Adjusting radio, cassette, CD	11.4
Other occupant in vehicle	10.9
Moving object in vehicle	4.3
Other device/object brought into vehicle	2.9
Adjusting vehicle/climate controls	2.8
Eating or drinking	1.7
Using/dialing cell phone	1.5
Smoking related	0.9
Other distraction	25.6
Unknown distraction	8.6
	100.0

Percentages for the different types of distractions should be viewed as preliminary estimates that are likely biased by differential underreporting. These are research results that will be useful in building a broader understanding of driver distraction. The percentages for the different types of distractions should not be used to guide policy development.

Young drivers (under 20 years of age) were the most likely to be involved in distraction-related crashes. In addition, certain types of distractions were more prominent in certain age groups, for example, adjusting the radio, cassette or CD among the under 20-year-olds; other occupants (e.g., young children) among 20-29 year-olds; and outside objects and events among those age 65 and older. Variations by driver sex were less pronounced, although males were slightly more likely than females to be categorized as distracted at the time of their crash.

In addition to these driver factors, a number of roadway, environmental, vehicle, and crash characteristic variables were also examined to determine their relationship to driver distraction. Although these results were less conclusive, they nevertheless underscore the importance of taking into account specific contextual factors in collecting and analyzing driver distraction data. A few illustrative examples include the higher proportion of adjusting radio/cassette/CD events occurring in nighttime crashes, the higher proportion of moving object in vehicle events occurring in crashes on non-level grade roadways, and the higher proportion of other occupant distractions occurring at intersection crashes.

To obtain further insight into the specific events falling into each of the identified CDS categories, two years of narrative CDS data were reviewed. In addition, a computerized search was made of two years of North Carolina police-reported crash narratives. Both activities proved helpful in developing a more complete taxonomy of events distracting drivers.

When interpreting the results of this Phase I analysis, it is important to keep in mind both the purpose for which it was conducted, and the limita-

tions inherent in the data. The primary purpose of the analysis was to provide input for the development of a more comprehensive taxonomy of driver distractions and to understand important contextual variables. The data limitations are considerable and include potential underreporting of distracted driving in general as well as differential underreporting of specific distracting events.

These results suggest that demographic and situational factors are related to driver distraction. Additional research is needed to quantify the frequency and intensity of different driver distractions and to understand how other variables affect distractability and willingness to engage in distracting behaviors. As roads grow more congested and the demands on drivers increase, it seems likely that new in-vehicle technologies will add even more potential distracters.

INTRODUCTION

Driver inattention is a major contributor to highway crashes. The National Highway Traffic Safety Administration (NHTSA) estimates that approximately 25% of police-reported crashes involve some form of driver inattention – the driver is distracted, asleep or fatigued, or otherwise "lost in thought" (Wang, Knipling and Goodman, 1996; Ranney, Mazzae, Garrott and Goodman, 2000). Estimates from other sources are as high as 35-50% (Sussman, Bishop, Madnick and Walter, 1995; NHTSA, 1997).

The AAA Foundation for Traffic Safety (AAAFTS) is committed to educating the public about issues affecting safety on the roadway. A contract was awarded to the University of North Carolina Highway Safety Research Center to conduct research on "The Role of Driver Distraction in Traffic Crashes." The goal of the project is to identify the major sources of distraction to drivers and the relative importance of different types of distractions in causing crashes. The project involves a number of distinct yet interrelated tasks, including: analysis of crash data from the NASS Crashworthiness Data System (CDS) data file; analysis of narrative data from CDS and North Carolina crash reports; and collection and analysis of field data to determine the prevalence and implications of selected driving distractions in real-world driving.

This report documents the work carried out to date on the project, focusing on the CDS and North Carolina data analyses.

AAAFTS has chosen to focus its efforts specifically on driver distraction, rather than the broader category of driver inattention. It defines distraction as "when a driver is delayed in the recognition of information needed to safely accomplish the driving task because some event, activity, object, or person within or outside the vehicle compelled or tended to induce the driver's shifting attention away from the driving task." The presence of a triggering event distinguishes a distracted driver from one who is simply inattentive or "lost in thought."

Safety problems related to driver inattention and distraction are expected to escalate in the future as more technologies become available for use in personal vehicles. During the summer of 2000, NHTSA hosted an Internet Forum on the safety implications of driver distraction when using in-vehicle technologies including cell phones, in-vehicle navigation systems, night vision systems, and wireless Internet (Llaneras, 2000). The Forum attracted broad international participation from both the public and private sectors.

While cellular telephones and other in-vehicle technologies have been the focus of considerable research within the highway safety community, much less attention has been given to identifying other, non-technological, distractions within the vehicle and their potential role in causing crashes.

The last in-depth crash causation research was sponsored by NHTSA and conducted at Indiana University during the mid-1970s (Treat, Tumbas, McDonald et al., 1979). This study, frequently referred to as the Indiana Tri-Level Study because of the three levels of crash investigation employed, examined the human, environmental, and vehicular factors in traffic crashes.

Study results identified human factors as probable causes in 93% of the investigated crashes, environmental factors as probable causes in 34%, and vehicular factors as probable causes in 13%. Internal distraction was cited as a causal factor in 9% of the crashes and driver inattention in an additional 15%. No information was reported on the frequency of external distractions.

CDS DATA ANALYSIS

The National Highway Traffic Safety Administration initiated the Crashworthiness Data System (CDS) in 1988. It is intended to complement the General Estimates System (GES) data, which is based entirely on information derived from police crash reports. The CDS collects much more detailed information on an annual probability sample of approximately 5,000 police-reported traffic crashes involving at least one passenger vehicle that has been towed from the crash scene. The CDS employs trained professional crash investigation teams that collect information at the scene of the crash, from an examination of the crash-involved vehicles, directly from interviews with the crash victims and other witnesses, and from available medical records.

The CDS captures information on passenger vehicles, which includes automobiles, pickup trucks, light vans, and sport utility vehicles, and on a few non-passenger vehicles whose air bag may have deployed in the crash. These vehicle types comprise 93% of all crash-involved vehicles and are the target of the current investigation. Only passenger vehicles damaged seriously enough to require towing from the crash scene are included in the CDS; about a fourth of all police-reported crashes involve vehicles this seriously damaged. This towaway selection criterion has the advantage of limiting the sample to those crashes that have the most serious consequences in terms of injury and/or property damage: nearly half of the drivers of vehicles reported in the CDS are injured, compared to a third of drivers in the GES. This criterion also standardizes the reporting threshold across states rather than requiring investigators to estimate the cost of vehicle repairs or to make other subjective judgments about whether a vehicle should be included in the sample.

Both the focus on passenger vehicles and the restriction to more serious crashes make the CDS a potentially useful source of data for the current project. The primary reason for using the CDS, however, is the level of detail contained for each reported crash, including a variable describing the attention status of the driver – “Driver’s Distraction/Inattention to Driving” (see Appendix A). The variable was added to the data collection protocol beginning in 1995. In addition to specific driver distraction and inattention codes, it includes optional narrative information that gives a fuller picture of an identified distraction and can be used to record new and unspecified distractions.

The current analysis is based on 1995-1999 CDS data obtained from the NHTSA National Center for Statistics and Analysis. For this analysis two variables were created from the original “Driver’s Distraction/Inattention to Driving” variable shown in Appendix A.

DRIVER ATTENTION STATUS has five categories:

1. Attentive
2. Distracted
3. Looked but didn't see
4. Sleepy or fell asleep
5. Unknown or no driver

DRIVER DISTRACTION has 13 categories:

1. Eating or drinking
2. Outside person, object or event
3. Adjusting radio, cassette, or CD
4. Other occupants in vehicle
5. Moving object in vehicle
6. Smoking related
7. Talking or listening on cellular phone
8. Dialing cellular phone
9. Using device/object brought into vehicle
10. Using device/controls integral to vehicle
11. Adjusting climate controls
12. Other distraction
13. Unknown distraction

Table 1. Driver attention status based on the unweighted CDS data[1]

Driver Attention Status	1995	1996	1997	1998	1999	Total
Attentive	3030 (46.5)[2]	3204 (48.0)	2451 (37.8)	2877 (44.5)	2598 (42.2)	14160 (43.8)
Distracted	557 (8.6)	476 (7.1)	393 (6.1)	468 (7.2)	486 (7.9)	2380 (7.4)
Looked but didn t see	**347 (5.3)**	**347 (5.2)**	**288 (4.4)**	**275 (4.3)**	**305 (5.0)**	**1562 (4.8)**
Sleepy or fell asleep	188 (2.9)	195 (2.9)	113 (1.7)	151 (2.3)	150 (2.4)	797 (2.5)
Unknown/no driver	2390 (36.7)	2457 (36.8)	3247 (50.0)	2691 (41.6)	2619 (42.5)	13404 (41.5)
TOTAL	6512	6679	6492	6462	6158	32303

[1] The unweighted data includes some special study cases (e.g., redesigned air bag and truck underride) that are not included in the weighted tables that follow.
[2] Column percent

Table 1 shows the recorded attention status of drivers on the unweighted (or raw) data files. The information in Table 1 is vehicle, not crash, oriented. In other words, there is one record for each vehicle that was towed from the crash scene.

For these unweighted data files involving approximately 6,500 vehicles/drivers annually, instances of driver distraction are coded for 7.4% of the overall sample. It should also be noted, however, that the attention status of the driver just prior to the crash is reported as unknown (or no driver present) in a large proportion of the vehicles (41.5%), despite the in-depth nature of the crash investigations.[1]

Table 2 presents the same percentage distributions of driver attention status, but based on the weighted CDS data files; instead of 6,500 crash-involved vehicles per year, the table reflects an average of 3.4 million crash-involved vehicles annually. The weighting factor assigned to a given case is determined by (1) the probability of the primary sampling unit being selected, (2) the probability of the particular police agency being selected, and (3) the

Table 2. Driver attention status based on the weighted CDS data (column percents and standard errors)

Driver Attention Status	1995 (N=3.4 M)	1996 (N=3.5 M)	1997 (N=3.7 M)	1998 (N=3.3 M)	1999 (N=3.2M)	Overall (N=17.1 M)
Attentive	50.9[1] (3.1)[2]	54.4 (3.7)	40.4 (5.2)	51.0 (3.6)	46.9 (2.0)	48.6 (2.7)
Distracted	**9.6 (1.1)**	**8.0 (0.8)**	**4.9 (1.1)**	**11.1 (1.4)**	**8.2 (1.2)**	**8.3 (0.6)**
Looked but didn t see	6.4 (1.3)	5.7 (0.9)	3.9 (0.9)	4.4 (1.4)	6.8 (0.8)	5.4 (0.7)
Sleepy or fell asleep	2.0 (0.8)	2.5 (0.8)	0.9 (0.3)	1.2 (0.3)	2.3 (0.8)	1.8 (0.4)
Unknown/no driver	31.1 (1.8)	29.4 (2.9)	49.9 (6.1)	32.3 (3.5)	35.9 (2.7)	35.9 (2.8)

[1]Column percent
[2]Standard error

probability of the crash being selected for that day. The weighted frequencies reflect the same sampling base as the unweighted frequencies — passenger vehicles involved in towaway crashes. However, the frequencies are extrapolated to represent the total population of such crash-involved vehicles in the U.S.

With the weighting factors in place, the percentage of vehicles involving a distracted driver increases to 8.3%, and the percentage of unknown or no driver cases drops to 35.9%. Although this table only shows the percentage distributions, the overall projected numbers of vehicles can be calculated by multiplying the percentages by the sample sizes shown at the top of the table. For example, 8.3% of 17.1 million vehicles/drivers is 1.4 million cases over the 5-year study period, or an annual average of 284,000 distracted

[1] The percentage of unknown cases was especially high in 1997, due to fewer occupant interviews and vehicle inspections being conducted while data collection procedures were being converted to a new electronic system.

drivers in towed vehicles.

Having such a large proportion of unknown cases in the data dilutes the overall proportion of drivers identified as distracted at the time of their crash. Also, the fact that the percentage of unknown cases varies widely across years (from 29 to almost 50%) makes it difficult to draw comparisons in the percentage of distraction cases occurring from one year to the next. If one assumes that the unknown cases are distributed like the known cases[2], the overall percentage of crash-involved vehicles with distracted drivers is 12.9%. The yearly percentages are 13.9% for 1995, 11.3% for 1996, 9.9% for 1997, 16.5% for 1998, and 12.7% for 1999.

Because the CDS are weighted sample data, each of the percentage estimates presented in Table 2 has a corresponding standard error. Percentage estimates and standard errors were calculated using SUDAAN, a statistical software package that handles multi-level and multi-year sample data (Shah, Barnwell, and Bieler, 1997). By multiplying the standard error by 1.96 and then adding and subtracting this number from the estimate, one can obtain upper and lower 95% confidence limits for each of the estimates.

Figure 1 shows the overall estimates of driver attention status contained in Table 2 along with their associated 95% confidence intervals. Based on the data, we can conclude with 95% certainty that, if *all* towaway crashes in the U.S. were examined following the CDS protocol, 7.1% to 9.4% of the drivers in those vehicles would be identified as distracted. An additional 30.4% to 41.5% would have unknown or not applicable attention status.

As was described earlier, the CDS data also contains more detailed

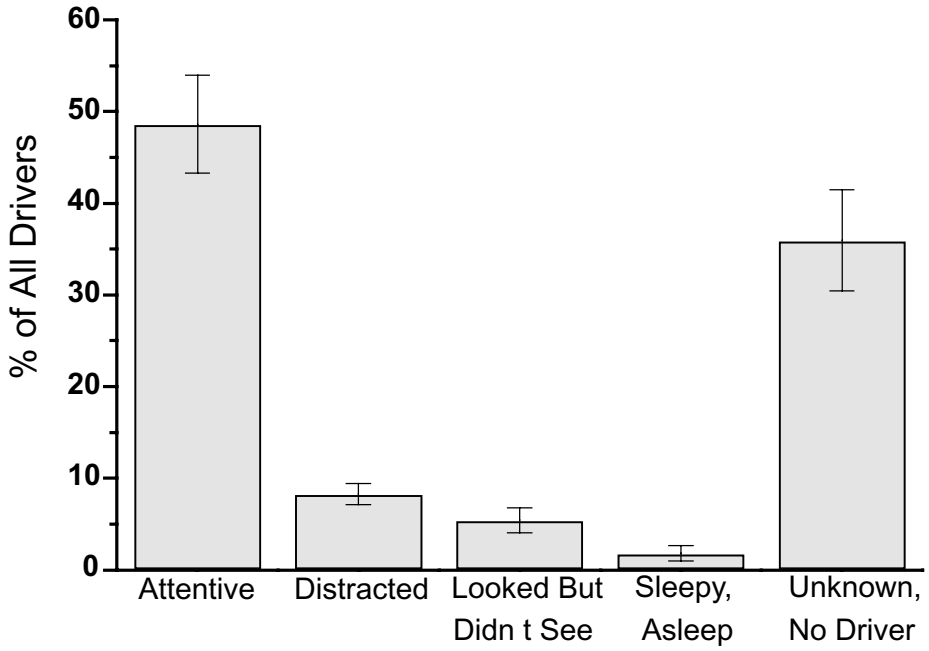

Figure 1. Overall distribution of driver attention status based on the weighted 1995-1999 CDS data.

[2] Analyses showed unknown cases to be similar to known cases with respect to driver age, gender, and other important variables. However, unknown cases were more likely to occur at nighttime, and were less likely to involve occupants other than the driver.

Table 3. Yearly trends in specific driving distractions based on weighted CDS data (column percents and standard errors)

Driver Distraction	1995 (N=322K)	1996 (N=279K)	1997 (N=182K)	1998 (N=371K)	1999 (N=265)	Overall (N=1,420K)
Outside person, object, event	28.1[1] (6.9)[2]	35.1 (4.7)	35.4 (6.4)	19.8 (5.5)	34.3 (4.1)	29.4 (2.4)
Adjusting radio/cassette/CD	14.1 (1.6)	4.7 (1.5)	0.4 (0.3)	23.5 (12.5)	5.7 (2.4)	11.4 (3.7)
Other occupant	11.8 (1.7)	12.8 (4.3)	10.6 (5.6)	7.5 (2.4)	12.7 (3.0)	10.9 (1.7)
Moving object in vehicle	3.5 (2.5)	6.2 (3.1)	2.5 (1.0)	2.2 (1.0)	7.6 (4.0)	4.3 (1.6)
Other device/object	---[3]	2.6 (1.1)	4.1 (2.5)	5.3 (3.2)	2.7 (1.2)	2.9 (0.8)
Vehicle/climate controls[4]	4.1 (1.2)	1.6 (0.9)	3.4 (1.0)	2.4 (1.4)	2.7 (0.8)	2.8 (0.6)
Eating, drinking	1.8 (0.6)	1.3 (0.5)	0.3 (0.2)	1.6 (0.7)	3.3 (1.8)	1.7 (0.3)
Using/dialing cell phone[5]	1.2 (0.6)	2.8 (1.7)	3.5 (1.4)	0.3 (0.1)	0.8 (0.7)	1.5 (0.5)
Smoking related	1.6 (0.9)	0.5 (0.4)	1.6 (0.5)	0.01 (0.01)	1.2 (0.7)	0.9 (0.2)
Other distraction	17.1 (6.0)	19.7 (3.0)	35.0 (7.2)	35.3 (9.4)	21.9 (5.7)	25.6 (3.1)
Unknown distraction	16.7 (7.5)	12.9 (3.1)	3.0 (2.0)	2.1 (0.9)	7.2 (2.3)	8.6 (2.7)

[1] Column percent
[2] Standard error
[3] Variable not available in 1995
[4] Combination of using device/controls integral to vehicle and adjusting climate controls
[5] Combination of talking or listening on cellular phone and dialing cellular phone

information on the specific nature of distracting events. This information is summarized in **Table 3**, again based on the weighted data. The total number of projected crash-involved vehicles with distracted drivers is shown at the top of each column, and the percentage distribution by type of distraction is given below, along with their standard errors. Percentages in each column total 100%. Two of the distraction categories represent combined categories from the original list of 13: “Using device/controls integral to vehicle” and “adjusting climate controls” have been combined into a single “vehicle/climate control” category, and “talking or listening on cellular phone” and “dialing cellular phone” have been combined into “using/dialing cell phone.” This was done because of very small numbers of raw cases for the adjusting climate controls and dialing cell phone categories.

Based on the Table 3 results, the most frequently reported source of distraction for drivers of vehicles in towaway crashes is outside persons, objects, or events (29.4%), followed by adjusting the radio, cassette or CD (11.4%), and other occupants in vehicle (10.9%). All other identified distractions – moving objects in vehicle, objects brought into the vehicle, adjusting vehicle or climate controls, eating and drinking, using a cellular phone, and smoking – each

account for only 1% to 4% of the total. In addition, there is a large category of "other" distracting events (25.6%) and "unknown" distractions (8.6%). More detailed information on the specific types of events is included in the section on the CDS Narrative Analysis and Table 15 later in this document.

It should be noted that there is large year-to-year variability in the generated percentages. This is true even for some categories (such as adjusting the radio, cassette or CD player) that are based on relatively large annual counts. In addition, the weighting process substantially alters some of the percentages. Consequently, the results contained in this report are primarily based on the combined, five-year weighted data.

Figure 2 is similar to Figure 1, and shows the overall estimates for the

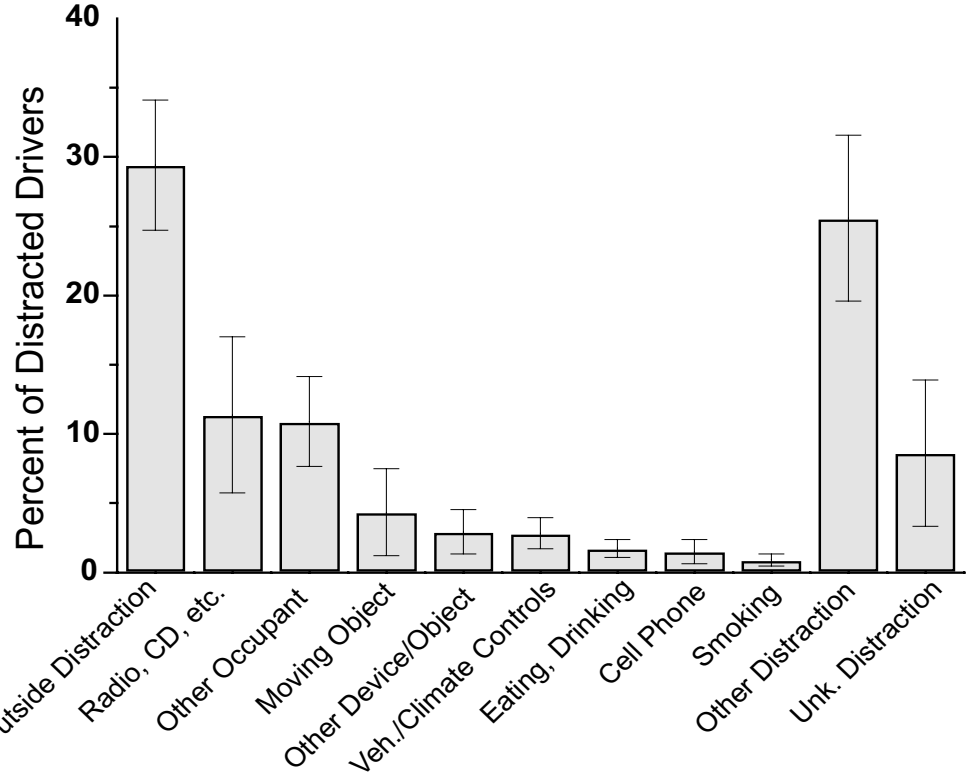

Figure 2. Overall distribution of specific driver distractions based on the weighted 1995-1999 CDS data.

various distractions and their 95% confidence intervals. In many cases the confidence intervals are quite large, a reflection of the heavily weighted data. Nevertheless, outside distractions; distractions involving a radio, CD or tape player; and distractions by other occupants in the vehicle generally stand out as most important.

The remainder of this section presents tables based on the overall weighted CDS data, examining the impact on driver distraction of various driver, roadway, environmental, vehicle, and crash characteristics. In describing these tables, we have not limited ourselves to only those results that are statistically significant. In part, this is because each table presents many possible comparisons. In addition, some results, even though not statistically significant (such as those pertaining to cell phones or other specific

Table 4. Distribution of driver attention status within categories of driver age based on weighted 1995-1999 CDS data (column percents and standard errors)

Driver Attention Status	AGE				
	<20	20-29	30-49	50-64	65+
Attentive	48.6 [1]	47.4	50.7	53.6	47.8
	(2.7) [2]	(2.9)	(2.8)	(5.1)	(3.9)
Distracted	**11.7**	**7.6**	**8.0**	**7.5**	**7.9**
	(1.9)	**(0.7)**	**(0.9)**	**(0.8)**	**(1.4)**
Looked but didn t see	5.4	4.6	4.2	4.4	16.5
	(0.7)	(1.2)	(1.0)	(0.9)	(2.8)
Sleepy or fell asleep	1.7	1.9	1.9	2.0	1.1
	(0.5)	(0.6)	(0.6)	(0.6)	(0.3)
Unknown/no driver	32.6	38.6	35.2	32.6	26.7
	(2.8)	(3.3)	(3.3)	(4.4)	(2.6)
OVERALL	16.9	29.9	35.4	9.9	7.8

[1] Column percent
[2] Standard error

distractions based on small sample sizes), may still have important research implications. In many instances significance can be determined by a quick comparison of the confidence intervals shown in the figure accompanying a table. For readers interested in more detailed comparisons, having standard errors included in the tables allows this flexibility.

Driver Factors

Table 4 presents information on driver attention status by the age of the driver. The table shows that drivers under age 20 were more likely than older drivers to be identified as distracted at the time of their crash: 11.7% of drivers under age 20 were found to be distracted, compared to 8.0% or less for each of the other age groups. When the “unknown” cases are subtracted from the totals, the percentage of young drivers identified as distracted climbs to 17.3%. The proportion of distracted drivers was fairly consistent across all age groups above the youngest. These same results are shown graphically in **Figure 3**. From the graph, it is easy to see that while the youngest age group is more likely to be identified as distracted, this difference is not statistically significant since its confidence interval overlaps with those of the other categories.

In contrast, it is the oldest age group of drivers, those age 65 and above, who stand out with regard to the two other forms of driver inattention identified in Table 4: “looked but didn’t see” and “sleepy or fell asleep.” Drivers age 65 and older were three to four times more likely to have “looked but didn’t see,” and almost half as likely to have been sleepy or asleep prior

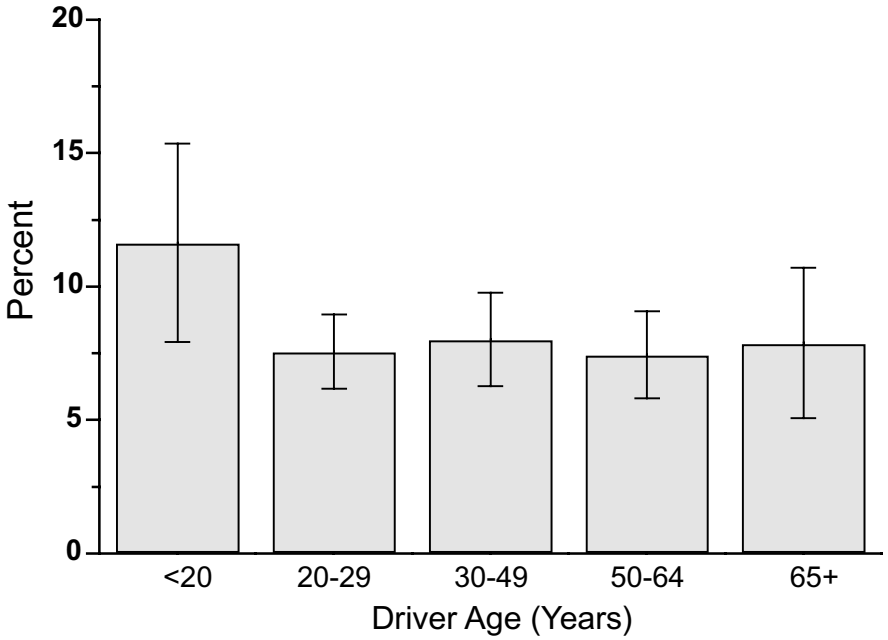

Figure 3. Percentage of drivers identified as distracted by age group.

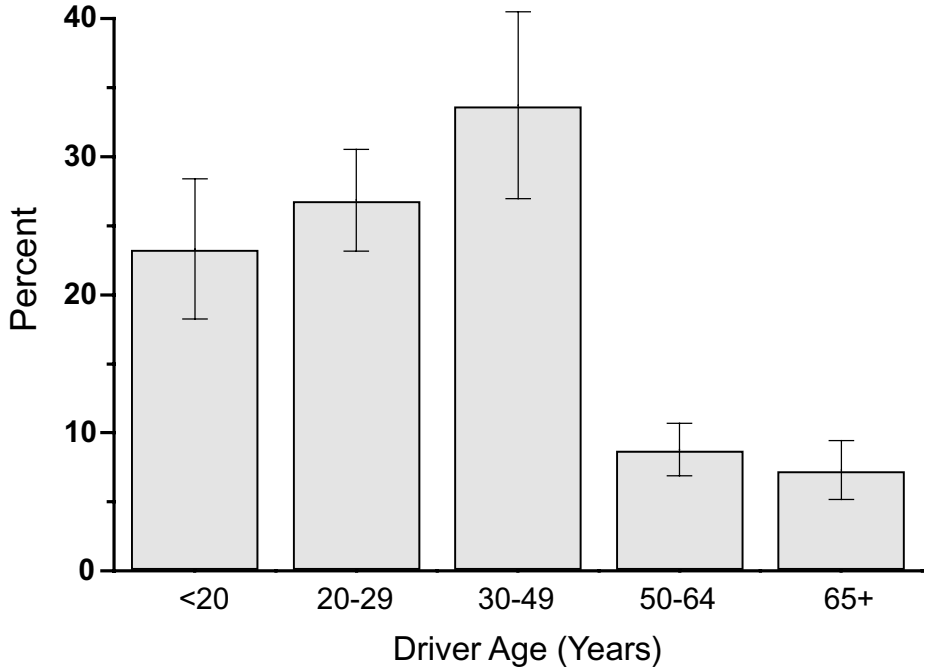

Figure 4. Age distribution of drivers identified as distracted.

Table 5. Distribution of driver age within categories of driver attention status based on weighted 1995-1999 CDS data (row percents and standard errors)

Driver Attention Status	AGE				
	<20	20-29	30-49	50-64	65+
Attentive	16.6 [1]	28.7	36.4	10.8	7.6
	(0.9) [2]	(1.6)	(1.7)	(0.8)	(0.6)
Distracted	**23.3**	**26.9**	**33.7**	**8.8**	**7.3**
	(3.1)	**(1.9)**	**(3.5)**	**(1.0)**	**(1.1)**
Looked but didn t see	16.5	24.9	27.3	8.0	23.4
	(1.8)	(3.1)	(5.1)	(1.9)	(4.8)
Sleepy or fell asleep	16.3	31.5	36.7	10.8	4.7
	(3.3)	(4.8)	(5.5)	(4.7)	(1.8)
Unknown/no driver	15.8	33.2	35.8	9.3	6.0
	(1.4)	(1.8)	(1.2)	(1.0)	(0.6)
OVERALL	16.9	29.9	35.4	9.9	7.8

[1] Row percent
[2] Standard error

to crashing.

Table 5 and **Figure 4** examine driver age from a different perspective, by presenting row percents rather than column percents. The question of interest here is, “What is the age distribution of drivers involved in distraction crashes, compared to other types of crashes?” Here we can see that half (50.2%) of drivers involved in distraction crashes are under 30 years of age and 83.9% are under 50. While this is a relatively youthful population of drivers, it is not too different from the overall age distribution of drivers involved in crashes serious enough to require towing from the scene. Meanwhile, drivers age 50 and above are involved in only 16.1% of distraction crashes.

Table 6 provides more detailed information on the specific types of distractions for the various age groupings of drivers. Drivers under age 20 were much more likely than older drivers to have been distracted while adjusting a radio, cassette, or CD player. For drivers in the 20-29 year age group, other occupants were especially likely to be a source of distraction,

Table 6. Distribution of specific driver distractions within categories of driver age based on weighted 1995-1999 CDS data (column percents and standard errors)

Driver Distraction	AGE				
	<20	20-29	30-49	50-64	65+
Outside person, object, event	27.0 (5.9) [2]	29.0 (4.3)	27.5 (2.1)	33.3 (9.2)	42.8 (13.5)
Adjusting radio/cassette/CD	28.9 (12.1)	7.9 (3.3)	7.3 (3.3)	0.6 (0.4)	0.2 (0.2)
Other occupant	10.7 (2.0)	17.8 (4.7)	9.8 (2.4)	1.5 (1.0)	2.6 (1.0)
Moving object in vehicle	5.0 (4.4)	2.4 (0.9)	6.5 (4.1)	3.6 (2.1)	0.1 (0.1)
Other device/object	1.3 (0.6)	2.7 (0.9)	4.2 (1.6)	4.4 (3.2)	1.4 (1.0)
Vehicle/climate controls	3.1 (1.5)	2.1 (0.5)	3.3 (1.2)	3.4 (2.0)	1.8 (1.7)
Eating, drinking	1.1 (0.5)	1.4 (0.6)	1.1 (0.4)	7.9 (2.1)	0.5 (0.6)
Using/dialing cell phone	0.1 (0.1)	0.7 (0.4)	3.3 (1.2)	0.1 (0.1)	2.3 (2.1)
Smoking related	0.9 (0.4)	1.1 (0.3)	1.0 (0.5)	0.3 (0.3)	0.0 (0.0)
Other distraction	19.4 (4.2)	22.6 (4.5)	25.7 (3.1)	34.5 (6.0)	45.0 (11.7)
Unknown distraction	2.5 (0.6)	12.4 (2.9)	10.5 (3.8)	10.3 (6.0)	3.2 (1.5)
OVERALL	23.0	26.8	34.0	9.2	7.1

[1] Column percent
[2] Standard error

while for those ages 30-49, dialing and using a cell phone was more frequently cited (although still only a small percentage of the cases overall). Drivers ages 50-64 were overrepresented with respect to eating and drinking distractions, while those ages 65 and older were more likely to have been distracted by objects and events outside the vehicle (other vehicles, signs, animals, etc.) and by other (unspecified) distractions.

With regard to driver sex, males were slightly more likely than females to be involved in crashes involving driver distraction, but the difference was not statistically significant (**Table 7**). The specific types of distractions were also similar for male and female drivers (**Table 8** and **Figure 5**). Overall, 63% of the distracted drivers were male and 37% were female (compared to 56% and 44%, respectively, for all drivers in the CDS database).

It should again be emphasized that these percentages are vehicle or

Table 7. Distribution of driver attention status for males and females based on weighted 1995-1999 CDS data (column percents and standard errors)

Driver Attention Status	Male	Female
Attentive	46.6 [1] (3.1) [2]	52.6 (2.7)
Distracted	**8.8 (0.7)**	**7.8 (0.6)**
Looked but didn t see	4.9 (0.6)	6.2 (1.0)
Sleepy or fell asleep	2.7 (0.8)	0.7 (0.1)
Unknown/no driver	37.0 (2.8)	32.8 (3.3)
OVERALL	56.2	43.8

[1] Column percent
[2] Standard error

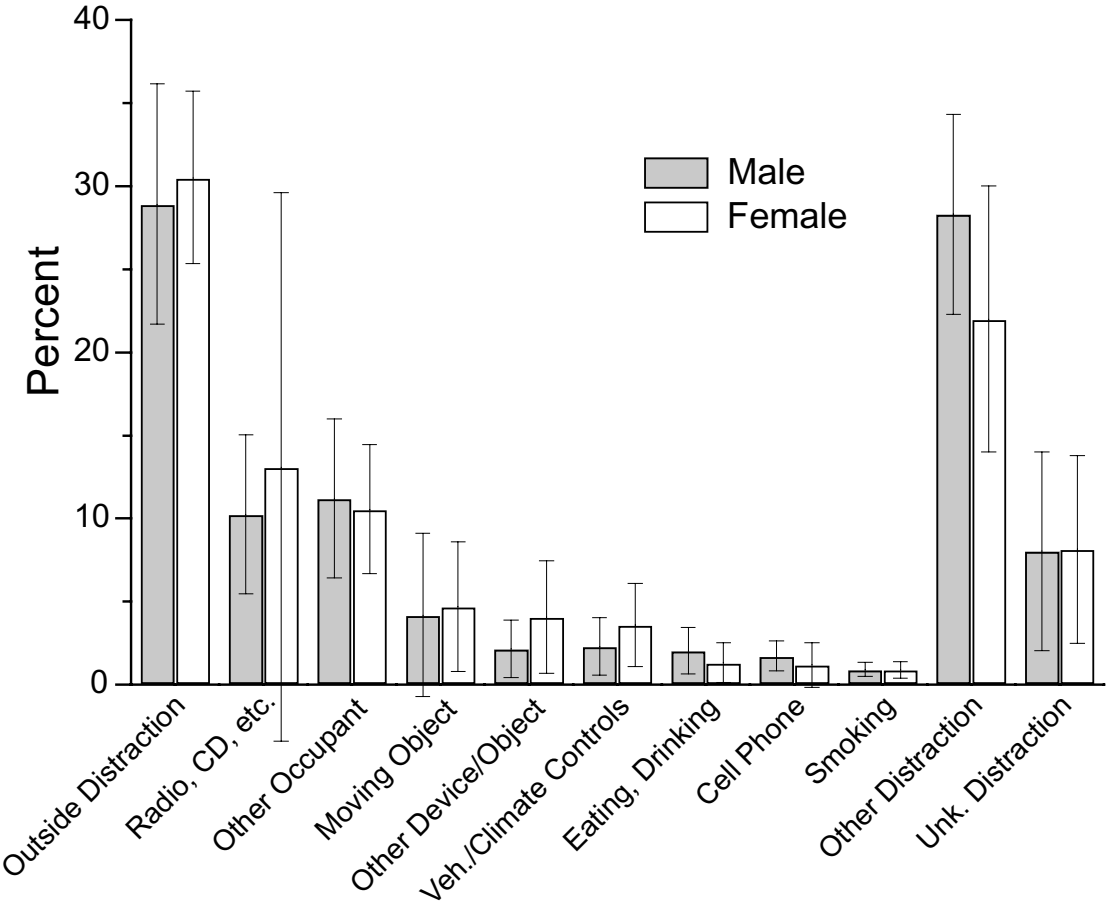

Figure 5. Distribution of specific driver distractions for males and females based on weighted 1995-1999 CDS data.

Table 8. Distribution of specific driver distractions for males and females based on weighted 1995-1999 CDS data (column percents and standard errors)

Driver Distraction	Male	Female
Outside person, object, event	28.9 [1] (3.7) [2]	30.5 (2.7)
Adjusting radio/cassette/CD	10.3 (2.4)	13.1 (8.4)
Other occupant	11.2 (2.4)	10.6 (2.0)
Moving object in vehicle	4.2 (2.5)	4.7 (2.0)
Other device/object	2.2 (0.9)	4.1 (1.7)
Vehicle/climate controls	2.3 (0.9)	3.6 (1.3)
Eating, drinking	2.0 (0.7)	1.3 (0.6)
Using/dialing cell phone	1.7 (0.5)	1.2 (0.7)
Smoking related	0.9 (0.2)	0.9 (0.4)
Other distraction	28.3 (3.1)	22.0 (4.1)
Unknown distraction	8.0 (3.1)	8.1 (2.9)
OVERALL	63.1	36.9

[1] Column percent
[2] Standard error

driver oriented, rather than crash oriented. To the extent that young and/or male drivers are more likely to be “at fault” in their collisions, one might also anticipate higher incidences of distracted or inattentive driving. The percentages also underestimate the importance of distraction as a contributing factor to *crashes*. This is because it is unlikely that more than one of the drivers involved in two (or more) vehicle crashes is distracted at the time of the crash: if 10 out of 100 two-vehicle crashes are caused by distracted drivers, then 10% of the crashes involve a distracted driver, but only 5% (10 out of 200) of the vehicles had distracted drivers.

Other Factors Impacting Driver Distraction

The incidence of driver distractions and their role in crashes may vary as a function of roadway, environmental, and vehicle conditions. This is especially true for voluntary distracting behaviors, such as eating, drinking, smoking, or dialing a cell phone. Drivers may be less likely to engage in these types of behaviors when driving task demands are high, for example, when negotiating a busy intersection, driving in poor weather conditions, at nighttime, or on a busy multi-lane roadway. Distracting events that are less under the driver's control, such as moving objects inside the vehicle or objects or events outside the vehicle, should be less influenced by such external factors.

The relationship is not straightforward, since factors that decrease the likelihood of engaging in a behavior may also increase the likelihood of a crash in the presence of that behavior. Thus, drivers may be less likely to initiate a phone call while traveling on a busy roadway in traffic, but for those who do choose to initiate the call, the risk of a crash is likely higher than under less demanding driving conditions. While there has been some laboratory-based research on the effect of increased driver workload on driving performance (for example, see Ranney et al., 2000; Tijerina, 2000; and Martens and van Winsum, 2000; all papers presented at a Summer, 2000 NHTSA-sponsored Internet Forum on the Safety Implications of Driver Distraction and summarized in Llaneras, 2000), there is little real-world data to tease out the effects of exposure versus risk.

In the sections that follow, selected roadway, environmental/vehicle, and crash variables are examined for their relevance to driver distraction. Each of the variables was examined independently in a multi-level contingency table (e.g., number of travel lanes by driver attention status). However, to maximize precision and facilitate presentation, the variables were subsequently dichotomized, and in the tables included with this report only a single percentage is presented (e.g., percentage of crashes occurring on roadways with more than two travel lanes for each level of driver attention status). As in the section on driver factors, results have also been summarized graphically using bar charts with 95% confidence intervals superimposed on the point estimates (see Appendix B).

Roadway Factors

Tables 9 and **10** (and Figures B.1-B.8 in Appendix B) summarize results for selected roadway variables available in the weighted CDS data file. Table 9 compares cases involving driver distraction to other cases on the data file, while Table 10 provides the more indepth information for the specific categories of driver distraction.

Compared to drivers who were judged attentive, those who were distracted at the time of their crashes were less likely to be traveling on multilane roadways and less likely to have crashed at an intersection or other road junction. Only a third (37.1%) of the distracted drivers were traveling on multilane roadways, compared to half (50.1%) of the attentive drivers; half (50.4%) of the distracted drivers collided at an intersection or other junction, compared to two-thirds (66.0%) of the attentive drivers. Results with respect

Table 9. Roadway effects on driver attention status based on weighted 1995-1999 CDS data

Driver Attention Status	Percent of Crashes Involving:			
	>2 Lanes	Speed Limit >45 mph	Non-Level Grade	Intersection/ Junction
Attentive	50.1 [1] (2.1) [2]	24.9 (3.0)	32.6 (3.0)	66.0 (1.9)
Distracted	**37.1 (3.7)**	**20.2 (2.8)**	**36.4 (5.9)**	**50.4 (2.8)**
Looked but didn t see	41.1 (2.6)	15.1 (2.8)	22.3 (4.2)	88.3 (3.4)
Sleepy or fell asleep	34.1 (6.6)	42.8 (5.7)	34.0 (7.6)	14.2 (6.1)
Unknown/no driver	45.6 (2.8)	21.6 (3.7)	31.5 (2.2)	61.1 (1.0)
OVERALL	46.6	23.1	32.0	63.2

[1] Percent of crashes
[2] Standard error

to the other two roadway variables, speed limit and road profile, were not significantly different for the distracted versus attentive comparison. Nevertheless, these results indicate that distracted drivers are crashing under different roadway conditions than are attentive drivers.

Table 10 (along with the corresponding figures in Appendix B) contains the same roadway information for each of the various categories of driver distraction. Keeping in mind that many of the table cells are based on small sample sizes and have large standard errors, there is considerable variability in percentages across categories. For example, distractions involving other occupants in the vehicle were overrepresented on multi-lane roadways and at intersections or other roadway junctions, while eating and drinking distractions were overrepresented on higher speed (>45 mph) roadways. Non-level grade roadways were associated with higher incidences of distractions involving moving objects in the vehicle, using or reaching for other devices or objects brought into the vehicle, and manipulating radios, cassettes or CDs. At the same time, some distraction types were less likely to occur under various roadway conditions. For example, eating and drinking and manipulating a radio, cassette or CD were less likely than other distracting events to occur at intersections, while cell phone distractions were less likely to occur on higher speed roadways or on non-level grade sections of roadway. Although these differences suggest different factors at play in the various distractions, without more detailed multivariate analyses (e.g., adjusting for driver age and gender) they must be viewed primarily as descriptive

Table 10. Roadway effects on specific nature of driver distraction based on weighted 1995-1999 CDS data

Driver Distraction	Percent of Crashes Involving:			
	>2 Lanes	Speed Limit >45 mph	Non-Level Grade	Intersection/ Junction
Outside person, object, event	34.4 [1] (3.2) [2]	24.3 (6.2)	32.0 (4.2)	51.8 (4.0)
Adjusting radio/cassette/CD	24.7 (12.5)	18.8 (2.8)	49.1 (16.9)	30.6 (13.1)
Other occupant	49.1 (8.3)	23.3 (4.4)	37.5 (14.4)	61.7 (8.5)
Moving object in vehicle	18.5 (12.2)	9.7 (5.8)	67.8 (14.0)	50.8 (10.9)
Other device/object	41.0 (12.3)	13.7 (7.0)	52.9 (16.7)	43.9 (10.8)
Vehicle/climate controls	37.1 (12.7)	12.8 (6.6)	26.4 (8.7)	46.8 (14.0)
Eating, drinking	24.1 (6.6)	33.0 (8.0)	29.6 (11.3)	27.4 (5.8)
Using/dialing cell phone	42.3 (16.4)	8.9 (7.0)	19.6 (8.8)	56.5 (13.8)
Smoking related	39.6 (18.8)	17.1 (10.0)	36.0 (16.8)	36.3 (7.0)
Other distraction	33.8 (6.8)	20.0 (3.1)	35.5 (6.4)	49.4 (6.3)
Unknown distraction	66.9 (3.1)	14.8 (3.2)	21.8 (9.8)	68.8 (5.3)
OVERALL	37.1	20.2	36.4	50.4

[1] Percent of crashes
[2] Standard error

rather than explanatory. Also, the reader is reminded that very few of the differences are significant from a statistical point of view, as judged by overlapping confidence intervals (see Appendix B graphs).

Environmental and Vehicle Factors

Selected environmental and vehicle factors that may moderate driver distractions include time of day/light condition, weather condition, vehicle type, and number of occupants in the vehicle. These variables are summarized in **Tables 11** and **12** following the same general layout as for the roadway factor tables. In addition, results are presented graphically in Appendix B (Figures B.9 - B.16). Compared to attentive drivers, distracted drivers were more likely to be driving during non-daylight hours, more likely to be driving a pickup truck, van, or sport utility vehicle, and more likely to have other occupants in the vehicle. They were also less likely to be driving under

Table 11. Environmental and vehicle effects on driver attention status based on weighted 1995-1999 CDS data

Driver Attention Status	Percent of Crashes Involving:			
	Non-Daylight	Adverse Weather	Non-Passenger Car	>1 Occupant
Attentive	30.0 [1] (1.3) [2]	21.5 (1.9)	23.7 (0.9)	35.9 (1.2)
Distracted	**34.2 (3.9)**	**15.5 (3.5)**	**28.0 (3.2)**	**38.7 (4.8)**
Looked but didn t see	22.4 (2.5)	13.2 (1.4)	21.7 (4.9)	33.6 (3.2)
Sleepy or fell asleep	60.5 (8.4)	8.4 (1.4)	38.7 (6.7)	17.1 (2.4)
Unknown/no driver	43.4 (1.5)	20.6 (1.7)	28.0 (1.2)	29.0 (1.3)
OVERALL	35.3	20.0	25.7	33.2

[1] Percent of crashes
[2] Standard error

adverse weather conditions (rain, sleet, fog, etc.). All differences were relatively small, however, and not significant statistically.

Turning to specific distraction categories (Table 12), almost 90% of drivers who crashed while smoking, two-thirds of those who crashed while adjusting a radio, cassette or CD, and half of those who crashed while using a cell phone, were driving during non-daylight hours. Nearly half (46.0%) of the adjusting radio, cassette or CD crashes also occurred under adverse weather conditions. Pickups, vans, and sport utility vehicles were associated with higher incidences of eating and drinking and cell phone collisions, although the standard error was particularly large for the latter. Finally, while adjusting the radio, cassette or CD and adjusting vehicle or climate controls were both more likely to occur when other occupants were present in the vehicle, other distractions such as moving object in vehicle, eating and drinking, and using a cell phone were less likely to occur. As with the Table 10 on roadway conditions, large standard errors permit only tentative conclusions to be drawn from these data. However, the results suggest that driver overload may be a factor in some crashes involving driver distraction, and that having other occupants in the vehicle can be a source of distraction as well as a moderating force reducing the likelihood of other distractions.

Table 12. Environmental and vehicle effects on specific nature of driver distraction based on weighted 1995-1999 CDS data

Driver Distraction	Percent of Crashes Involving:			
	Non-Daylight	Adverse Weather	Non-Passenger Car	>1 Occupant
Outside person, object, event	29.9 [1] (3.5) [2]	16.2 (4.9)	23.7 (2.2)	27.5 (3.1)
Adjusting radio/cassette/CD	63.7 (9.9)	46.0 (14.3)	21.7 (5.9)	63.6 (20.8)
Other occupant	38.9 (9.8)	16.4 (3.3)	24.6 (10.3)	99.8 (0.2)
Moving object in vehicle	40.4 (5.6)	4.0 (2.6)	20.2 (10.0)	5.6 (3.2)
Other device/object	26.4 (9.4)	2.2 (1.0)	26.2 (10.2)	19.1 (11.0)
Vehicle/climate controls	40.6 (11.6)	5.6 (5.6)	23.0 (5.1)	51.7 (14.3)
Eating, drinking	31.2 (9.2)	11.9 (6.5)	46.6 (8.2)	11.3 (4.1)
Using/dialing cell phone	53.0 (12.5)	11.1 (7.9)	45.9 (17.4)	14.0 (8.4)
Smoking related	88.2 (5.3)	0.5 (0.5)	37.9 (13.5)	27.2 (8.6)
Other distraction	25.4 (4.0)	6.7 (2.5)	33.6 (4.6)	25.3 (4.6)
Unknown distraction	19.3 (3.7)	14.1 (7.0)	37.7 (12.1)	37.1 (11.1)
OVERALL	34.2	15.5	28.0	38.7

[1] Percent of crashes
[2] Standard error

Crash Factors

The crash characteristics summarized in **Tables 13** and **14** and Appendix B (Figures B.17 - B.24) indicate that compared to attentive drivers, distracted drivers are less likely to be in crashes involving two or more vehicles, and more likely to be involved in frontal impact collisions. Only 57.0% of distracted drivers were in crashes involving two or more vehicles, and three-fourths (74.6%) experienced frontal impact. Distracted drivers were no more or less likely than attentive drivers to be going straight prior to their crash (as opposed to turning, backing, merging, etc.), and were no more likely to be seriously or fatally injured.

Table 13. Effects of crash characteristics on driver attention status based on weighted 1995-1999 CDS data

Driver Attention Status	Percent of Crashes Involving:			
	2+ Vehicles	Vehicle Going Straight	Front Impact	Serious or Fatal Driver Injury
Attentive	77.6 [1]	53.5	56.8	7.6
	(1.3) [2]	(1.0)	(1.4)	(3.3)
Distracted	**57.0**	**55.3**	**74.6**	**7.9**
	(5.3)	**(4.7)**	**(2.7)**	**(2.9)**
Looked but didn t see	96.4	36.0	48.4	6.8
	(1.5)	(4.8)	(7.7)	(2.7)
Sleepy or fell asleep	18.5	62.8	68.3	29.3
	(1.9)	(6.9)	(4.7)	(11.4)
Unknown/no driver	73.5	59.7	64.3	13.9
	(1.8)	(1.4)	(1.1)	(5.5)
OVERALL	74.4	55.1	61.4	10.2

[1] Percent of crashes
[2] Standard error

Crash characteristics varied considerably for the different categories of driver distraction, especially with regard to single- versus multi-vehicle crashes. Drivers distracted by cell phones or by persons, objects, or events outside the vehicle were overrepresented in multi-vehicle collisions, while those distracted by a moving object inside the vehicle or by smoking were underrepresented. Adjusting vehicle/climate controls, using or dialing a cell phone, and other occupant distractions were all overrepresented in situations where the vehicle was going straight ahead just prior to crashing, suggesting that drivers may be less likely to engage in these behaviors when turning, backing, or otherwise maneuvering their vehicle.

Although some distraction types, including moving object in vehicle and adjusting radio/cassette/CD, were more likely to result in frontal impact, the significance of these findings is not clear without additional analyses adjusting for crash type and other related variables. Differences among the various distraction categories with respect to percentage of drivers seriously or fatally injured ranged from less than 2% to almost 14%, but large standard errors limit the conclusions that can be drawn from the data.

Table 14. Effects of crash characteristics on specific nature of driver distraction based on weighted 1995-1999 CDS data

Driver Distraction	Percent of Crashes Involving:			
	2+ Vehicles	Vehicle Going Straight	Front Impact	Serious or Fatal Driver Injury
Outside person, object, event	66.1 [1] (4.0) [2]	42.7 (4.7)	69.7 (2.7)	5.7 (1.8)
Adjusting radio/cassette/CD	37.8 (21.3)	46.5 (24.7)	87.9 (7.5)	1.9 (0.5)
Other occupant	55.9 (7.5)	68.2 (4.6)	59.1 (2.1)	8.3 (2.9)
Moving object in vehicle	17.0 (8.8)	43.9 (9.1)	91.1 (5.0)	11.3 (11.2)
Other device/object	48.8 (11.3)	61.0 (12.1)	81.6 (10.5)	13.7 (7.7)
Vehicle/climate controls	59.6 (11.0)	70.1 (10.9)	85.5 (6.7)	3.4 (1.1)
Eating, drinking	53.4 (8.4)	61.3 (8.8)	79.7 (9.3)	10.3 (3.4)
Using/dialing cell phone	82.9 (11.6)	68.5 (11.4)	68.8 (16.4)	8.4 (4.6)
Smoking related	15.6 (4.9)	59.3 (7.6)	42.7 (10.0)	7.8 (2.0)
Other distraction	53.8 (5.8)	61.8 (3.5)	73.7 (4.6)	12.7 (5.5)
Unknown distraction	85.3 (2.7)	69.0 (9.9)	83.3 (10.4)	6.5 (2.8)
OVERALL	57.0	55.3	74.6	7.9

[1] Percent of crashes
[2] Standard error

CDS NARRATIVE ANALYSIS

In addition to the coded variables on the CDS data file, the raw CDS data also contain narrative descriptions that sometimes elaborate on the coded variables. This information was made available to the project for years 1997 and 1998 in hard copy (paper) format. A sample of this printout is contained in Appendix C. These narratives helped to clarify the range and nature of distracting activities included under each category of distraction event. As can be seen on the sample pages, the printouts contained additional text that was sometimes entered along with the distraction code as well as an overall narrative summary of the crash. Further information on a particular distraction could appear in one, both, or neither of these locations.

Table 15. Analysis of narrative data from 1997 and 1998 CDS datafiles

Distraction Category	1997 CDS Data (N=332 narratives)	1998 CDS Data (N=412 narratives)
Outside person, Object or Event	**96** [1]	**125**
Outside traffic/vehicle (vehicle swerved, turned in front of, changed lanes, slowed or stopped, encroached on lane, emergency vehicle, bright vehicle lights, etc.)	17	37
Police (being chased by police, officer directing traffic, thought saw police, police NOS [2])	8	5
Animal in roadway (deer, dog, elk, animal NOS)	3	10
Sunlight, sunset	1	6
People/objects in roadway (child in road, basketball game, crowd, broken glass, garbage can, etc.)	3	5
Crash scene/leaving scene of crash	3	1
Road construction	3	0
Other (waved ahead by driver, another person or driver, parachutes in sky, bicycle, toll booth, brush obstructing vision, tire blowout, etc.	13	20
Outside object, person or event NOS	45	41
Adjusting Radio/Cassette/CD	**10**	**21**
Radio	1	9
Cassette	1	0
CD	1	0
Adjusting radio, cassette, CD NOS	7	12
Other Occupant	**41**	**53**
Talking, arguing, conversing with passenger	10	22
Passenger doing something (yelling, grabbing, reaching, fighting, sleeping)	5	4
Child/infant distraction	6	6
Other (looking at passenger, helping buckle seat belt, rear seat passenger NOS)	0	4
Other occupant NOS	20	17
Moving Object in Vehicle	**12**	**16**
Dog (barking, jumping, hitting steering wheel)	1	4
Bee/bug/insect (swatting, flying into window, in vehicle)	4	1
Other (objects falling off seat, spilled groceries, spilled beverage, object rolling under brake pedal, sick cat)	3	7
Moving object NOS	4	4
Using Other Device Brought into Vehicle	**20**	**30**
Reaching for something on floor (cassette, water bottle, purse, NOS)	0	6

Table 15 cont...

Other (reaching for candy, dishes falling, object in backseat, something in front passenger seat, throwing away trash, rolling down window, reaching for thermos, getting makeup, using data terminal)	6	8
Using device NOS	14	16
Using Other Device Integral to Vehicle	**10**	**8**
Adjusting, fastening seat belt	0	4
Mirrors, lights, wiper, etc.	4	4
Other NOS	6	0
Adjusting Climate Controls NOS	**3**	**0**
Eating/Drinking	**7**	**16**
Eating (burger, NOS)	0	2
Drinking (tea, coffee, soda, alcohol, juice, NOS)	2	7
Eating or drinking NOS	5	7
Cell Phone	**8**	**10**
Answering cell phone/cell phone ringing	1	1
Cell phone use NOS	7	9
Smoking	**11**	**4**
Reaching/looking for/getting cigarette	2	1
Lighting cigarette	2	2
Dropped cigarette	1	0
Cigarette blew back into vehicle	2	0
Smoking cigarette NOS	4	1
Other Distraction	**66**	**79**
Medical problem (heart attack, blackout, medication, loss of consciousness, seizure, blurred vision, etc.)	16	18
Looking outside vehicle (in rear veiw mirror, at traffic, at road signs, in store window, for gas station, for parking space, for business, etc.)	8	9
Looking inside vehicle (at map, papers, mail, for pen, for address on paper, down NOS)	8	3
Reaching for object (wallet, pills, inhaler, backseat)	0	4
Other (sun glare, sneezed, tired, sleepy, child playing with controls, intoxicated, depressed, etc.)	11	18
Other NOS	23	27
Inattentive/Lost in Thought	**11**	**27**
Unknown Distraction NOS	**37**	**23**

[1] Number of cases recorded on the unweighted data (N) [2] NOS = Not Otherwise Specified

Table 15 summarizes the results of the CDS narrative analysis. The numbers in the table represent the actual number of cases reviewed. Altogether, there were 332 narratives for the 1997 data and 412 for the 1998 data, representing 84-88% of the (raw number of) distraction cases coded for each year. In a large percentage of the cases (43%), no further information that might clarify the nature of the distraction was given. These cases are simply recorded as “not otherwise specified” or “NOS” (for example, “outside object, person or event NOS”). In many instances, however, further detail was provided and an attempt made to categorize this information. Under the category of “other occupant,” for example, subcategories were

formed that included talking or arguing with passenger; passenger action (grabbing, reaching, fighting, etc.); child or infant; and “other” (looking at passenger, helping buckle seat belt, etc.). Results for each of the other categories included in Table 15 are highlighted below:

Outside objects, persons, or events included other vehicles, other drivers, emergency vehicles, police cars, animals, children or others in the roadway, pedestrians and bicyclists, crash scenes, and road construction.

Adjusting the radio was specified more often than adjusting a tape or CD player. In most cases, however, no further information was provided.

Moving objects in vehicle included dogs; bees, bugs, or insects; and falling or spilled objects such as drinks or groceries.

Other devices brought into the vehicle that distracted drivers included objects that fell onto the floor and/or off the seat of the vehicle, such as cassette tapes, water bottles, purses, etc., and also actions, such as reaching for objects in the vehicle or rolling down the window of the vehicle.

Vehicle/climate controls generally referred to equipment such as mirrors, lights, or windshield wipers, or were left unspecified.

Eating and drinking was generally not clarified further other than to sometimes identify the specific beverage or food.

Cell phone was only differentiated according to answering a ringing phone and other.

Smoking distractions were all attributed to cigarettes, and included about equal numbers of searching for a cigarette, lighting it, dropping it, and having it blow back into the vehicle when trying to dispose of it outside.

The broad category of "**other**" distraction included medical problems (blackout, loss of consciousness, etc.), looking or searching for something outside the vehicle (street signs, parking place, etc.), looking or reaching for something inside the vehicle (map, pen, wallet, etc.), and a broad range of "other" events too specific to categorize (sneezing, sun glare, etc.)

The category "**inattentive/lost in thought**" is not included as a separate category on the CDS reporting form, but was identified in the narrative fields without further elaboration.

The report narratives are too incomplete to be used in any statistical way to determine the relative importance of specific distracting events. As noted above, they were only available for 84-88% of the cases involving a distracted driver and 43% of the time they contained no further information about the nature of the distracting event. Nevertheless, by elaborating on some of the broader distraction categories such as outside events, moving objects, and "other," the narratives can provide input to the development of a more complete taxonomy of driver distractions. Further insight was gained from a similar review of the North Carolina crash narratives, described in the following section.

Table 16. Results of Narrative Key Word Search for Driver Distraction Cases on 1998 N.C. Crash File

Key Word	No. Cases Identified	No. Distraction Cases	Distraction Hit Rate	Notes
1. Baby	18	13	72%	Gets baby and baby bottle.
2. Bee	26	21	81%	Also gets misspelled been.
3. Billboard	5	0	0%	Vehicle hits billboard, no distractions.
4. Bug	19	16	84%	Useful.
5. Casset (for cassette)	4	4	100%	High hit rate but few cases.
6. Cat	41	2	5%	Mostly cats in roadway causing crash.
7. CB	8	5	63%	Few cases but most are distractions.
8. CD	19	18	95%	Almost all are distractions.
9. Cell (for cell phone	54	48	89%	Almost exclusively gets cell phones; some are cell phones reporting crashes.
10. Child	215	62	29%	Gets many school bus, pedestrian, cyclist, child driver, child fall crashes.
11. Cig (for cigarette,cigar)	59	55	93%	Gets many cigarette and smoking related distractions.
12. Climat (for climate control)	2	0	0%	Not that useful a search word.
13. Daughter	22	17	77%	Many driver talking to daughter; similar to passenger in what it picks up.
14. Distrac (for distract)	139	139	100%	Gets exactly what we are looking for; some overlap with other words; many outside the vehicle events.
15. Dog	906	- -	--	Did not review all these; most were dogs in road causing crash.
16. Drink	100	47	47%	Gets many drunk driving crashes, as well as spilled drinks.
17. Eat	7	1	14%	Gets more distracted by looking for place to eat than eating in vehicle.
18. Grab	47	19	40%	Not as useful; many positives would be caught by other words.

Cont. next page

NORTH CAROLINA NARRATIVE ANALYSIS

North Carolina is the only state that routinely captures the narrative description portion of its crash report form on a computerized crash database. These narratives can be searched using key words. For example, the system will search and print out all narratives containing the word “distracted” and its variants. For the current project, we proposed to examine the North Carolina narratives in addition to the CDS narratives, since (1) the North Carolina data reflects a much larger number of crashes — approximately 220,000 crashes per year, and (2) it contains less severe as well as the more severe (towaway) crashes and so might be expected to produce a somewhat different distribution of distractions.

Table 16 cont…

Key Word	No. Cases Identified	No. Distraction Cases	Distraction Hit Rate	Notes
19. Infant	6	6	100%	Few cases but high hit rate; some overlap with child, daughter, distractions.
20. Insect	4	4	100%	Few cases, but all relevant.
21. Map	16	15	94%	Need to delineate as _map_, otherwise gets Maple Street, etc.
22. Noise	51	5	10%	More hearing noise of crash rather than noise causing crash.
23. Page (for pager, paged)	37	12	32%	Did pick up pager distractions but many would be picked up with other words.
24. Passeng (for passeng	1520	- -	- -	Did not review all these, most did not appear to be distractions.
25. Phon (for phone)	262	69	26%	Low hit rate but does pick up car phone and other phones not picked up as cell phones. Also gets telephone pole.
26. Radio	82	68	83%	Many hits, picks up a few street names.
27. Read	152	11	7%	Picks up other words; most hits were reading map.
28. Smok (for smoke)	107	4	4%	Picks up place names, few distractions.
29. Son	389	- -	- -	Most were misspellings of sun or S on (South on); did not review all cases.
30. Sound	37	1	3%	Mostly sounding horn, sound of crash, or sound of mechanical problem prior to crash
31. Tape	13	10	77%	Few cases but high hit rate, not picked up elsewhere.
32. Tempe (for temperature)	4	3	75%	Small number of cases.
33. Window	151	22	15%	Few distractions; most picked up by other words such as bug
TOTALS	4522	697	15%	Many words have low hit rate, but others are good indicators of driver distraction leading to crash.

Two years of narrative data were searched: the 1998 data, because it was the most recent full year of data available at the time, and the 1994 data, because this was the last year that complete narratives were typed into the system. Since 1994 only portions of the narratives have been entered and it was thought that the 1994 data might provide the truest accounting of distraction cases. As an initial step in the process a list of potential key words was developed, based on the CDS codes as well as "brainstorming" by the project team. Thirty-three key words were identified. Searching with these keywords yielded 4,522 crash reports. The narratives were reviewed to determine whether they actually involved distracted driving. The results of these efforts for the 1998 data are summarized in **Table 16**.

From the subset of 4,522 crashes 697 distraction cases were identified using the narrative search system. Words producing the greatest numbers of "hits" were "distrac" for distract (139 cases), "phon" for phone (69 cases),

Table 17. Results of More Restricted Narrative Key Word Search for Driver Distraction Cases on 1994 North Carolina Crash File

Key Word	Number Cases Identified	Number Distracted Cases	Distraction "Hit Rate"	Notes
1. Baby	24	17	71%	Similar hit rate but more cases than 1998.
2. Bee	23	21	91%	Higher hit rate than 1998.
3. Bug	10	5	50%	Fewer cases, lower hit rate than 1998.
4. CD	5	1	20%	Many fewer cases, lower hit rate than 1998 - very different.
5. Cell (for cell phone)	7	6	86%	Many fewer cases than 1998 but same high hit rate.
6. Child	223	55	25%	Similar to 1998.
7. Cig (for cigarette, cigar)	45	44	98%	Very similar to 1998
8. Daughter	16	8	50%	Lower hit rate than 1998 - picking up similar cases to child in 1998.
9. Distrac (for distract, distraction)	106	106	100%	Same high hit rate as 1998 - most useful word for narrative searches.
10. Drink	61	23	38%	Fewer hits than in 1998.
11. Grab	31	5	16%	Mostly passengers grabbing steering wheel, causing the crash.
12. Map	12	11	92%	Similar high hit rate to 1998.
13. Page (for pager, paged)	9	1	11%	Many fewer cases, only one not Page Rd.
14. Phon (for car phone)	173	18	10%	Lower hit rate than 1998. Mostly hitting phone poles/boxes or reporting crash on phone.
15. Radio	70	62	89%	Similar to 1998.
16. Tape	28	24	86%	More cases, higher hit rate than 1998 - probably related to changes in CD.
TOTALS	834	407	49%	Limited set of key words produces higher case identification rate.

radio (68 cases), child (62 cases), "cig" for cigarette or cigar (55 cases), "cell" for cellular phone (48 cases), and drink (47 cases). Other words that did not produce as many total hits but which had a high "hit rate" were baby, bee, bug, "casset" (for cassette), CB, CD, daughter, infant, insect, map, and "tempe" (for temperature).

A reduced set of key words, comprised of those that identified at least 10 positive cases and that had at least a 25% positive identification rate, was applied to the 1994 crash data. Results from this smaller set of 16 key words are summarized in **Table 17**. The overall number of identified distraction cases is lower – 407 compared to the 697 for 1998. In addition to fewer key words being applied to the data, there were considerably fewer hits for the words "CD," "cell," "page" and "phone," reflecting the smaller number of cell phone users at the time. The key words "drink" and "grab" also pro-

duced fewer hits. For the 1994 data, the words identifying the greatest numbers of crashes involving distracted drivers were “distrac,” radio, child, “cig,” tape, drink, bee, phone, and baby, in that order.

Overall, these results suggest that today’s drivers are being distracted by a combination of old and new events. Some of the “old” distractions that continue to cause problems are children and babies; cigarettes; drinks; radios and tape players; and insects or bugs that find their way into the vehicle. “Newer” distractions include CDs, pagers, and cell phones. The search also appears to suggest that some items – such as CB radios, billboards, and temperature controls – are not significant distractions.

It is important to keep in mind the uses and limitations of a key word narrative search. By definition, such searches are not designed to uncover new or unimagined distractions, since they depend on applying an a priori list of key words to the search process: you only retrieve narratives that you seek. Other key words might have been applied to the 1998 and 1994 North Carolina data, for example, reach, drop, police car, honking horn, etc. This exercise was more difficult than most simply because the list of potential search words is so large. In past uses of the system, searches have been much more confined, for example, to identify narratives for crashes that involved deer or post-crash fires.

Even in ideal situations narrative searches will underestimate the total number of crashes involving a particular event, since they depend not only on the investigating officer noting the event in the narrative but also on the researchers specifying appropriate search words and the officer using one of those words to describe the event. The primary value of this search was to provide a feel for the range of events that distract drivers so that a more complete taxonomy of distracted driving events could be developed and applied to future field data collection efforts.

SUMMARY AND CONCLUSIONS

The Crashworthiness Data System is currently the largest and most comprehensive dataset available for studying the role of driver distraction in real-world traffic crashes. Even so, it has many limitations. Driver attention status is unknown for over one-third of the cases in the weighted data file, and small cell sizes in the raw data contribute to large measurement errors associated with many of the weighted estimates. In addition, there may be biases in the recording of specific distracting events. Understanding both the strengths and the limitations in this analysis is crucial to a balanced interpretation of its results.

Based on the combined 1995-1999 data, events occurring outside the vehicle, adjusting radio/cassette/CD controls, and interactions with other occupants inside the vehicle were all frequently reported sources of driver distraction sources of driver distraction. Moving objects in the vehicle, other objects brought into the vehicle, adjusting vehicle or climate controls, eating and drinking, using a cell phone, and smoking were all less frequently reported sources of driver distraction. It should be emphasized that these findings are based purely on the available crash data and do not take into account the frequency of the various distractions. Without a measure of exposure it is not possible to draw conclusions regarding the relative risk of crashing associated with a particular distraction.

These results are also likely influenced by the data collection method. One category of great popular interest is cellular phone use. Given the huge increase in reported ownership and use of cellular phones nationwide (see **Figure 6**; also, Lissy et al., 2000), one might have expected an increase in the reported number of crashes involving cell phones over the five years covered by the analysis. No such increase was apparent, however. The “raw” number of reported cases involving cell phones was 8 in 1995, 10 in 1996, 8 in 1997, 10 in 1998, and 6 in 1999. But it must be reiterated that these are reported cases. As more attention has been drawn to the potential role of cellular phones in unsafe driving and crashes, drivers have likely become less willing to reveal this information when involved in a crash. Admitting to cell phone use at the time of a crash may be associated with greater legal and financial (insurance) jeopardy than admitting to spilling a cup of coffee or dropping a CD.

Thus, the larger issue here is that of potential biases in identifying sources of driver distraction, not only in the CDS data, but also in any crash data that relies on information accessible to officials investigating a crash. As suggested above, a differential willingness by drivers to report a particular distraction may produce bias in the data. In addition, distracting events for which some form of “evidence” exists (drink containers, loose CDs, pets, spilled packages, etc.) may be more likely to trigger an inquiry and subsequently get reported than those (such as adjusting climate controls) that do not entail evidence. As a further example, when cellular phones were first introduced in the mid-1980s, they were much larger than the small hand-held models popular today and potentially more likely to be observed and reported by witnesses or officers investigating a crash.

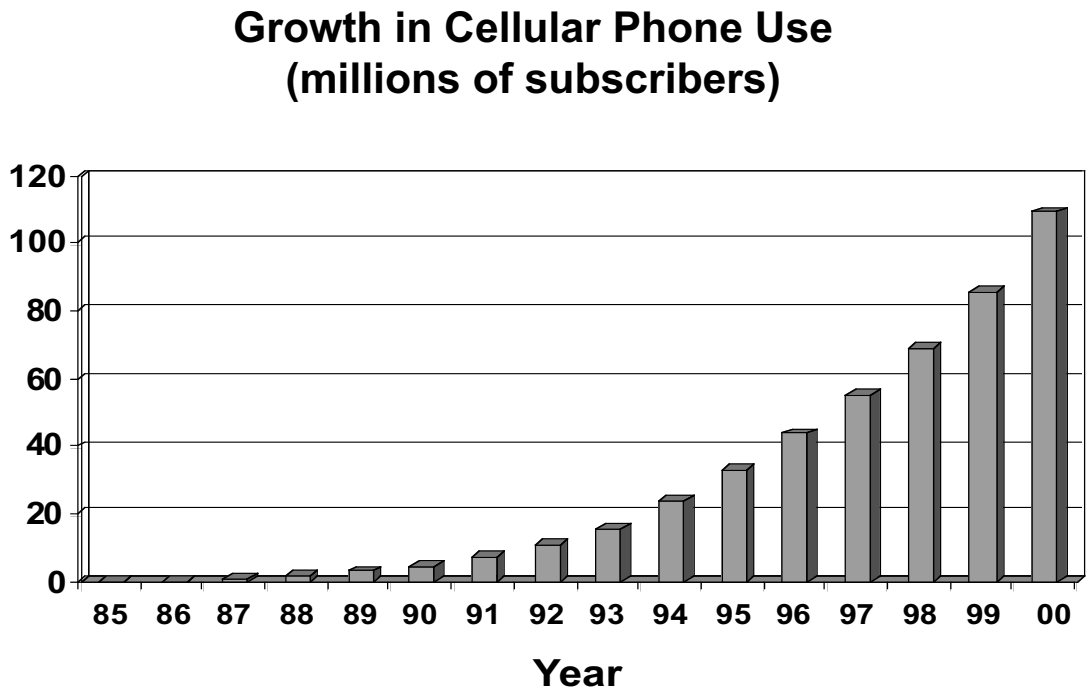

Figure 6. Growth in cellular phone use as measured by millions of subscribers.
(Source: Cellular Telecommunications Industry Association, 2000: www.wow-com/industry/stats)

In general, it is recognized that the CDS underestimates the role of driver inattention and distraction in crashes. Wang et al. (1996) estimated that 25.6% of the crashes in the 1995 CDS data involved driver inattention or distraction, with 13.2% specifically involving distraction. Following the same protocol as Wang et al., we have estimated that 10.6% of the crashes in the 1995-1999 CDS data involve driver distraction. This estimate does not take into account the large percentage of crashes involving one or more vehicles with unknown distraction status.

It is also clear that police narrative data severely underreport the frequency of distraction crashes, regardless of the nature of the distracting event. For the 1998 North Carolina narrative data, there were 697 "hits," or positively identified distraction cases, out of a total of approximately 220,000 crash reports filed. This number of "hits" is not precise, because some cases may have been counted more than once (if they contained more than one of the identified search words), while others (such as those involving distraction by a passenger) were not counted at all because of the large number of narratives identified. Nevertheless, the identified number of distraction cases amounts to less than one-half of 1% of all crashes occurring in North Carolina in 1998.

Wierwille and Tijerina (1996) undertook a much more thorough investigation of multiple years of North Carolina narrative data in an effort to identify crashes associated with both driver distraction and inattention.

Based on their narrative analyses, only 1.5% of the crashes were categorized as inattentive or distracted, a percentage far below the 26% identified by Wang et al. (1996) using NASS/CDS data.

These limitations of the CDS and narrative crash data are not felt to be critical to the current project efforts; estimating the true percentage of crashes attributable to various distracting events was not the goal. This study intended to develop a taxonomy of events and effect modifiers to guide future field data collection; actual event counts for the range of behaviors implicated in operational definitions of driver distraction will be obtained in Phase II of the study. In this regard, the results of the descriptive analyses examining the distribution of distraction cases across levels of driver, roadway, vehicle, and crash variables was particularly useful. In addition, the analysis of narrative data from both the CDS and North Carolina crash reports provided important insights into distracting events not specifically identified in the pre-defined CDS categories.

With regard to the descriptive analyses of the CDS data, there were clear differences in the relative importance of distracting events in general, as well as of specific distractions, across age categories. Young drivers (under 20 years of age) were the most likely to be involved in distraction-related crashes. Furthermore, certain types of distractions were more prominent in certain age groups: adjusting the radio/cassette/CD among the under 20-year-olds; other occupants (e.g., young children) among 20-29 year-olds; cell phone use among 30-49 year-olds; eating and drinking among 50-64 year-olds; and outside objects and events, as well as “other distractions,” among those age 65+. Variations by gender were less pronounced, with males showing a slightly higher overall proportion of distraction cases. Together these results reinforce the notion that while distraction is a problem for all age drivers and for drivers of both sexes, the specific sources of the distraction can vary considerably.

To examine additional factors that might modify driver distraction, various roadway, environmental, vehicle, and crash characteristic variables were identified and cross-tabulated with the distraction variables. Results here were less conclusive, since the two-way cross-tabulations could not control for potential confounders such as age and gender. Also, even with the variables collapsed into just two levels, large measurement errors still make it difficult to interpret the findings. Although certain patterns did emerge, they were not always easy to explain – for example, our finding that other occupants were especially likely to be a distraction on multilane roadways and at intersections or junctions. Other results do, however, appear reasonable – for example, the finding that adjusting radios/cassettes/CD players or using cell phones was more of a problem at nighttime and more of a problem for young drivers. Taken as a whole, these results reinforce the importance of considering a wide range of contextual factors in collecting and analyzing data on driver distraction.

Clearly better crash data are needed to understand and quantify the magnitude of the driver distraction problem and the relative contributions of different sources of driver distraction. Equally important, however, are empirical data that will provide information on how often drivers engage in

potentially distracting behaviors and what it is about these behaviors that increases crash risk. For example, does a particular distraction lead to reduced vehicle control (in the form of lane wandering, reduced headways, lower speeds, braking, etc.), reduced situational awareness (measured by eye gaze direction, longer response times, fewer mirror checks to monitor surrounding traffic, etc.), or both? To date, these kinds of data are limited and have primarily been collected in laboratory settings, which raises questions of generalizability to real-world experience. Good, unobtrusive techniques are needed for collecting data on how individuals allocate their attention under actual driving conditions during self-directed travel in their own vehicles. Only then will we be able to respond with appropriate recommendations, policies, and programs that address this important highway safety issue.

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Appendix A

CDS Driver Inattention/Distraction Variables

PRECRASH DRIVER RELATED DATA

30. Driver's Distraction/Inattention To Driving (Prior To Recognition Of Critical Event)
(00) No driver present
(01) Attentive or not distracted
(02) Looked but did not see

Distractions
(03) By other occupant(s), (specify):
(04) By moving object in vehicle (specify):
(05) While talking or listening to cellular phone (specify location and type of phone):
(06) While dialing cellular phone (specify location and type of phone):
(07) While adjusting climate controls
(08) While adjusting radio, cassette, CD (specify):
(09) While using other device /object in vehicle (specify):
(10) Sleepy or fell asleep
(11) Distracted by outside person, object, or event (specify):
(12) Eating or drinking
(13) Smoking related
(97) Distracted/inattentive, details unknown
(98) Other, distraction (specify):
(99) Unknown

31. Pre-Event Movement (Prior to Recognition of Critical Event)
(00) No driver present
(01) Going straight
(02) Decelerating in traffic lane
(03) Accelerating in traffic lane
(04) Starting in traffic lane
(05) Stopped in traffic lane
(06) Passing or overtaking another vehicle
(07) Disabled or parked in travel lane
(08) Leaving a parking position
(09) Entering a parking position
(10) Turning right
(11) Turning left
(12) Making a U-turn
(13) Backing up (other than for parking position)
(14) Negotiating a curve
(15) Changing lanes
(16) Merging
(17) Successful avoidance maneuver to a previous critical event
(97) Other (specify):
(99) Unknown

32. Critical Precrash Event
This Vehicle Loss of Control Due To:
(01) Blow out or flat tire
(02) Stalled engine
(03) Disabling vehicle failure (e.g., wheel fell off) (specify): _____
(04) Non-disabling vehicle problem (e.g., hood flew up) (specify): _____
(05) Poor road conditions (puddle, pot hole, ice, etc.) (specify): _____
(06) Traveling too fast for conditions
(08) Other cause of control loss (specify):
(09) Unknown cause of control loss

This Vehicle Traveling
(10) Over the lane line on left side of travel lane
(11) Over the lane line on right side of travel lane
(12) Off the edge of the road on the left side
(13) Off the edge of the road on the right side
(14) End departure
(15) Turning left at intersection
(16) Turning right at intersection
(17) Crossing over (passing through) intersection
(18) This vehicle decelerating
(19) Unknown travel direction

Other Motor Vehicle In Lane
(50) Other vehicle stopped
(51) Traveling in same direction with lower steady speed
(52) Traveling in same direction while decelerating
(53) Traveling in same direction with higher speed
(54) Traveling in opposite direction
(55) In crossover
(56) Backing
(59)Unknown travel direction of other motor vehicle in lane

Other Motor Vehicle Encroaching Into Lane
(60)From adjacent lane (same direction) -over left lane line
(61)From adjacent lane (same direction)-over right lane line
(62) From opposite direction-over left lane line
(63) From opposite direction-over right lane line
(64) From parking lane
(65) From crossing street, turning into same direction
(66) From crossing street, across path
(67) From crossing street, turning into opposite direction
(68) From crossing street, intended path not known
(70) From driveway, turning into same direction
(71) From driveway, across path
(72) From driveway, turning into opposite direction
(73) From driveway, intended path not known
(74) From entrance to limited access highway
(78) Encroachment by other vehicle-details unknown

Pedestrian, Pedalcyclist, or Other Nonmotorist
(80) Pedestrian in roadway
(81) Pedestrian approaching roadway
(82) Pedestrian-unknown location
(83) Pedalcyclist or other nonmotorist in roadway (specify):_____
(84) Pedalcyclist or other nonmotorist approaching roadway, (specify):_____
(85) Pedalcyclist or other nonmotorist-unknown location (specify):_____

Object or Animal
(87) Animal in roadway
(88) Animal approaching roadway
(89) Animal-unknown location
(90) Object in roadway
(91) Object approaching roadway
(92) Object-unknown location
(98) Other critical precrash event (specify):
(99) Unknown

PRECRASH DRIVER RELATED DATA

30. Driver's Distraction/Inattention To Driving
(Prior To Recognition Of Critical Event)
(00) No driver present
(01) Attentive or not distracted
(02) Looked but did not see

Distractions
(03) By other occupant(s), (specify):
(04) By moving object in vehicle (specify):
(05) While talking or listening to cellular phone (specify location and type of phone):
(06) While dialing cellular phone (specify location and type of phone):
(07) While adjusting climate controls
(08) While adjusting radio, cassette, CD (specify):
(09) While using other device/controls integral to vehicle (specify):
(10) While using or reaching for device/object brought into vehicle (specify):
(11) Sleepy or fell asleep
(12) Distracted by outside person, object, or event (specify):
(13) Eating or drinking
(14) Smoking related
(97) Distracted/inattentive, details unknown
(98) Other, distraction (specify):
(99) Unknown

31. Pre-Event Movement
(Prior to Recognition of Critical Event)
(00) No driver present
(01) Going straight
(02) Decelerating in traffic lane
(03) Accelerating in traffic lane
(04) Starting in traffic lane
(05) Stopped in traffic lane
(06) Passing or overtaking another vehicle
(07) Disabled or parked in travel lane
(08) Leaving a parking position
(09) Entering a parking position
(10) Turning right
(11) Turning left
(12) Making a U-turn
(13) Backing up (other than for parking position)
(14) Negotiating a curve
(15) Changing lanes
(16) Merging
(17) Successful avoidance maneuver to a previous critical event
(97) Other (specify):
(99) Unknown

32. Critical Precrash Event
This Vehicle Loss of Control Due To:
(01) Blow out or flat tire
(02) Stalled engine
(03) Disabling vehicle failure (e.g., wheel fell off)
(specify): _____
(04) Non-disabling vehicle problem (e.g., hood flew up)
(specify):_____
(05) Poor road conditions (puddle, pot hole, ice, etc.)
(specify): _____
(06) Traveling too fast for conditions
(08) Other cause of control loss (specify):
(09) Unknown cause of control loss

THIS VEHICLE TRAVELING
(10) Over the lane line on left side of travel lane
(11) Over the lane line on right side of travel lane
(12) Off the edge of the road on the left side
(13) Off the edge of the road on the right side
(14) End departure
(15) Turning left at intersection
(16) Turning right at intersection
(17) Crossing over (passing through) intersection
(18) This vehicle decelerating
(19) Unknown travel direction

OTHER MOTOR VEHICLE IN LANE
(50) Other vehicle stopped
(51) Traveling in same direction with lower steady speed
(52) Traveling in same direction while decelerating
(53) Traveling in same direction with higher speed
(54) Traveling in opposite direction
(55) In crossover
(56) Backing
(59)Unknown travel direction of other motor vehicle in lane

OTHER MOTOR VEHICLE ENCROACHING INTO LANE
(60)From adjacent lane (same direction) -over left lane line
(61)From adjacent lane (same direction)-over right lane line
(62) From opposite direction-over left lane line
(63) From opposite direction-over right lane line
(64) From parking lane
(65) From crossing street, turning into same direction
(66) From crossing street, across path
(67) From crossing street, turning into opposite direction
(68) From crossing street, intended path not known
(70) From driveway, turning into same direction
(71) From driveway, across path
(72) From driveway, turning into opposite direction
(73) From driveway, intended path not known
(74) From entrance to limited access highway
(78) Encroachment by other vehicle-details unknown

PEDESTRIAN, PEDALCYCLIST, OR OTHER NONMOTORIST
(80) Pedestrian in roadway
(81) Pedestrian approaching roadway
(82) Pedestrian-unknown location
(83) Pedalcyclist or other nonmotorist in roadway (specify):_____
(84) Pedalcyclist or other nonmotorist approaching roadway, (specify):_____
(85) Pedalcyclist or other nonmotorist-unknown location (specify):_____

OBJECT OR ANIMAL
(87) Animal in roadway
(88) Animal approaching roadway
(89) Animal-unknown location
(90) Object in roadway
(91) Object approaching roadway
(92) Object-unknown location
(98) Other critical precrash event (specify):
(99) Unknown

Appendix B

Supporting Graphs

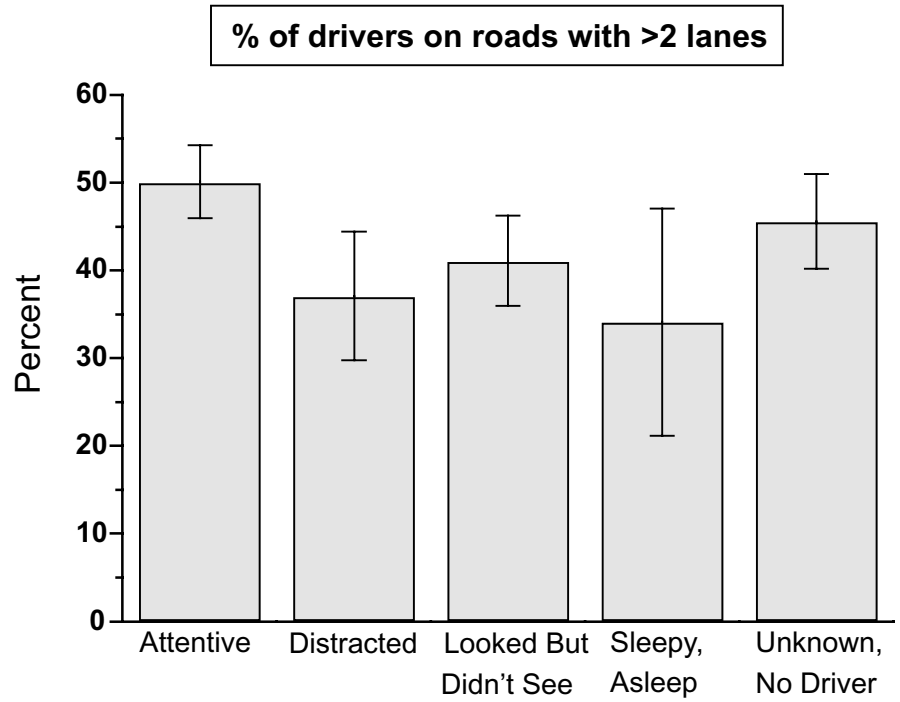

Figure B.1. Effect of number of travel lanes on driver attention status.

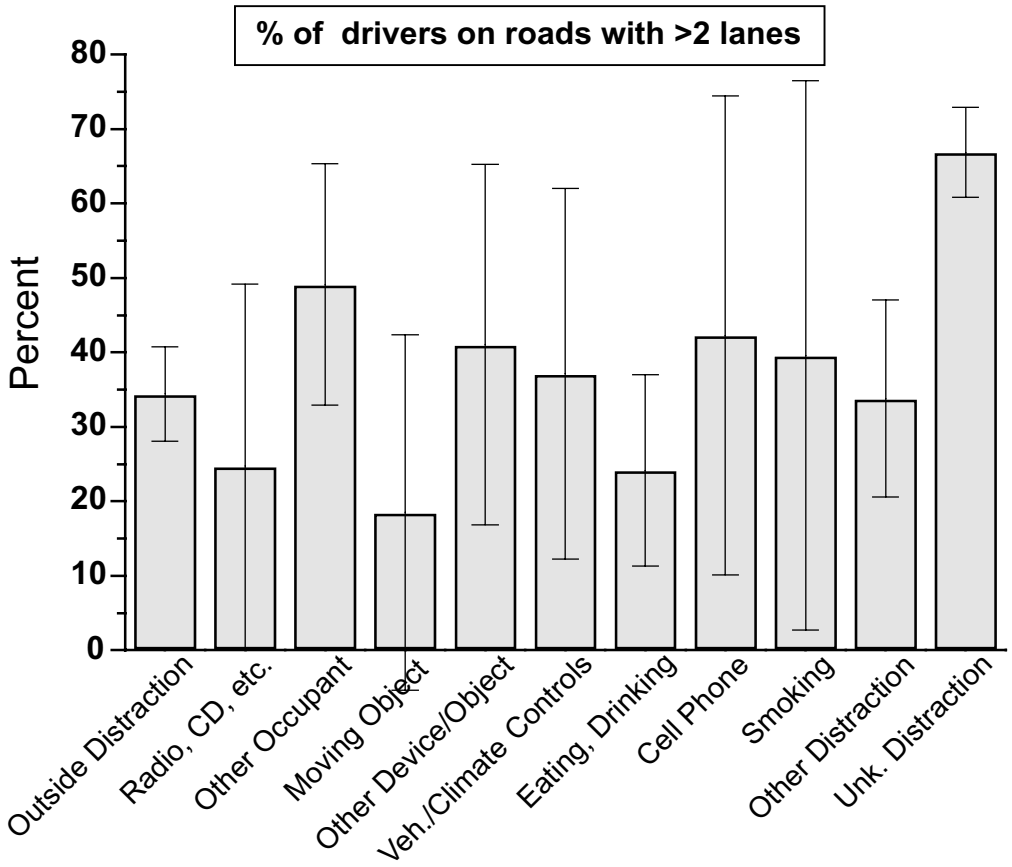

Figure B.2. Effect of number of travel lanes on specific driver distraction.

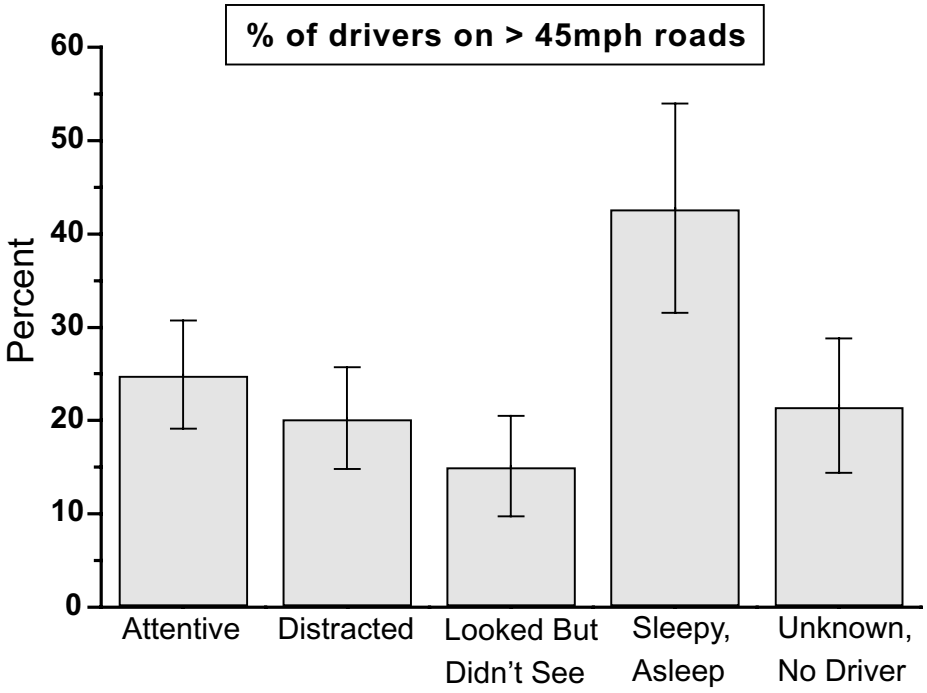

Figure B.3. Effect of speed limit on driver attention status.

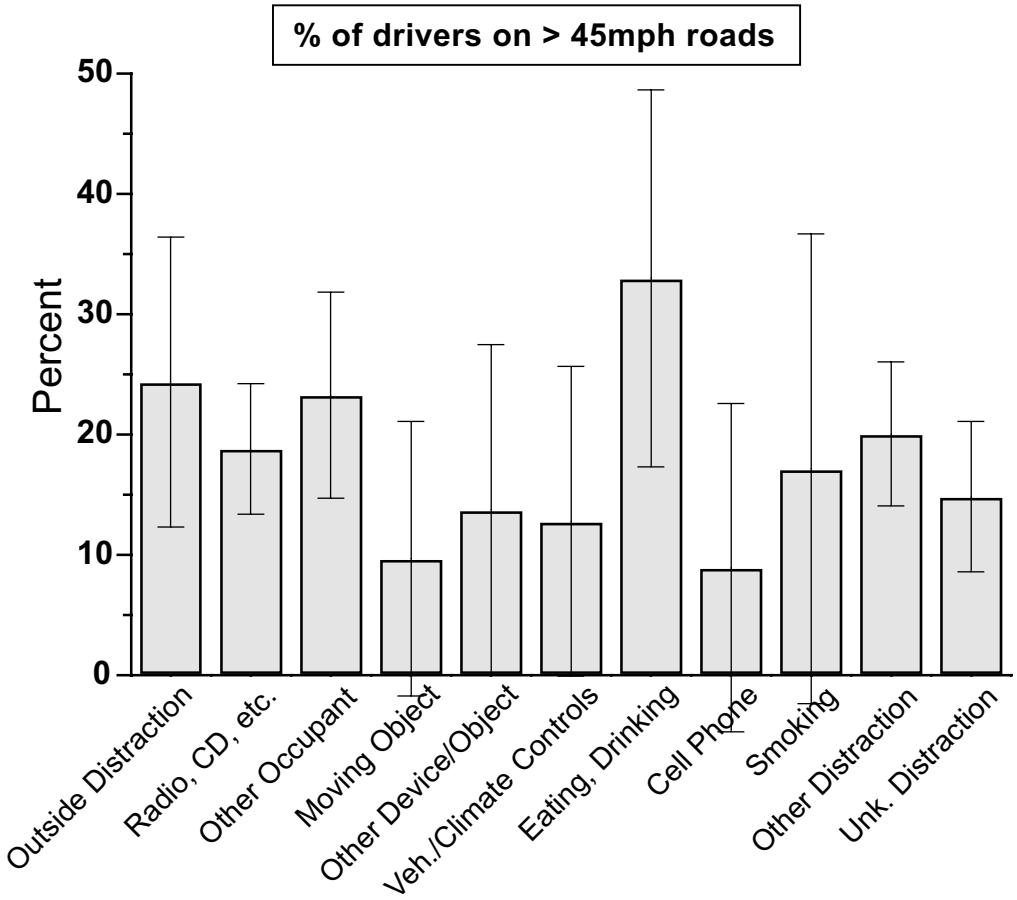

Figure B.4. Effect of speed limit on specific driver distraction.

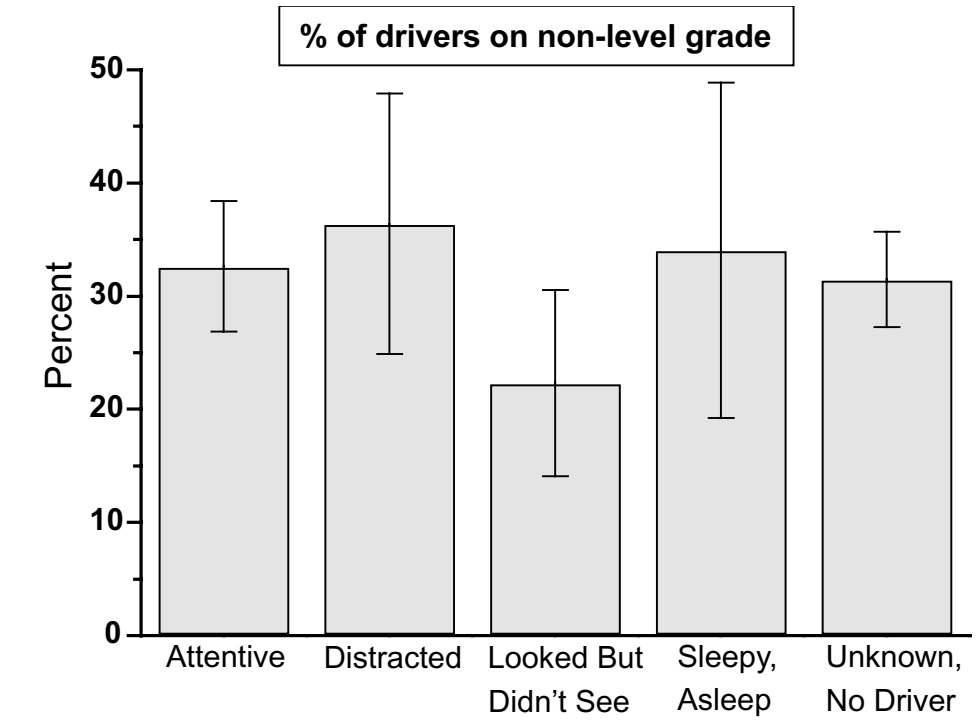

Figure B.5. Effect of road grade on driver attention status

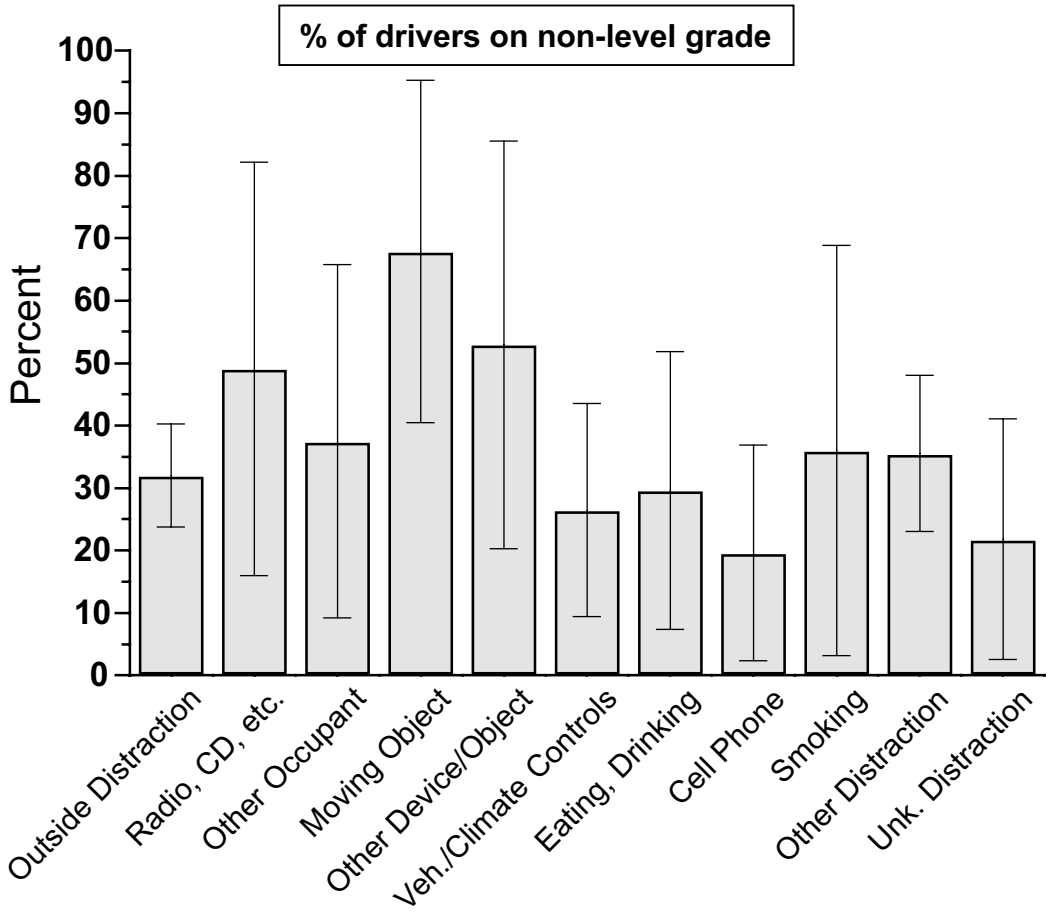

Figure B.6. Effect of road grade on specific driver distraction.

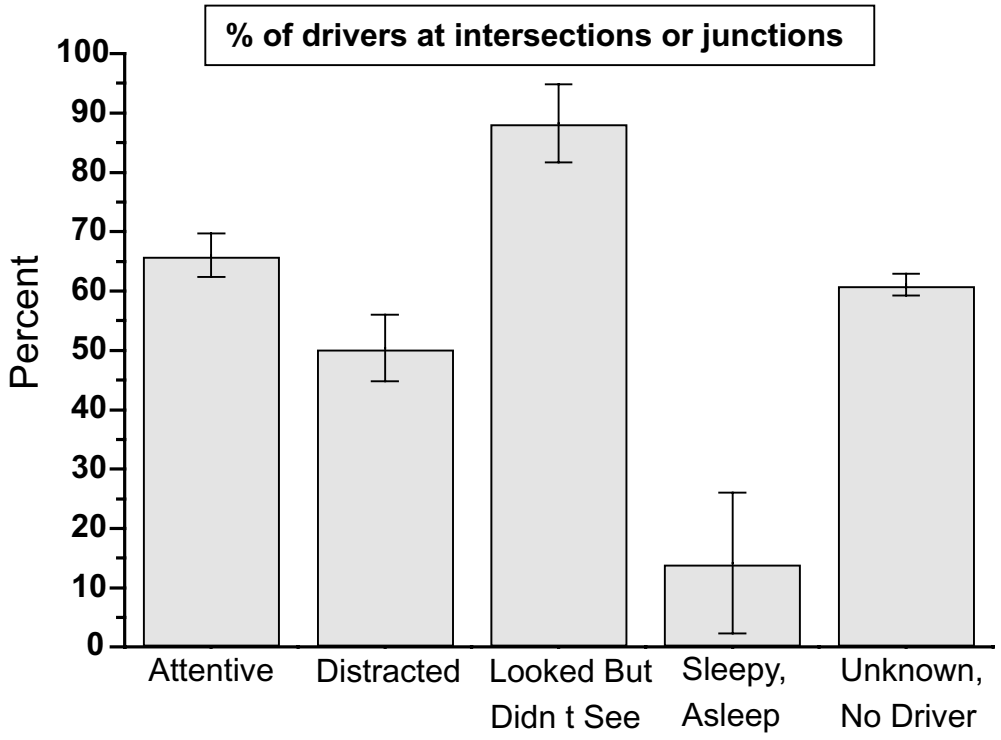

Figure B.7. Effect of intersection status on driver attention status.

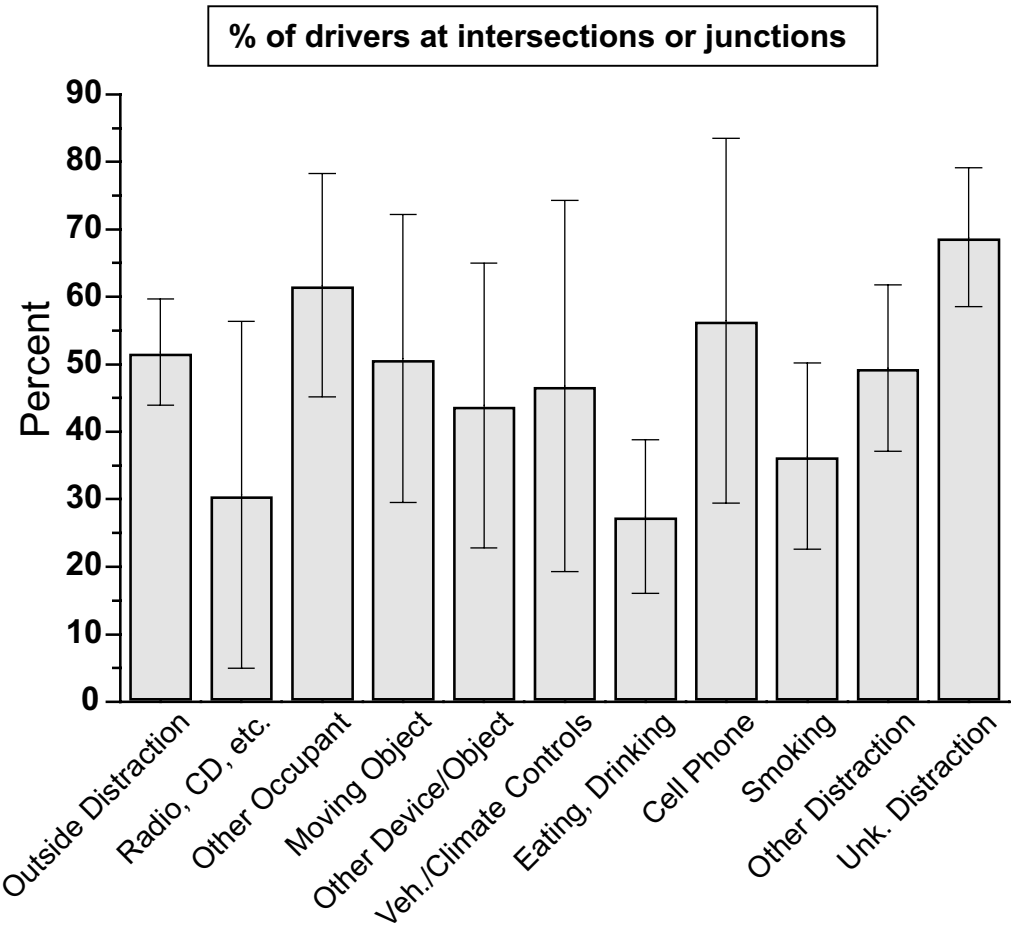

Figure B.8. Effect of intersection status on specific driver distraction.

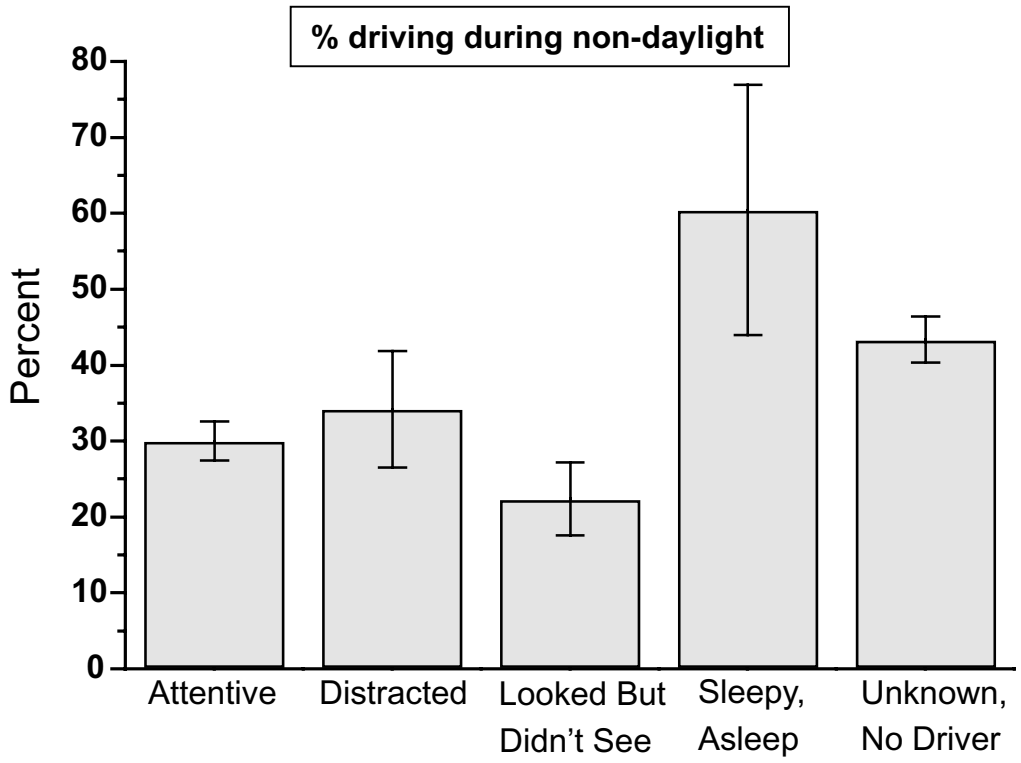

Figure B.9. Effect of light condition on driver attention status.

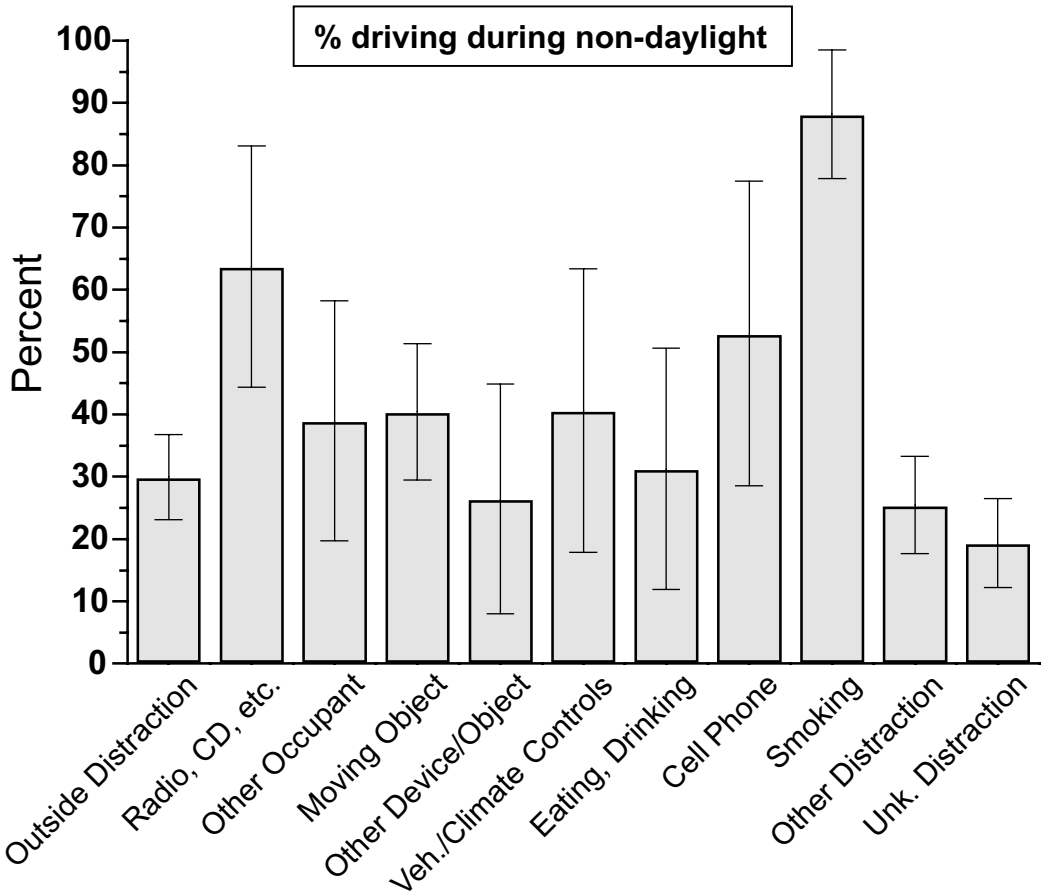

Figure B.10. Effect of light condition on specific driver distraction.

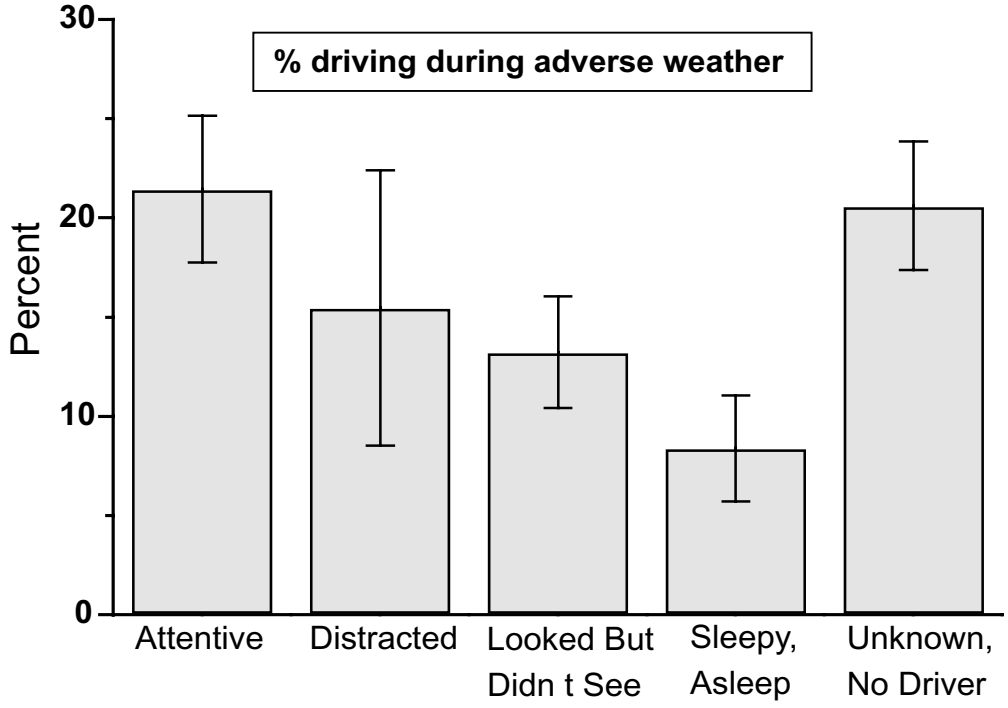

Figure B.11. Effect of weather condition on driver attention status.

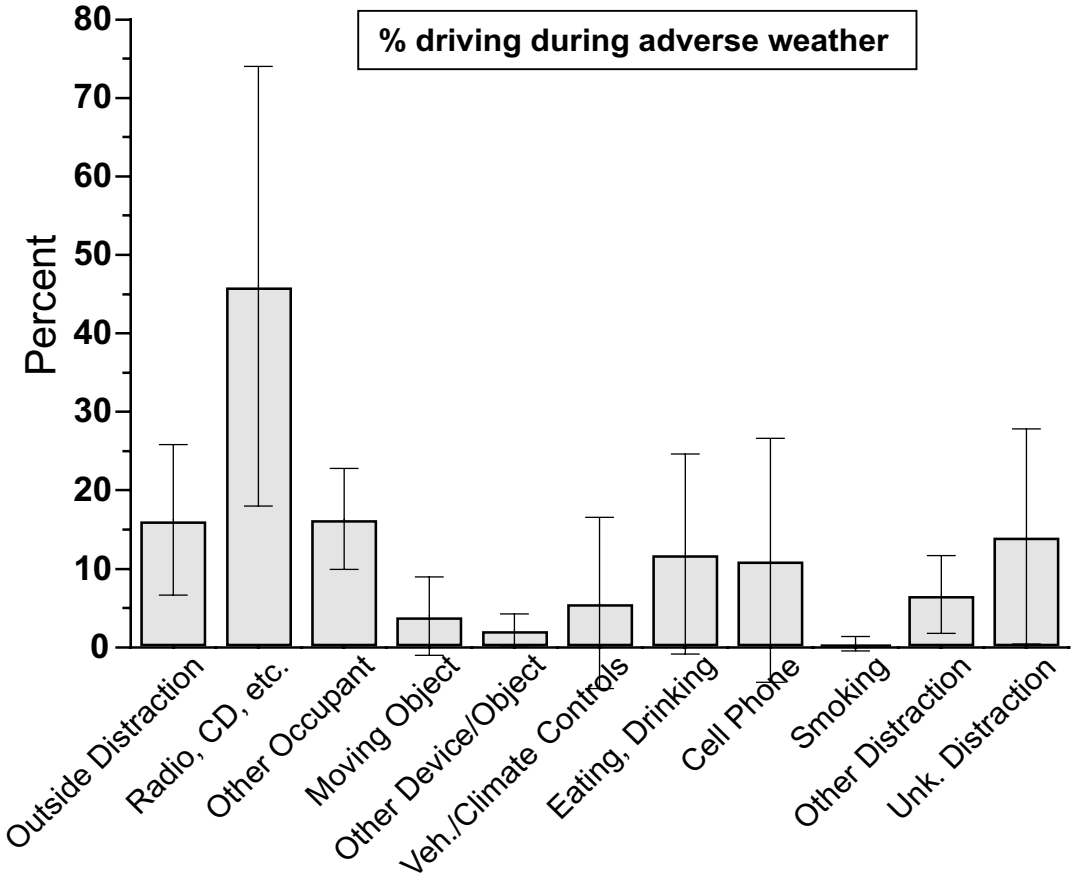

Figure B.12. Effect of weather condition on specific driver distraction.

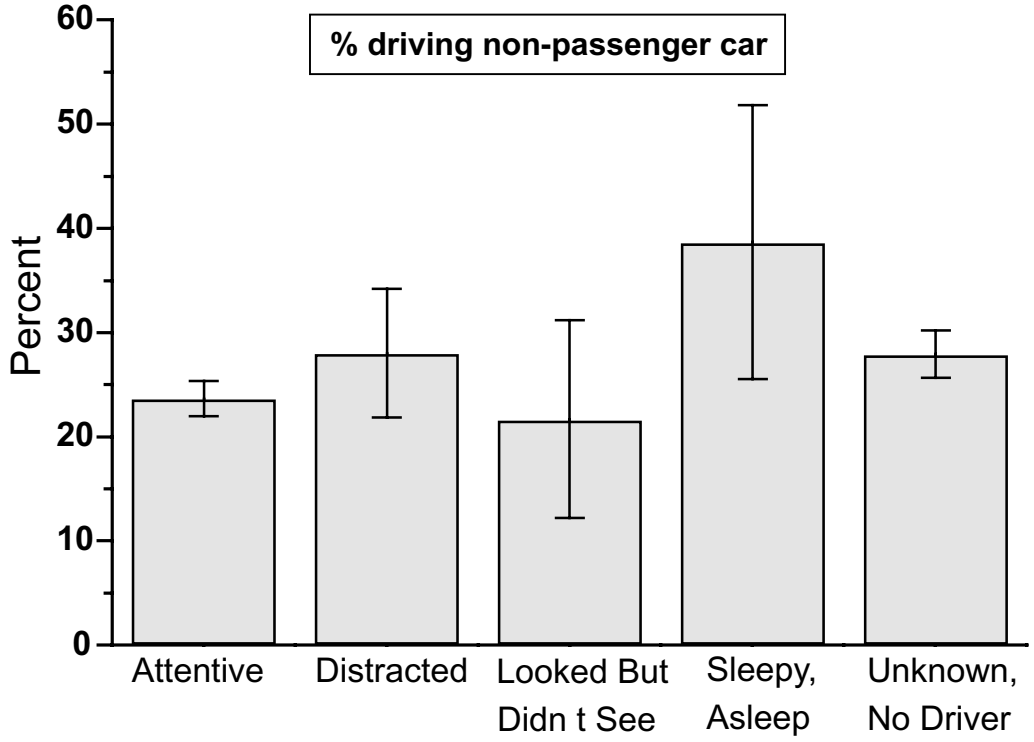

Figure B.13. Effect of vehicle type on driver attention status.

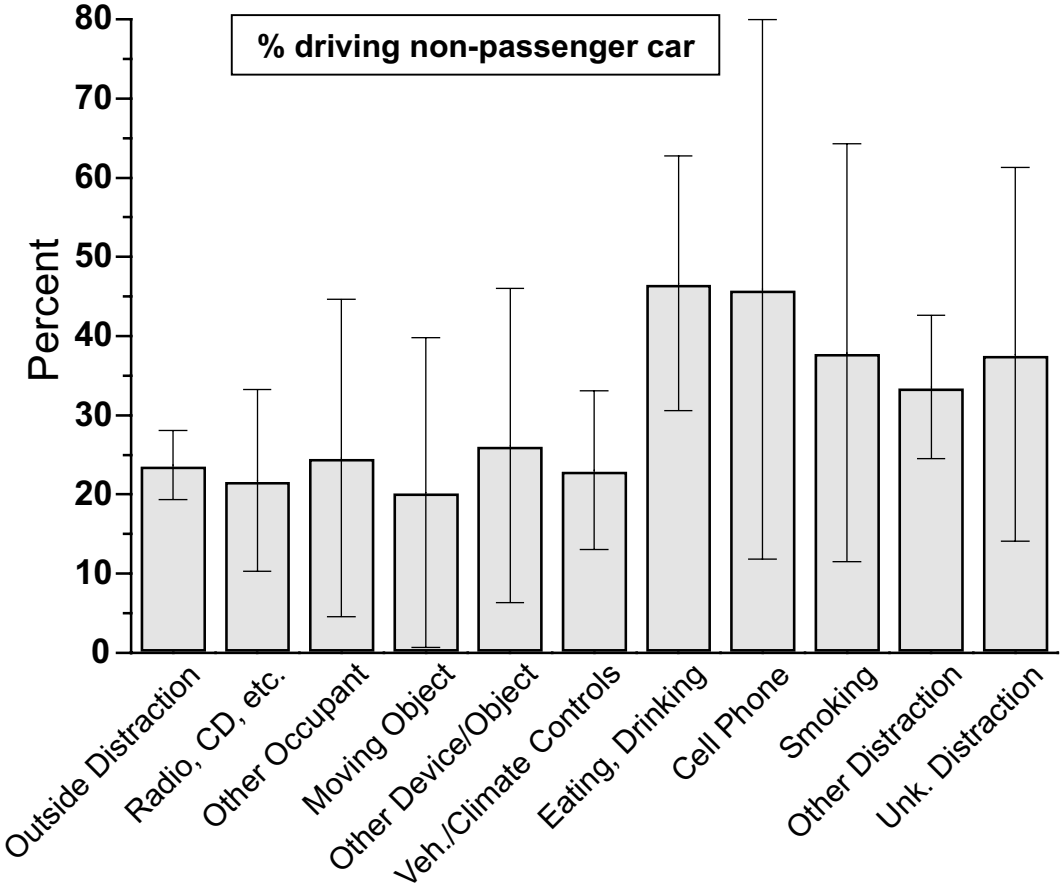

Figure B.14. Effect of vehicle type on specific driver distraction.

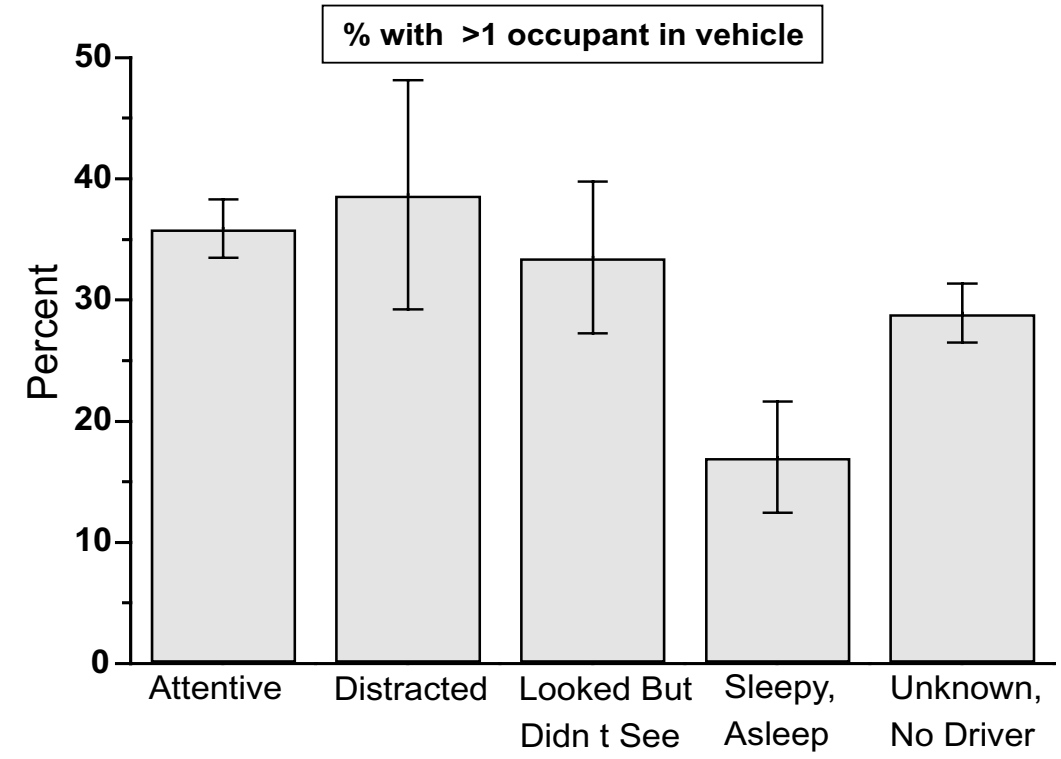

Figure B.15. Effect of other occupants in vehicle on driver attention status.

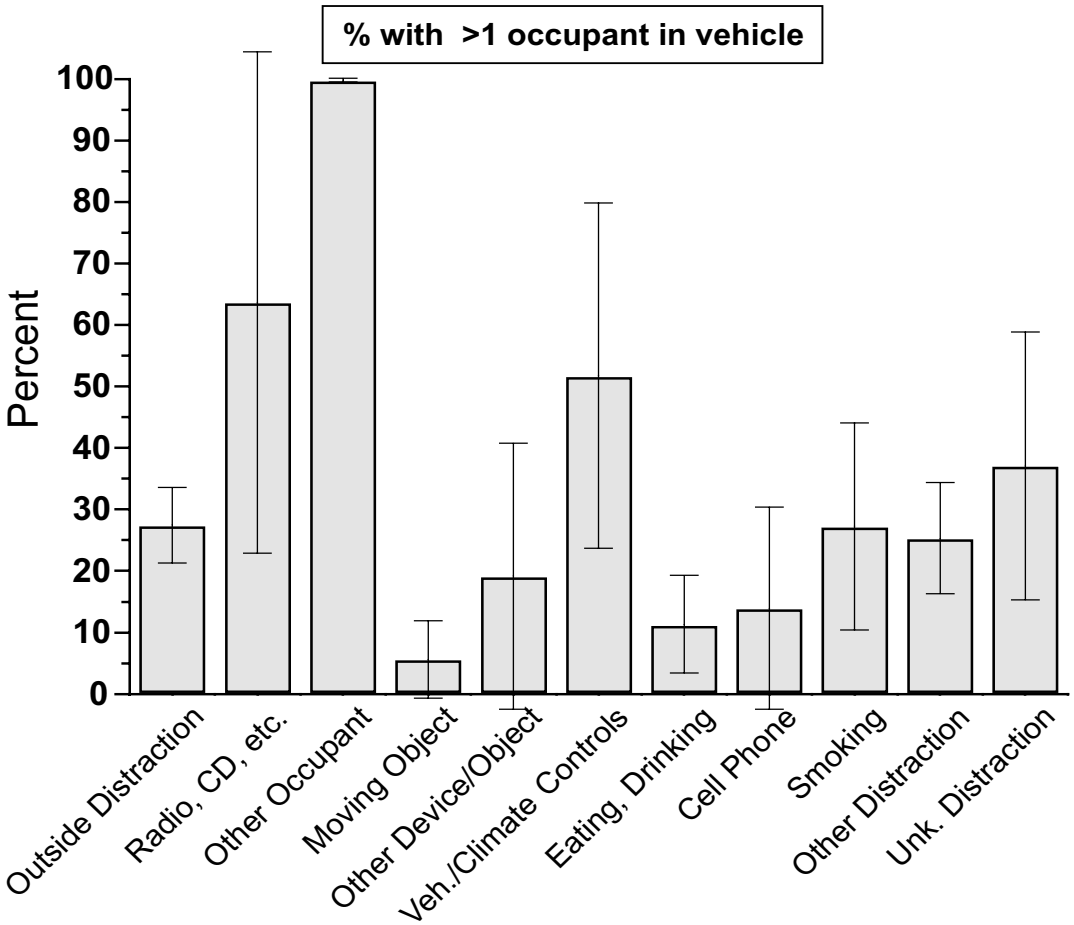

Figure B.16. Effect of other occupants in vehicle on specific driver distraction.

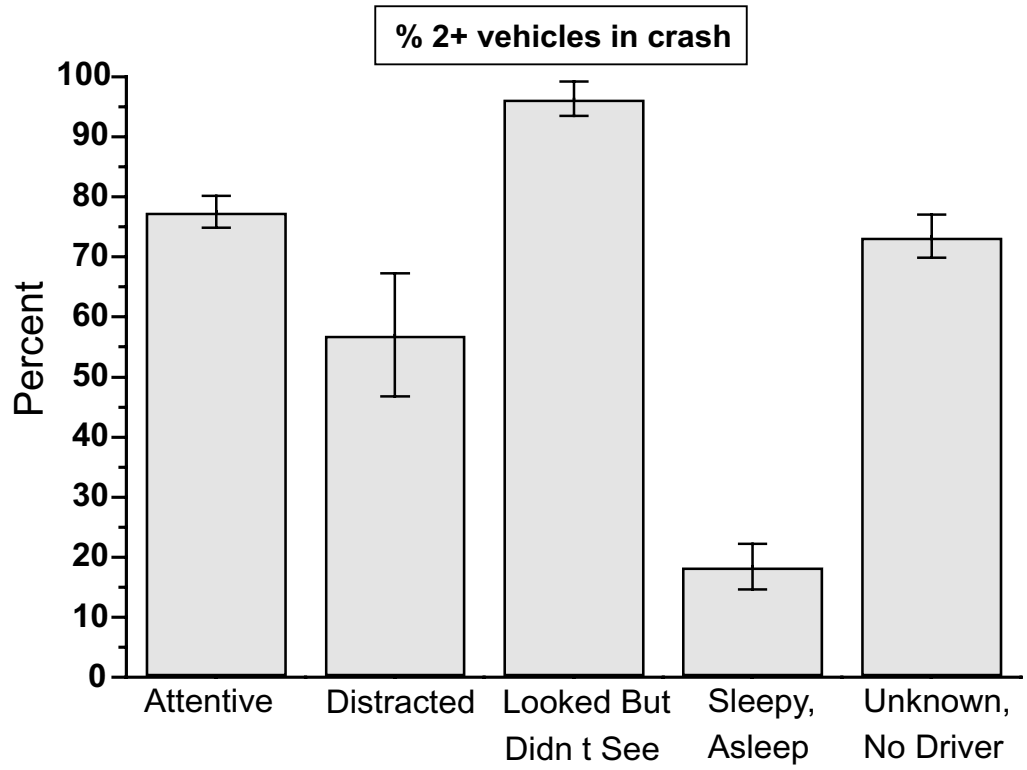

Figure B.17. Effect of number of vehicles on driver attention status.

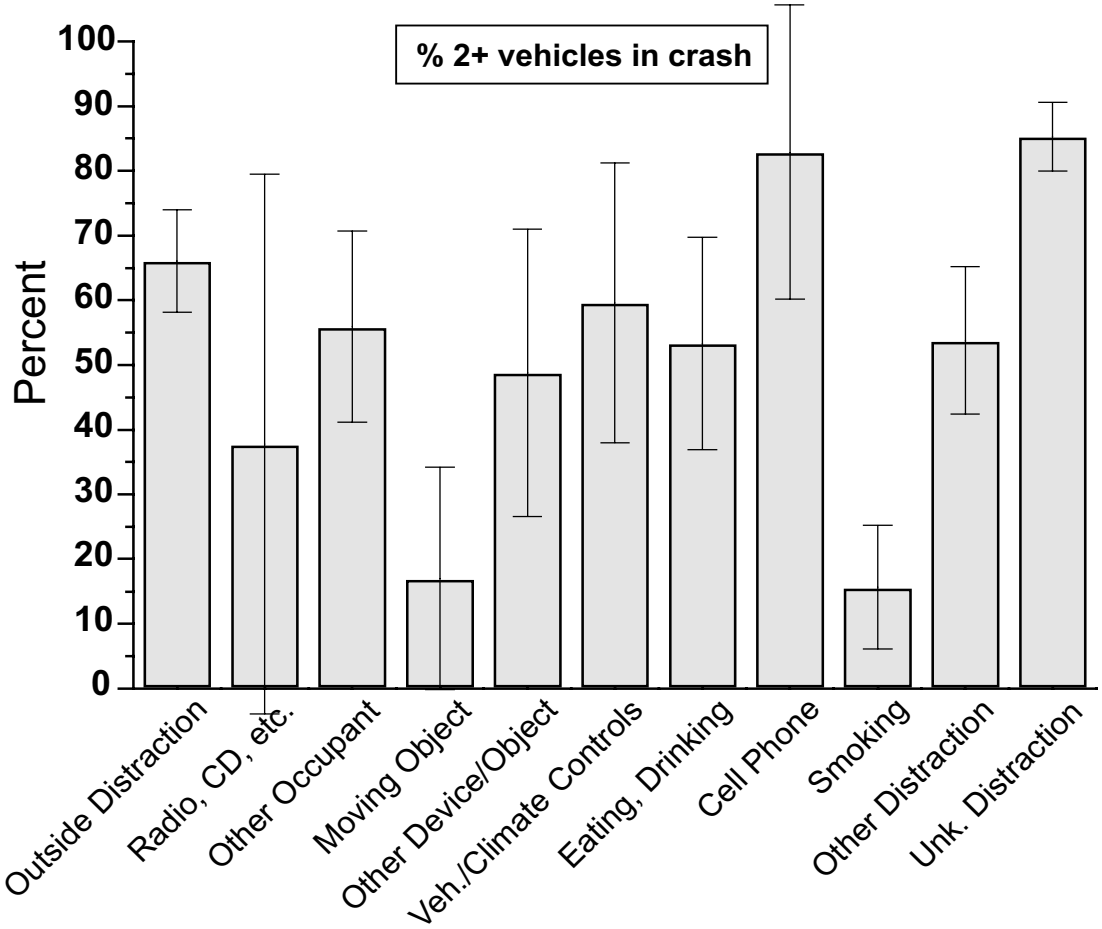

Figure B.18. Effect of number of vehicles on specific driver distraction.

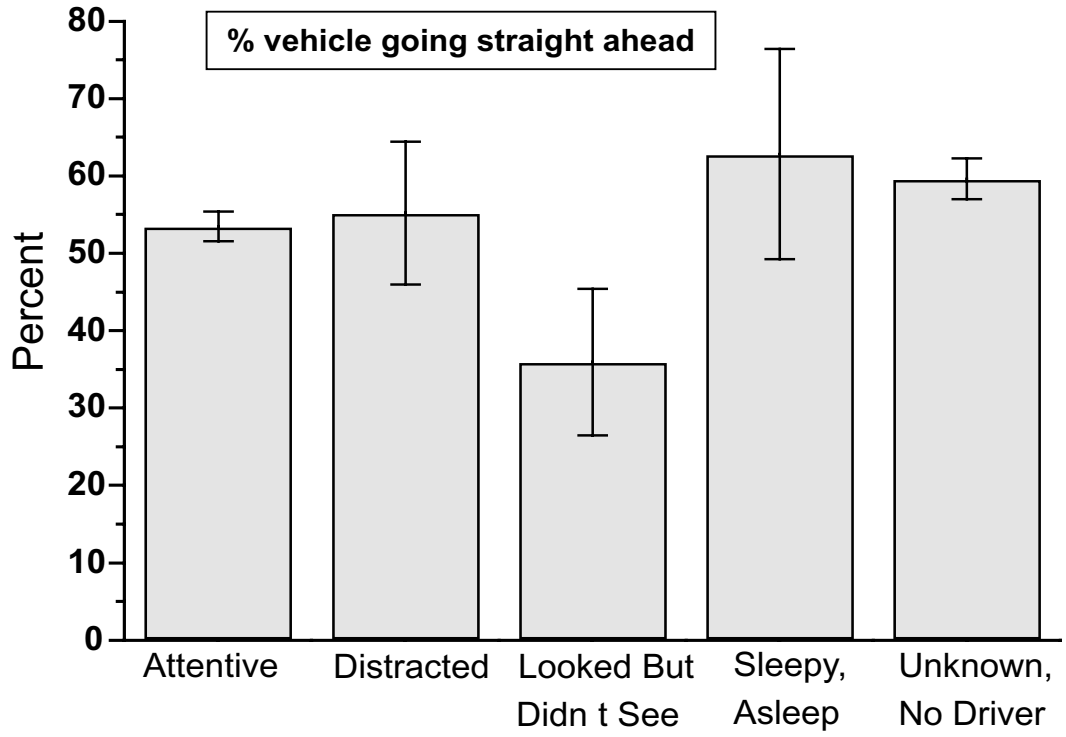

Figure B.19. Effect of precrash vehicle maneuver on driver attention status.

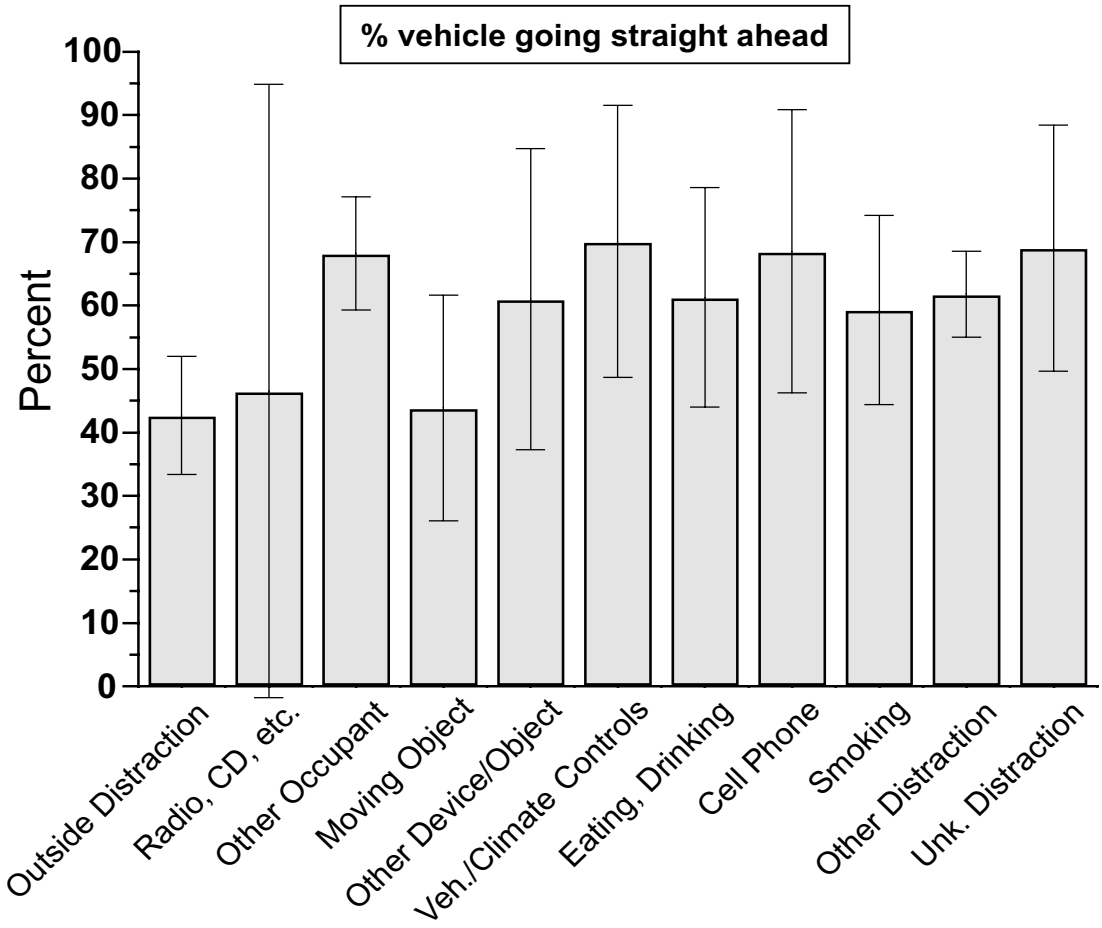

Figure B.20. Effect of precrash vehicle maneuver on specific driver distraction.

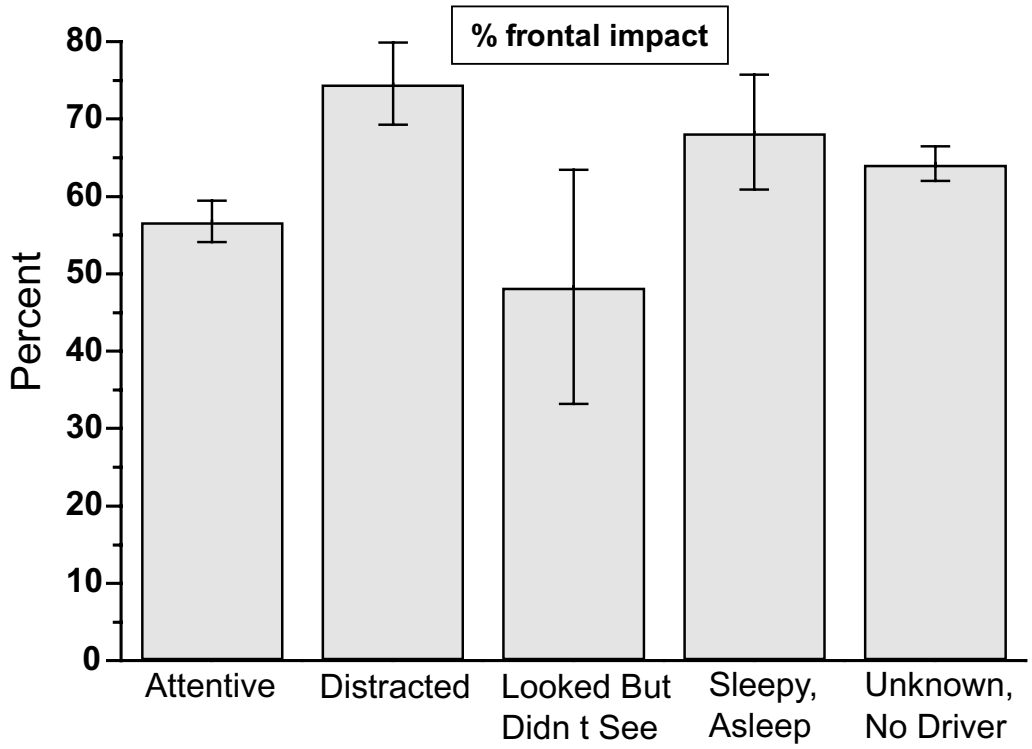

Figure B.21. Effect of region of impact on driver attention status.

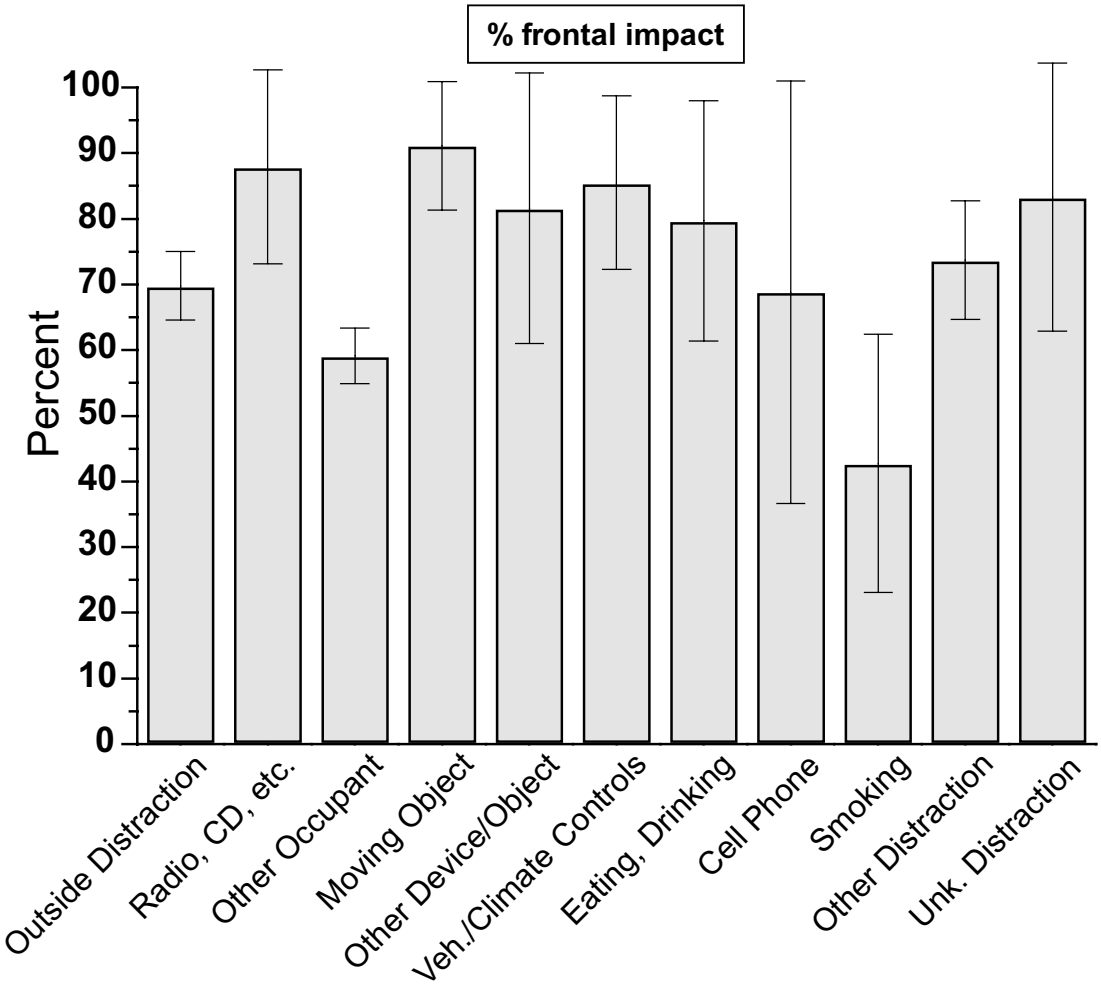

Figure B.22. Effect of region of impact on specific driver distraction.

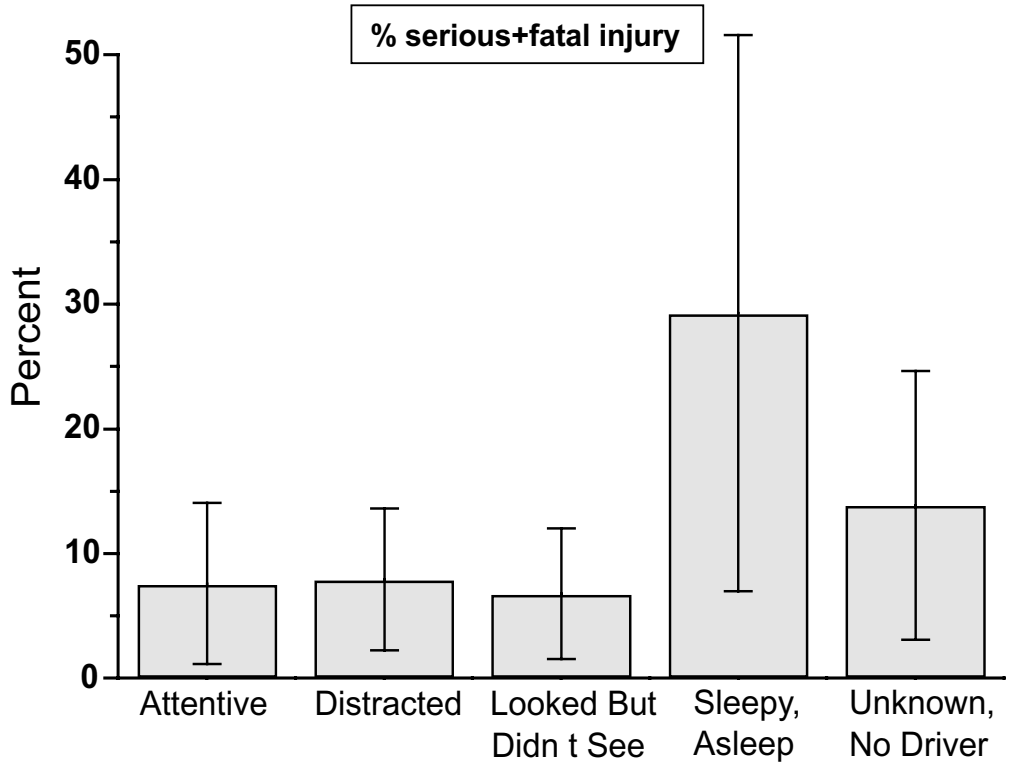

Figure B.23. Effect of driver injury on driver attention status.

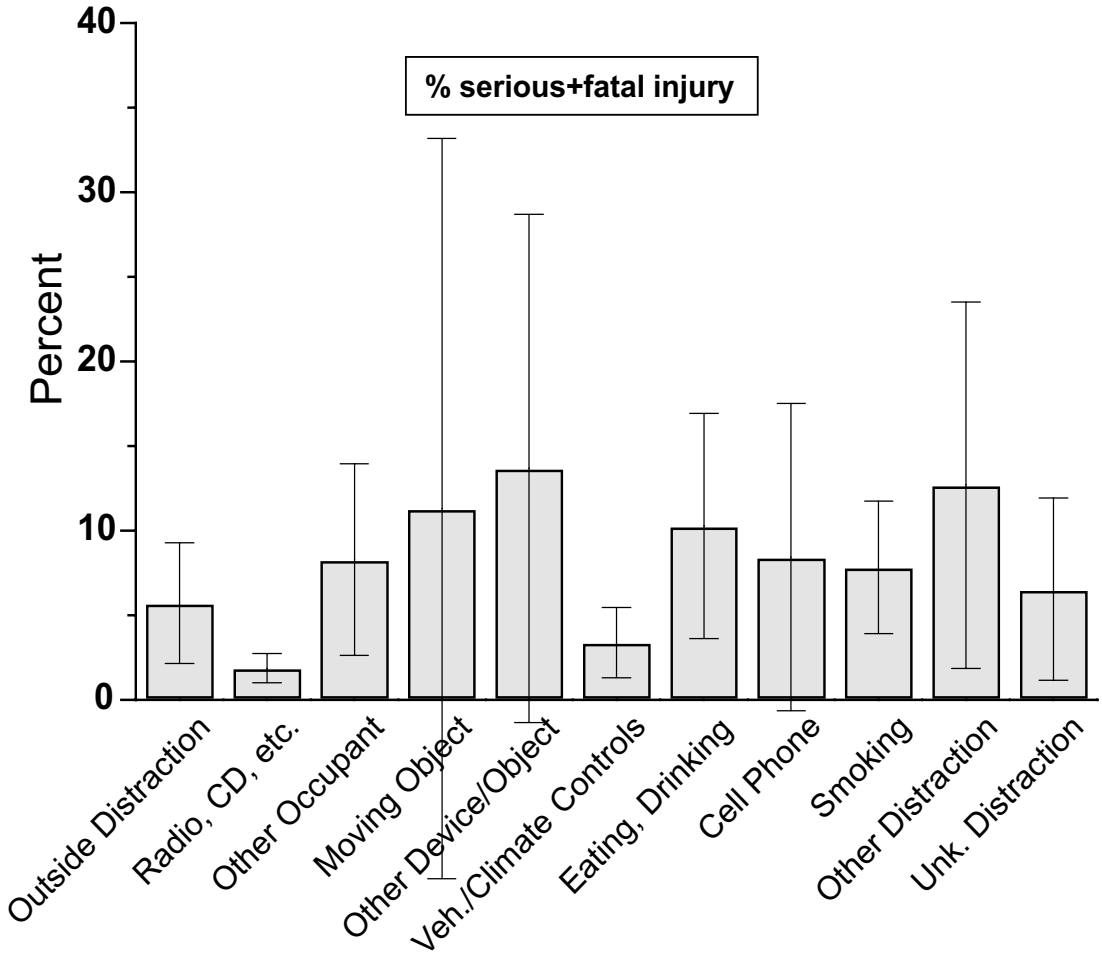

Figure B.24. Effect of driver injury on specific driver distraction.

Appendix C

Sample CDS Narrative Printout

CASE	DISTRACTION	SUMMARY
1998-004-017, V1	By other occupant(s), specify): By two passengers in back seat. Trying to break u	V1 was southbound on a two-lane roadway. V1 went off the roadway to the left striking a wall with the front. After the initial impact V1 continued southbound on the sidewalk and sideswiped another wall. V1 then re-entered the roadway in a west direction before making a U-turn and traveled east back off the roadway. V 1 continued east struck a wooden fence and a tree on the east roadside. V1 was towed; all three occupants were transported sustaining "B" and "C" injuries.
1998-004-020, V1	Sleepy or fell asleep	V1 was westbound on a two-lane roadway. V1 went off the roadway to the left and struck a tree. The roadway was wet and it had been raining. V1 was towed; the driver was transported sustaining "A" injuries.
1998-004-035, V2	Distracted by outside person, object, or event specify): police vehicle	V1 was traveling east on a six lane roadway and stopped for a police vehicle. V2 was traveling behind V1 in the second lane and attempted to stop. The front of V2 impacted the back of V1. V2 was towed due to front end damage, but no one was reported as being injured or transported.
1998-004-044, V1	Sleepy or fell asleep	V1 was southbound on a tow-lane roadway. V1 went off the roadway to the right, struck a utility pole, and snapped same at the base. V1 continued on and struck a small tree on the east roadside. The pole and tree were removed. V1 was towed; both occupants were transported sustaining "A" and "B" injuries.
1998-004-045, V2	Inattentive or lost in thought	V1 was traveling east on a two lane roadway approaching an intersection. V2 was traveling south on a two lane roadway approaching the same intersection. The front of V2 impacted the left of V1 causing V1to rotate and strike a curb with its right rear wheel. V1 then reversed rotation directions to CW and came to rest on a lawn. Both vehicles were towed due to damage. The driver of V1 was transported with "C" injuries and the driver of V2 with "A" injuries. There were no adverse road or weather conditions.
1998-004-052, V1	Sleepy or fell asleep	V1 was southbound on a two-lane roadway. The driver of V1 either fell asleep or passed out. V1 went off the roadway to the left. The vehicle initiially struck two metal poles designed to keep vehicles from striking a generator located on the roadside. V1 became airborne and began to rollover to the right. V1 then glanced off a tree and rolled onto it's roof. During the removal of the vehicle by the tow facility V1's engine compartment caught on fire while being turned rightside. The fire was extinguished and V1 was towed due to damage. The driver of Vl was transported sustaining "A" injuries.
1998-004-061, V1	Distracted by outside person, object, or event (specify): BY ANIMAL IN ROADWAY	V1 was eastbound on a two-lane roadway. An animal entered the roadway from the woodline south to north. V1 swerved to the right to avoid collision causing V1to rollover onto it's left side and then onto it's roof. V1 slid into a street sign and into a pole while on it's roof. V1 was towed; the dirver ofV1 was transported sustaining "A" injuries.
1998-004-067, V1	Sleepy or fell asleep	V1 was traveling south on a four lane roadway when the driver fell asleep. V1 departed the road to the left, struck a utility pole with its front left, then rolled two quarter turns on to its roof. V1 was towed due to damage; both occupants sustained "B" injuries, but refused medical treatment.
1998-004-083, V1	Sleepy or fell asleep	V1 was Southbound on a two-lane roadway. V1 went off the road to the right and struck six small trees. V1 was negotiating a left curve before exiting the roadway. V1 was towed and the driver sustained "A" injuries.

Appendix D

Sample North Carolina Narrative Printout

Keyword = baby ****************************

98016308 Length = 55 Column location = 28
1 TRAV W ON US74 TENDING TO BABY LOST CONTORL OVERTURNE

98051884 Length = 32 Column location = 28
V WAS TRYING TO TEND TO HER BABY

98057104 Length = 143 Column location = 60
V2 STATED THAT SHE WAS TRAV E WEHWEN SHE LOOKED OVER AT HER BABY
WHEN SHE LOOK UP V1 WAS MAKING A LEFT TURN. SHE DID NOT HAVE ANY-
TIME TO REACT.

98065147 Length = 202 Column location = 18
DRl STATED THAT A BABY BAG HAD SLID ONT HE FLOOD BOARD AROUDN HIS
FEET. DRi REACHED TO ROVE THE BAG & DROVE OFF THE RD TO THE RT TRAV
APPROX 213 FT BEFORE COLLIDG INTO A DRWY EMBANKMT TO EASONBURG
PARK.

98084720 Length = 245 Column location = 24
Vl TOLD OFFICER TET HER BABY STARTED CRYING AND SHE TUNED AROUND TO
CECK ON HER WHEN SHE TURNED BACK AROUND IT WAS TOO LATE TO AVOID
RUNNING INTO THE BACK OF V2. V2 TOLD OFFICER THAT HE WAS PREPARINHG
TO MAKE A LF TURN WHEN SHE WAS TRCK THE PAR.

98102431 Length = 107 Column location = 31
VEH 1 WAS PARKED WITNESS SAW A BABY BLUE FORD BRONCO WITH NC
REGIS.LNF3502 STRIKE VEH 1 THEN LEFT THE SCENE

98112630 Length = 256 Column location = 221
Vl STATED THAT HE WAS GONG NTO MAKEK A RT TURN ONTO EASTWAY AS HE
APPROACHED THE INTER HE SAW THE PEOPLE STOPPED AT THE INTERSECTION
SIDEWALK AS HE MADE HIS TURN HE WAS CLOSE JTO THE CURB AND BELIEVED
HE MAY HAVE HIT THE BABY STROLLER WITH THE RT REAR TIRE

98120744 Length = 187 Column location = 35
Vl ENGINE STALLED & A 11 MONTH OLD BABY WAS REMOVED FROM VEH &
PLACED HIM IN THE SHADE ON GARRSY AREA & DR PUSHED VEH BACK & WAS
STRUCK BY V2 & RAN OVER BABY & CAME TO REST AGAINST A TREE.

98143902 Length = 141 Column location = 101
VEH 2 WAS TRAV S SLOWING DOWN TO STOP FOR OTHER VEH VEH 1 WAS ALSO
TRAV STURNED HER HEAD TO CHECK ON BABY WHEN SHE RANINTO THE REAR
OF VHE 2

98145706 Length = 131 Column location = 42
V1 STATED THAT HE REACHED DOWN TO GET THE BABYS BOTTLE AND KWHEN HE
DIDI V1 RAN OFF RDWY ATO RT ADN TRAV A DIST ADN STRUCK A TREE.

98157922 Length = 221 Column location = 66
DR OF V1 STATED SHE HAD TAKEN HER EYES OFF OF THE RD TO CHECK HER
BABY & WHEN SHE LOOKED UP V2 WAS IN FRONT OF HER & SHE WAS UNABLE
TO STOP. DR OF V2 STATED HE HAD SLOWED TO TURN INTO A PARKG LOT &
WAS STURCK FROM BEHIND.

98169778 Length = 150 Column location = 23
THE DR STATED THAT THE BABY WAS FUSSYY SO HE TURNED TO GIVE THE
BABY HIS BOTTLE AS HE TURNED TO DO SO THE PU WENT OFF TEH RD TO
THE RT HITTING A SIGN

98173765 Length 184 Column location = 48
1 TRAV N ON DOE DR AND TRND AROUND TO GIVE HER BABY A BOTTLE AND STRK A TRLR THAT WAS HOLDING AS WATER PUMP DRIVER STATED SHE WAS SCARED AND DROVE HOME AND WAS APPRIHENDED 15 MIN LATER

98180887 Length = 170 Column location 126
1 TRAV W ON NC24 AND 1 RAN OFF RD ON RT AND THEN ON LFT AND OVRTRND TWICE LANDING ON IT TOP AND A DECEASED PASSENGER AND THE BABY SHE WAS HOLDING WERE THROWN FPM THE VEH

98182887 Length = 128 Column location = 40
V1 STATED THAT SHE WAS REACHING NNFOR A BABY BBOTTLE AND DIDI NOT SEE V2 STOPPINGN ION NFORNT OF HER SHE STRUCK THE REAR OF V2

98196075 Length = 171 Column location = 76
V2 WAS STOPPING AT THE RED LIGHT AND WAS HIT FROM BEHIND Vl STATED THAT HER BABY WAS IN THE CAR SEAT. THE SEAT FELL OVER ADN SHE REACHED KTO GET AND STRUCK V2

Keyword = radio ****************************

98000900 Length = 204 Column location = 67
V1 WAS LEAVING SHONEYS DRIVEWAY ATTEMPTING TO CROSS MEMORIAL DR TO RADIO RD. DR 1 STATED SHE LOOKED BOTH WAYS AND DID NOT SEE V2. V1 PROCEEDED ACROSS MEMORIAL DR AND WQS STRUCK IN RT PASSENGER DOOR AREQ.

98006748 Length = 180 Column location = 20
V1 WAS CHANGING THE RADIO STATION AND WHEN HE LOOKED UP HE RAN OFF THE RD JERKED THE WHEEL TO THE LEFT CAUSING THE VEH TO CROSS THE RD AND STRUCK A SMALL TREE AND THEN TURNED OVER.

98011487 Length = 213 Column location = 36
V1 STATED HE STOPPED AT GAITHER AND RADIO RD AND PULLED UP INTO THE INTER TO CHECK FOR ONCOMING TRAF WHEN HE COLLIDED WITH V2. GV2 STATED SHE WS TRAV ACROSS GAl THER WHE V1 PULLED INTO THE RDWAY AND STRUCK HER VEH.

98016314 Length = 67 Column location = 33
1 LOOKED DOWN BRIEFLY TO ADJUST RADIO LOST CONTORL STRIKING EMBKMT

98019502 Length = 192 Column location = 70
V1 STATED THAT SHE WAS TRAV E ON 37TH ST AND SHE WAS MESSING WITH THE RADIO AND SHE DID NOT SEE V2 PARKED ON THE SIDE OF THE ST AND WHEN SHE LOOKED UP IT WAS TOO LATE AND SHE COLLIDED INTO V2.

98022958 Length = 108 Column location = 47
D2 WAS TRAV N ON RP1826. Dl LOOKED DOWN AT HIS RADIO & CROSSED THE CENTER LINE & STRUCK THE BACK LEFT OF V2.

98023259 Length = 322 Column location = 155
2 ADVISED HE STOPPED AT LIGHT AT CLOVERDALE AVE & MEDICAL CTR BLVD. 1 ADVISED LIGHT WAS RED & HE BEGAN TO STOP. 1 STATD HE LOOKED AWAY FROM RD & DOWN AT RADIO. 1 STATED HE LOOKED BACK UP TO RD IN FR OF HIM HE SAW HE WAS GOING TO COLLIDE WITH2. 1 STATED HE

ATTEMPTED TO AVOID2 BY SWERVING & BRAKING. 1 COLLIDED WITH 2.

98025386 Length = 169 Column location = 73
1 STATED SHE SAW RT TURN SIGNAL ON 2 & THOUGHT 2 WAS GOING TO TURN RT AT RADIO ST SO SHE BEGAN TO MAKE L TTURN ONTO N CHESTER ST BUT AS SHE PULLED OUT 1 COLLIDE D WITH 2.

98031648 Length = 257 Column location = 144
Dl STATED THAT WHILE IN THE STOP & GO TRAFFIC APPROACHING THE INTER LT AT INTERNATIONAL. HE TOOK HIS EYES OFF THE RDWY LOOKING DOWN AT THE CAR RADIO. WHEN HE L00K BACK UP HE NOTICED THAT V2 WAS STOPPING. HE APPLIED THE BRAKES & SKIDDED INTO THE REAR OF V2.

98044565 Length = 148 Column location = 92
DR OF V1 WAS RESPONDING TO EMERGENCY CALL RELATED TO BURGLEARY IN PROGRESS WHILE TALKING ON RADIO & DIDNT SEE STREET ENDED & STRUCK DIRT EMBANKMENT.

98055385 Length = 213 Column location = 113
V1&2 WERE TRAV S. V2 WAS AHERAD OF Vi V2 SLOWED FOR A VEH TURNING INTO THE VANN YORK LOT. Vi STATED HE DROPPED A RADIO ONTO THE FLOORBOARD WHEN HE LOOKED BACK AT THE RD HE REALIZED V2 HAD SLOWED Vi REAR ENDED V2.

98059247 Length = 108 Column location = 37
D1 STATED THAT HE LOOKED DOWN AT HIS RADIO & DID NOT SEE V2 STOPPED BECAUSE OF THE CURVE &COLLIED WITH SAME.

98061301 Length = 99 Column location = 54
V1 WAS TRAVELING WEST N USHWY V2 WAS PULLING OUT FROM RADIO DR V1 STRUCK HER IN PASSENGER SIDE DOOR

98061652 Length = 265 Column location = 36
V1 2 AND A WERE TRAV N V1 AND A HAD RADIO COMMUNICATINS ViO GAVE A LEFT SIGNAL VEH A TO ENSURE THAT VEH A WAS STOPPING V2 BEGAN TO PASS VEH A AND COULD NOT SEE V1 DUE TO HILL CREST V2 STATED THAT HE INTENTION WAS TO PASS BOTH SLIDING ON DRY PAVEMENT AND STRUCK V1.

Keyword = cell **********

98015206 Length = 166 Column location = 115
Vl TRAV E ON GRAND AVE FAILED TO OBEY RAILRD WARNING LIGHTS & GATES. THE DR WENT AROUND THE GATE & STRUCK THE FUEL CELL ON THE LEAD ENGINE. THE DR OF V1 LT THE SCENE.

98018520 Length = 261 Column location = 68
DR1 REPORTED TRAFFIC STARTED TO MOVE & SO DID HE & WHILE MOVING HIS CELLULAR PHONE RAN & RE REACHED DOWN TO ANSWERS IT & STRUCK V2 IN THE REAR WHICH HAD STOPPED. DR2 REPORTED TRAFFIC BEGAN TO MOVE THEN STOPPED AGAIN & WHEN HE STOPPED V1 STRUCK HIM IN THE REAR.

98018752 Length = 136 Column location = 59
DRl STATED THAT SHE REAR ENDED V2 AS SHE WAS ANSWERING HER CELLULAR PHONE. DR2 STATED THAT HE STOPPED FOR TRAFFIC WHEN Vl REAR ENDED V2.

98027106 Length = 218 Column location = 119
DR2 STATED HE WAS MAKING A RT TURN INTO THE PVA WHEN HE HEARD V1 TIRES & THE FELT A HUGE BUMP. DR2 STATED DR1 WAS ON A CELL PHONE. DR1 STATED SHE THOUGHT V2 WAS GOING TO KEEP STRAIGHT & IT WAS A

TOTALLY SHARPE RT TURN.

98028543 Length 211 Column location = 182
V1 WAS TRAV W ON CHAPEL HLL BLVD WHEN IT WAS STRUCK IN THE BACK BUMEPR BY THE FREONT DISTRIBUTOR OF V2 WHICHW AS ALSO TRAV W ON CHAPEL HILL BLVD. V2 STATED HE ENT DOWN TO PICK UPHIS CELLULAR PHONE AND STRUCK V1

98042111 Length = 47 Column location = 10
V1 WAS ON CELL PHONE AND CHANGED LNS AND HIT V2

98045329 Length = 301 Column location = 111
V2 BUMPED V1 IN THE REAR WHILE WAITG FOR THE TRAIN TO CROSS. DR1 STATED THAT ANOTHER DR CALLED FRO POLICE ON A CELLPHONE & THEY BOTH WAITED APPOX 30 MIN & THEN SHE WENT TO ER DR2 STATED THAT THE BUMP HAPPENDED THEY EXCHARGED INFO & BOT LT THE EVERYTHING WAS FINE & THEY WERE ONLY THER APPORX 1 MINTUE.

98051115 Length = 214 Column location = 107
DR OF V2 STATED SHE WAS STOPPED AT THE LIGTH WHEN V1 STURCK HER FROM BEHIND. DR OF V1 STATES HE WAS ON HIS CELL PHONE TALKING WHEN THE LT HAND TURN LIGHT TURNED GREEN & HE REACTED BY GOING STRAIGHT AHEAD STRIKG V2.

98054884 Length 203 Column location = 53
V2 PULLED ACROSS THE EEND OF THE DRWY TO TALK ON HIS CELLULAR TELE-PHONE. V1 ATTEMPTED TO BACK OUT OF HER DRWY-I UNAWARE OF V23 BEING BEHIND HER. V1 STRUCK THE RT SIDE OF V2 WHICH WAS IN A PARKED POSI-TION.

98060679 Length = 217 Column location = 52
V1 STATED SHE LOOKED DOWN TO DO SOMETHING WITH HER CELLPHONE AND STRUCK V2 WHEN SHE LOOKED BACK UP. V2 STATED THAT HE WAS AT A STOP IN TRF WHEN HE WAS REARENDED BY V1 AND THAT THIS FORCED HIS CASR FORWARD HITTING V3.

98061048 Length = 135 Column location = 125
1 AND 2 TRAV W ON LYNN RD AND 1 STPPD IN RD FOR TRAFF CONGESTION AND 2 STRK 1 IN THE REAR 2 HAD DIVERTED HIS ATTN TO FIND A CELL PHONE

98061907 Length = 480 Column location = 239
V2 3 & 4 WERE TRAV S ON THE OFF RAMP OF US74 & WERE STOPPED IN TRAFFIC LEADING UPT TO THE SIGNAL LIGHT AT VILLAGE RD. V1 WAS ALSO ON THE OFF RAMP BHEIDN V2 3 &4. THE DR OF V1 ADVISED I/O GTHAT AS HE EXITED US74 HE LOOKED DOWN TO FIND HIS CELLULAR PHONE. WHEN HE LOOKED UP HE SAW THE TRAFFIC HAD STOPPED. AS HE ATTEMPTED TO STOP HE CAUGHT THE TOE OFHIS SHOE ON THE BRAKE PEDAL. DR OF V1 ADVISED HE COULDNT STOP IN TIME & STURCK V2 INTHE REAR CAUSING A CHAING REACTION WITH V3 & 4.

98064785 Length = 159 Column location = 75
BOTH Dl & D2 WERE AT A COMPLETE STOP BECUASE THE LT WAS RED. D3 WA SON HIS CELLULAR PHN NOT PAYING ATTENTION & CAUSED A REAR END COL-LISION WITH TWO OTHER CARS.

98065701 Length = 170 Column location = 47
MR SHIRLEY WAS HEADED S ON 301 & HIS TELEPHONE CELL & HE REACH FOR IT & WHEN HE LOOK UP THE LIGHT WAS RED & MRS SULLIVAN WAS ALREADY OUT ON 301 SHE WAS HEADED WON RP21309

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