- Zegeer, C.V., and Williams, C. (1994). Calculation of Accident Rates by Roadway Class for HSIS States. Chapel Hill, NC: University of North Carolina Highway Safety Research Center. NTIS PB-94-207222. *Note:* Prepared for the Federal Highway Administration.

CALCULATION OF ACCIDENT RATES BY ROADWAY CLASS FOR HSIS STATES
by

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Introduction

The purpose of this report is to summarize the results of an effort to formulate accident rates associated with various highway classes. The analysis made use of the five states which are part of the Federal Highway Administration's Highway Safety Information System (HSIS). For these states of Michigan, Minnesota, Maine, Utah, and Illinois, roadway, traffic, and accident files are available for merging which will allow for computing accident rates on a state-by-state basis by highway class.

This information on accident rates for various roadway classes should be useful for several purposes. First of all, there may be interest in determining the consistency of crash rates between the five HSIS states for similar highway types. Secondly, such information could be useful to highway designers and safety officials in gaining a better understanding of not only the rates of accidents under various highway situations, but also to better understand the types and characteristics of accidents which occur on these highway classes. Such information could then be used to help improve the design of new highways and upgrade existing highways to enhance safety. The results of these rate calculations will also be useful for comparison with corresponding rates for new candidate HSIS states, since two to four new states will be added in the coming months.

The following results are intended to provide more of a general framework and initial calculations of accident rates for a variety of roadway types contained in the five HSIS states. An earlier letter dated November 18, 1982, to HSRC from Mr. Justin True of FHWA described various data subsets being created for use in the Interactive Highway Design (IHD) model. The IHD data base is making use of specific roadway types (i.e., freeways, two-lane highways, multi-lane divided highways, and multi-lane undivided highways separated for urban and rural situations). Accident rates are also being computed for various types of intersections and interchanges. While rates of total accidents are being calculated for this data base, more detail in accident typing may also be included as needed.

The difference between that analysis and the analysis described below is that the IHD data base is intended to select roadway categories of interest for testing in a modeling effort.

That effort is subdividing highway sections into intersections, intersections, and highway segments. The data analysis below, however, is intended to cover these same basic roadway classes and include separate rates for specific accident types, severities, etc. for each of the five states. However, no attempt is being made in this analysis to subdivide roadway segments from intersections or interchanges.

This memo discusses the methodology used in computing overall accident rates by roadway class for the five HSIS states along with the results. Detailed accident rates by accident severity, accident type, etc. are also described in this memo. This memo also discusses some of the data problems which were found during this process and the steps taken to correct them.

Methodology

The creation of accident rates for various roadway features required that some initial decisions be made. First of all, there was a need to determine whether every single roadway segment in the file should be used, or whether some relatively "stable" segment lengths need to be defined. For the purposes of this analysis, sections of any length were used, that is, no roadway sections were eliminated because they were too short.

The next question related to how accidents should be tied to sections; that is, should accidents from the accident file be pulled and accident "counts" (by totals, severity, light condition, etc.) be appended directly onto each roadway section, or should accidents be identified with their corresponding segment so more detailed accident analyses may be possible (e.g., to allow for determining the severity distribution of run-off-road accidents at night on two-lane rural roads by driver age). For this analysis, simple accident "counts" were made based on matching accidents with each section in the roadway file. Then for a given roadway class (e.g., rural, two-lane), accidents were totaled for all sections in that class and divided by the total traffic exposure (in million vehicle miles) to yield accidents/mvm.

Within the HSIS roadway data files, there were some kinds of roadway situations which were not included in this analysis. For example, the roadway file for Minnesota contains tens of thousands of miles of unpaved roadway sections. Further, it was not clear whether accident data could be matched to all of this mileage of unpaved roadway in Minnesota.

Likewise, it was unclear whether any meaningful analyses could be made for roadway segments on one-way streets due to limited data, etc. Therefore, these sections of unpaved roads and one-way street sections were eliminated from the file. Again, this analysis did not attempt to separate out intersections or interchange segments from roadway sections.

There are several roadway variables which were believed to be of major importance for purposes of calculating accident rates by roadway class. These primary variables include:

- Urban/rural code
- Functional roadway class
- Number of lanes
- Divided versus undivided roads

Various data categories exist for each of these four primary roadway variables. It would be desirable to use some of the same variable classes as recommended for the IHD data base. The roadway classes chosen for computing accident rates included:

- Urban freeways
- Urban two-lane highways
- Urban multi-lane divided nonfreeways
- Urban multi-lane undivided nonfreeways
- Rural freeways
- Rural two-lane highways
- Rural multi-lane divided nonfreeways
- Rural multi-lane undivided nonfreeways

Rates of total accidents were computed for each of the categories listed above.

For each of these roadway classes, accident rates were also calculated by the following accident categories:

- PDO (property damage only), injury, and fatal accidents

- Day and night

- Accidents by pavement condition (wet, dry, icy)

- Collision type similar to the accident types identified and used for FHWA in the "Cross Section" study. These included the following types:

  - Run-off-road - fixed object
  - Run-off-road - rollover
  - Run-off-road - other
  - Head-on and opposite direction sideswipe
  - Rear-end and sideswipe - same direction
  - Angle/turning
  - Pedestrian/bicyclist
  - Animal
  - Parking and Backing
  - Other

Since state HSIS crash files did not all have each accident coded into one of these categories, a series of steps was developed to group crashes in each state into these categories based on such available data variables as accident type, collision sequence, event 1, 2, and 3, etc. Details of the logic used for classifying crashes by collision type in each state are given in Appendix A.

Crash data for 1991 were used from each of the five states, and sample sizes are shown in table 1. The largest sample size came from Illinois, with 129,299 crashes, followed closely by Michigan, with 128,832. Minnesota had 72,730 crashes, while there were 34,248 in Utah and 21,620 in Maine. Notice the largely urban crash sample in Illinois (82.0%), Utah (78.3%), and Michigan (64.6%), with a predominantly rural data base in Maine (68.0%) and Minnesota (63.4%).

Analysis Results

The calculation of crash characteristics and rates for the five HSIS states is discussed below for the following:

- Crash rates by roadway class
- Percentages by crash type
- Crash types by roadway class

Then, a discussion is given regarding data problems which were found in producing these crash statistics and the steps taken to overcome these problems.

Crash Rates by Roadway Class

The results of the overall accident rate analysis by roadway class in each state are shown in figures 1 through 5. Crash rates (accidents per million vehicle miles) are given for the states of Illinois (figure 1), Maine (figure 2), Michigan (figure 3), Minnesota (figure 4), and Utah (figure 5). For each state, rates are given for freeways, divided non-freeways, undivided non-freeways, and two-lane roads separately for urban and rural areas. Crash rates in figures 1-5 reveal several interesting trends, as follows:

- Crash rates on urban streets are considerably greater (approximately twice as high or more in many instances) than corresponding rural road classes in each state. For example, a comparison of Illinois crash rates (accidents per million vehicle miles) in urban vs. rural areas, respectively, (see figure 1) is 1.48 vs. 0.56 (freeways), 4.78 vs. 1.58 (multi-lane divided non-freeways), 5.77 vs. 2.50 (multi-lane undivided non-freeways), and 3.94 vs. 1.78 (2-lane roads). Note that insufficient sample sizes (less than 50 miles) was available in Maine (figure 2) on divided and undivided non-freeways in rural and urban areas to provide reliable rates.

- In both urban and rural areas, accident rates are by far the lowest on freeways than for any other roadway classes. Rates are also lower on divided non-freeways compared to undivided non-freeways (i.e., in states where adequate sample sizes were available for such a comparison).

Table 1. Summary of crashes by state and area type (1991 data).

State	Urban		Rural		Totals	
	No.	Percentage	No.	Percentage	No.	Percentage
Maine	6,915	32.0	14,705	68.0	21,620	100.0
Illinois	106,083	82.0	23,216	18.0	129,299	100.0
Utah	26,826	78.3	7,422	21.7	34,248	100.0
Michigan	83,269	64.6	45,563	35.4	128,832	100.0
Minnesota	26,581	36.6	46,149	63.4	72,730	100.0
Total	249,674	64.6	137,055	35.4	386,729	100.0

ILLINOIS

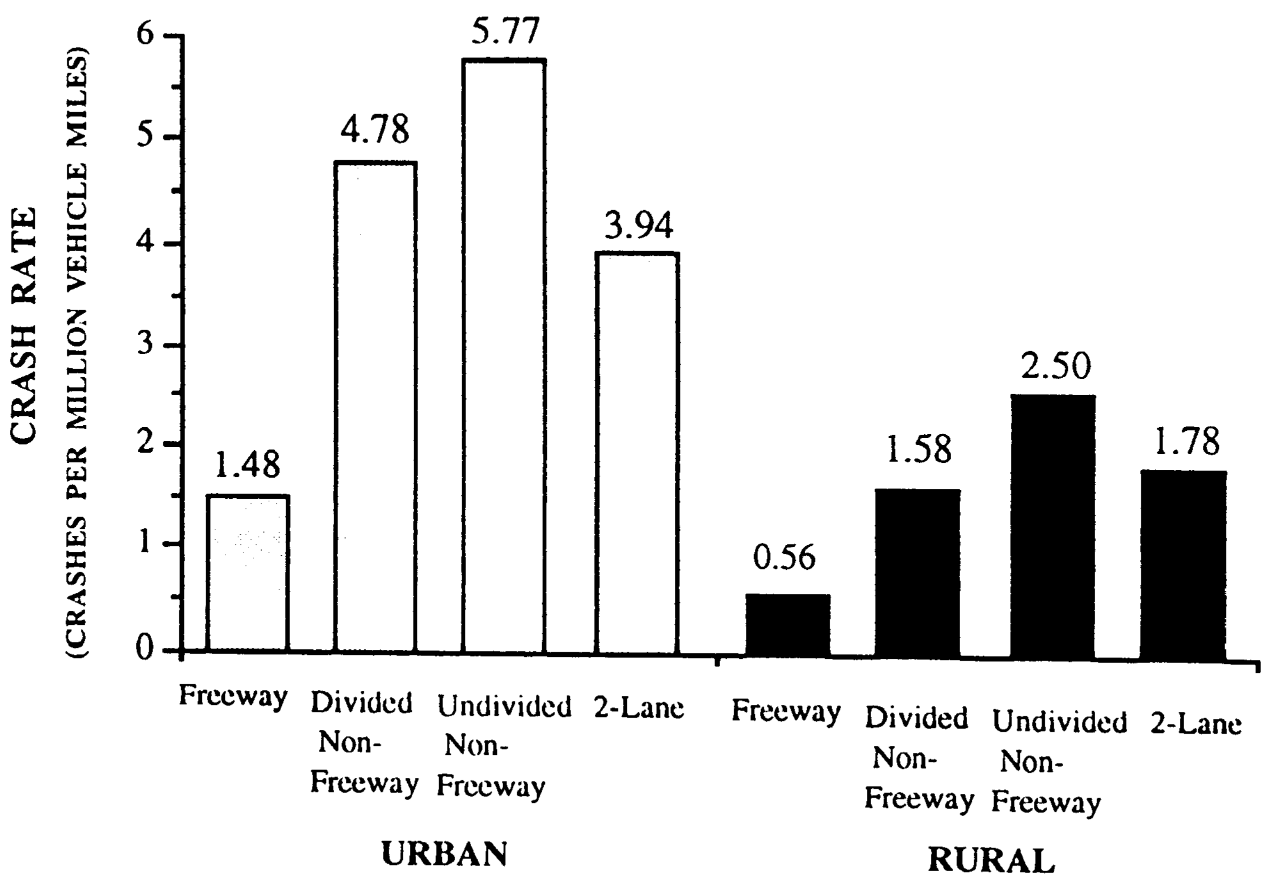
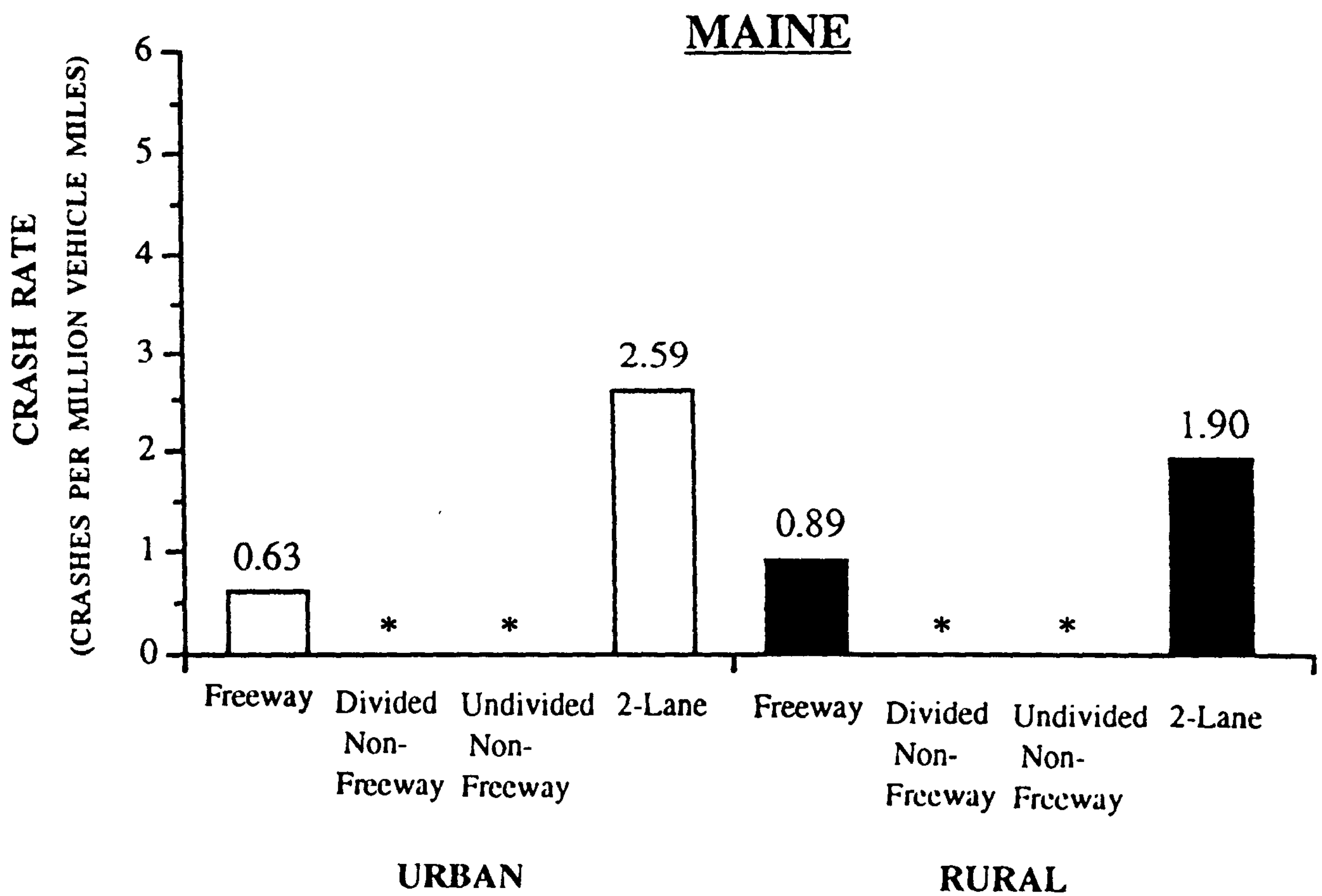


Figure 1. Illinois crash rates by roadway class.



* Not shown because of small sample size (< 50 miles)

Figure 2. Maine crash rates by roadway class.

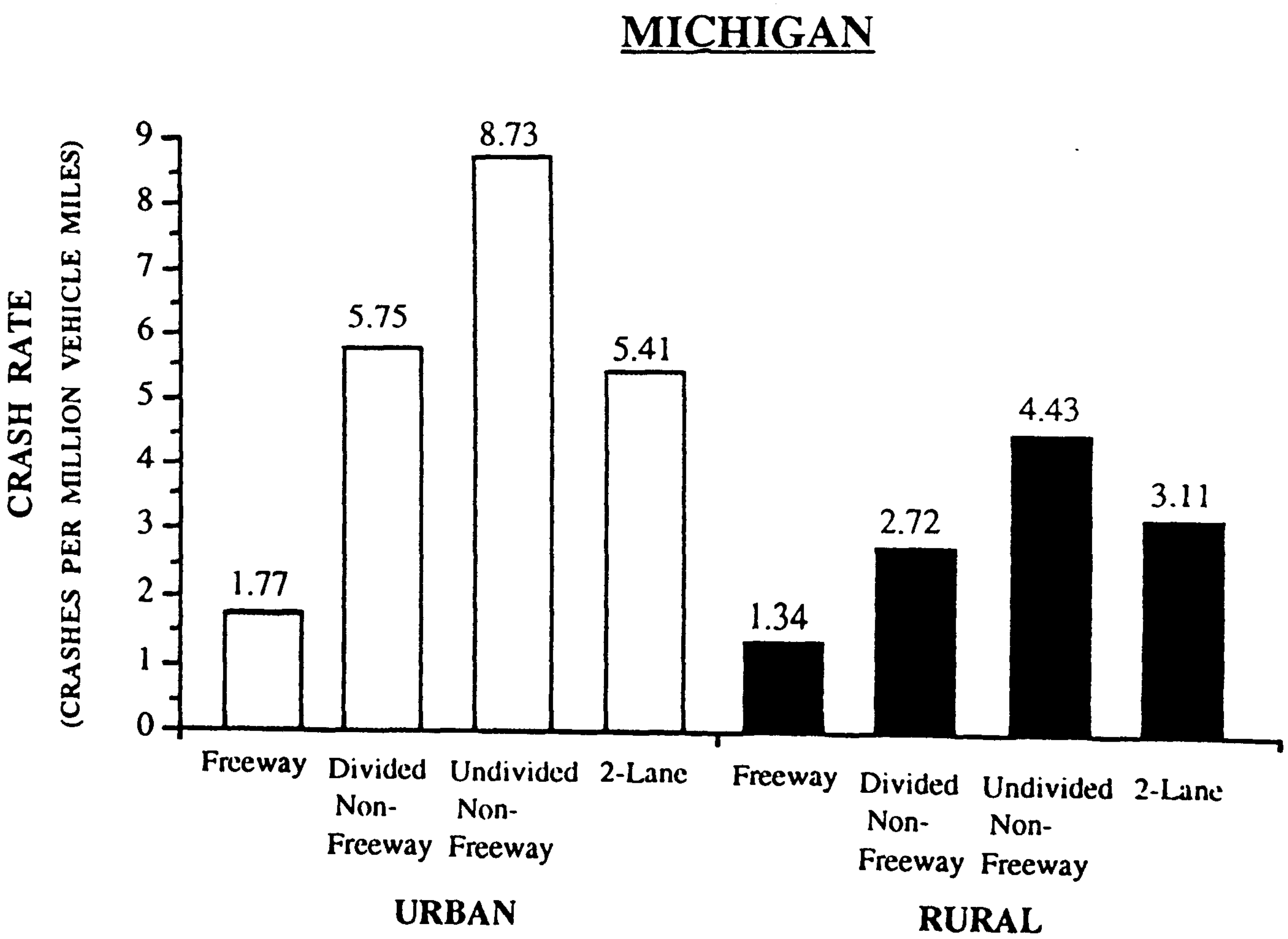


Figure 3. Michigan crash rates by roadway class.

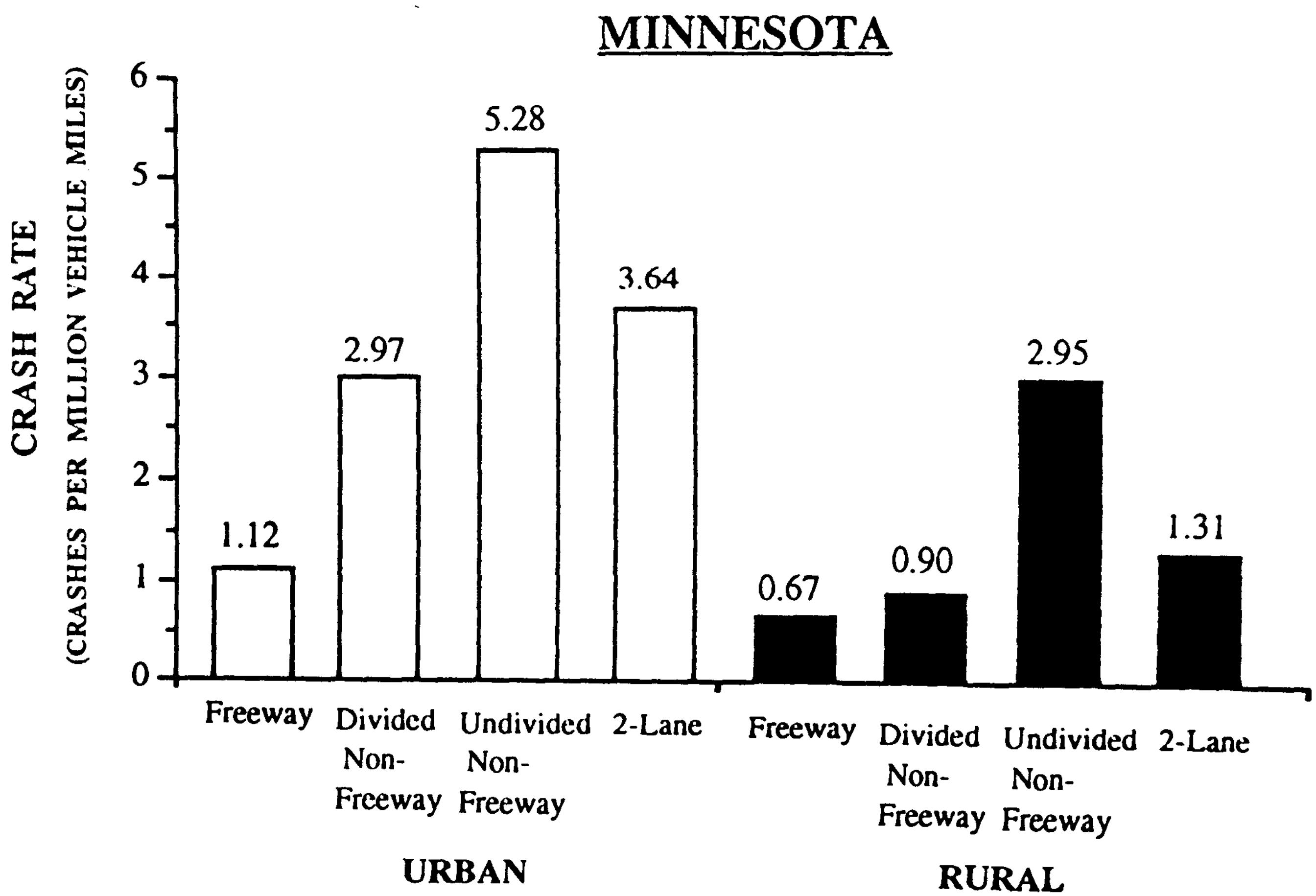
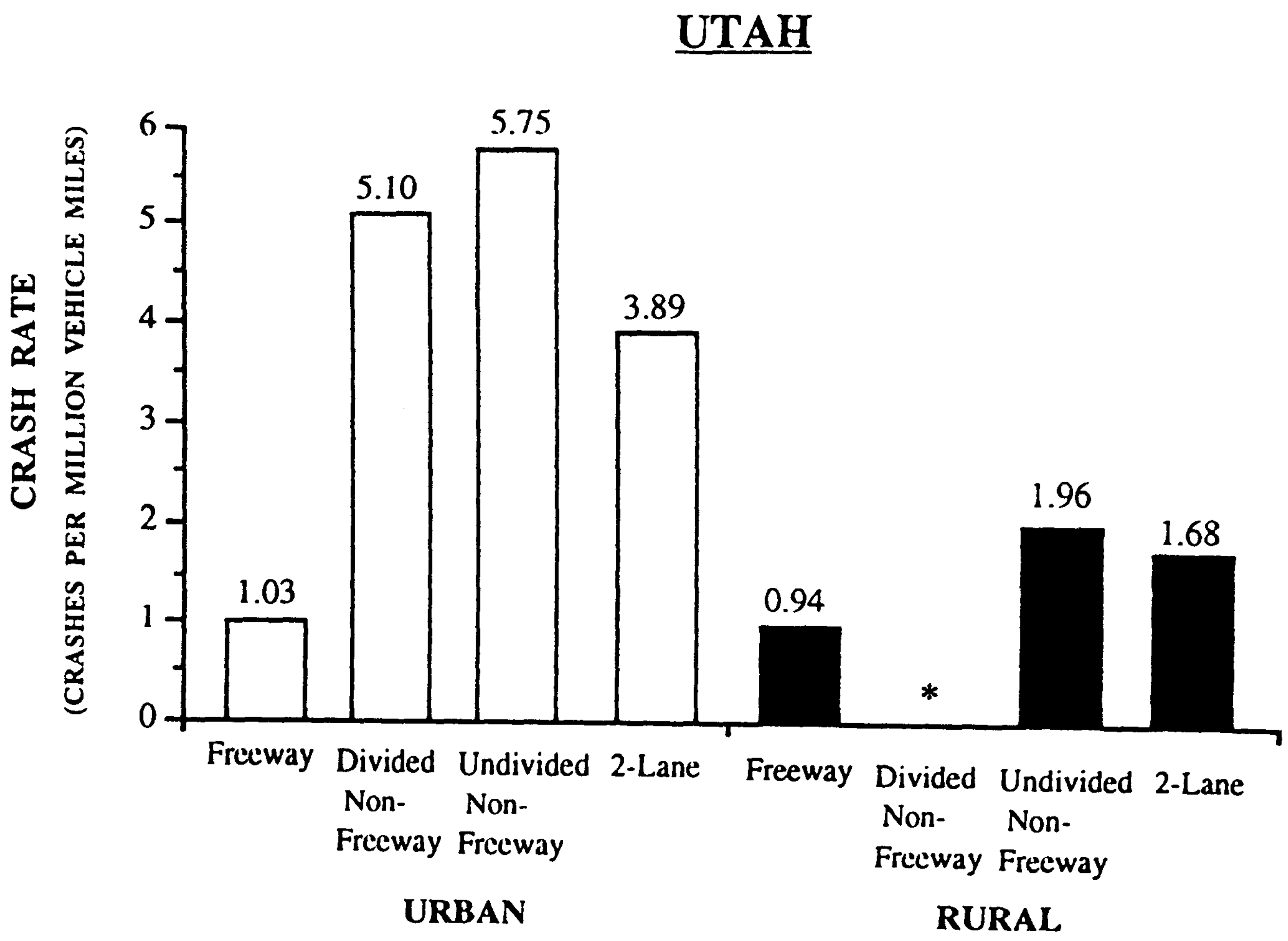


Figure 4. Minnesota crash rates by roadway class.



* Not shown because of small sample size (< 50 miles)

Figure 5. Utah crash rates by roadway class.

- Rates for two rural lane roads were generally higher than for rural divided non-freeways but generally lower than rural undivided non-freeways. However, on urban streets, rates for two-lane roads were clearly lower than undivided non-freeways in each state. Also, urban rates for two-lane roads were slightly lower than rates for divided, non-freeways in most states. The one exception was Minnesota, with a higher rate (3.6) for urban two-lane streets compared to the rate (3.0) for urban divided non-freeways.

A comparison was also made of crash rates between states for rural and urban areas, as shown in figures 6 and 7, respectively. Crash rates for rural freeways range between 0.6 (Illinois) and 1.3 (Michigan). For rural divided non-freeways, rates range from an unexplainable low value of 0.9 in Minnesota to a high of 2.7 in Michigan. Undivided rural non-freeway rates range from rates of 2.0 (Utah) to 4.4 (Michigan). Crash rates on rural two-lane roads range from a low of 1.3 (Minnesota) to a high of 3.1 in Michigan. In short, Michigan rates are generally highest of the states, while Minnesota rates are generally at the lowest levels.

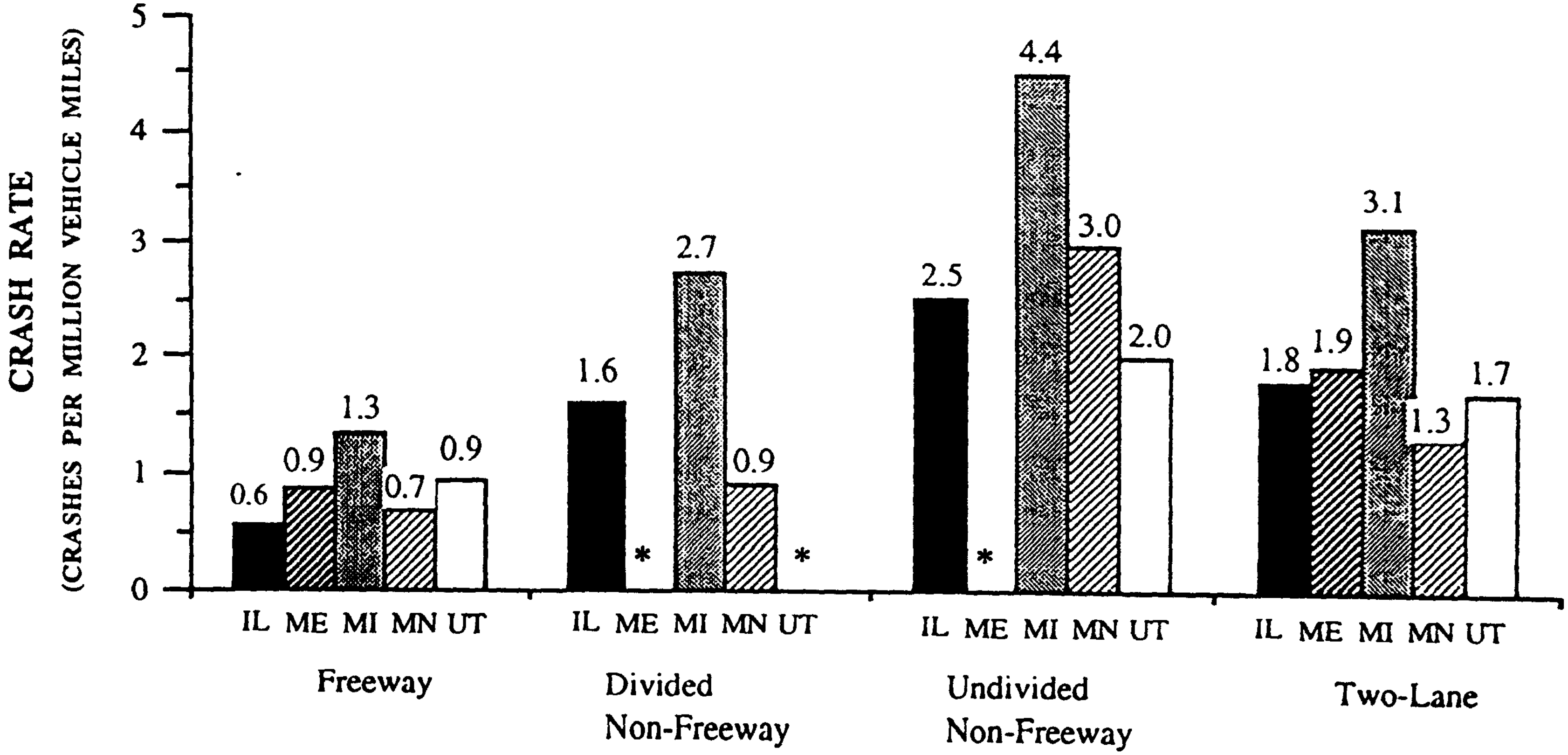
Urban crash rates are shown in figure 7. Michigan rates are the highest of any state for each roadway class. Minnesota rates are the lowest of the five states for divided and undivided non-freeways. Maine has the lowest urban rates for urban freeways (0.6) and two-lane roads (2.6). Again, note the lack of adequate sample sizes for some roadway classes in Maine.

Percentages by Crash Type

In addition to the calculation of total crash rates by roadway class as described above for each state, more detailed breakdowns of crash experience was also determined by crash severity, road surface condition, light condition, and collision type. This analysis was considered useful for determining the similarity of crashes between states by the characteristics of those crashes. The percentages of property damage only (PDO), injury, and fatal crashes are shown in figure 8 for each of the five HSIS states. The percentage of property damage accidents ranges from 65.2 percent in Utah to 74.0 percent in Michigan. Injury accidents vary between a low of 25.6 percent in Michigan to a high of 34.2 percent in Utah. Further, the overall percent of fatal crashes ranges from 0.4 percent in Michigan and 0.7 percent in Maine.

These percentages appear to be relatively constant between states, although slight variations in percentages may be expected due to possible differences in state reporting practices, the proportion of crashes which occur in high-speed rural areas compared to lower speed urban areas (e.g., states with a large percentage of rural mileage may be expected to have generally higher crash speeds and, therefore, higher percentages of injury in fatal

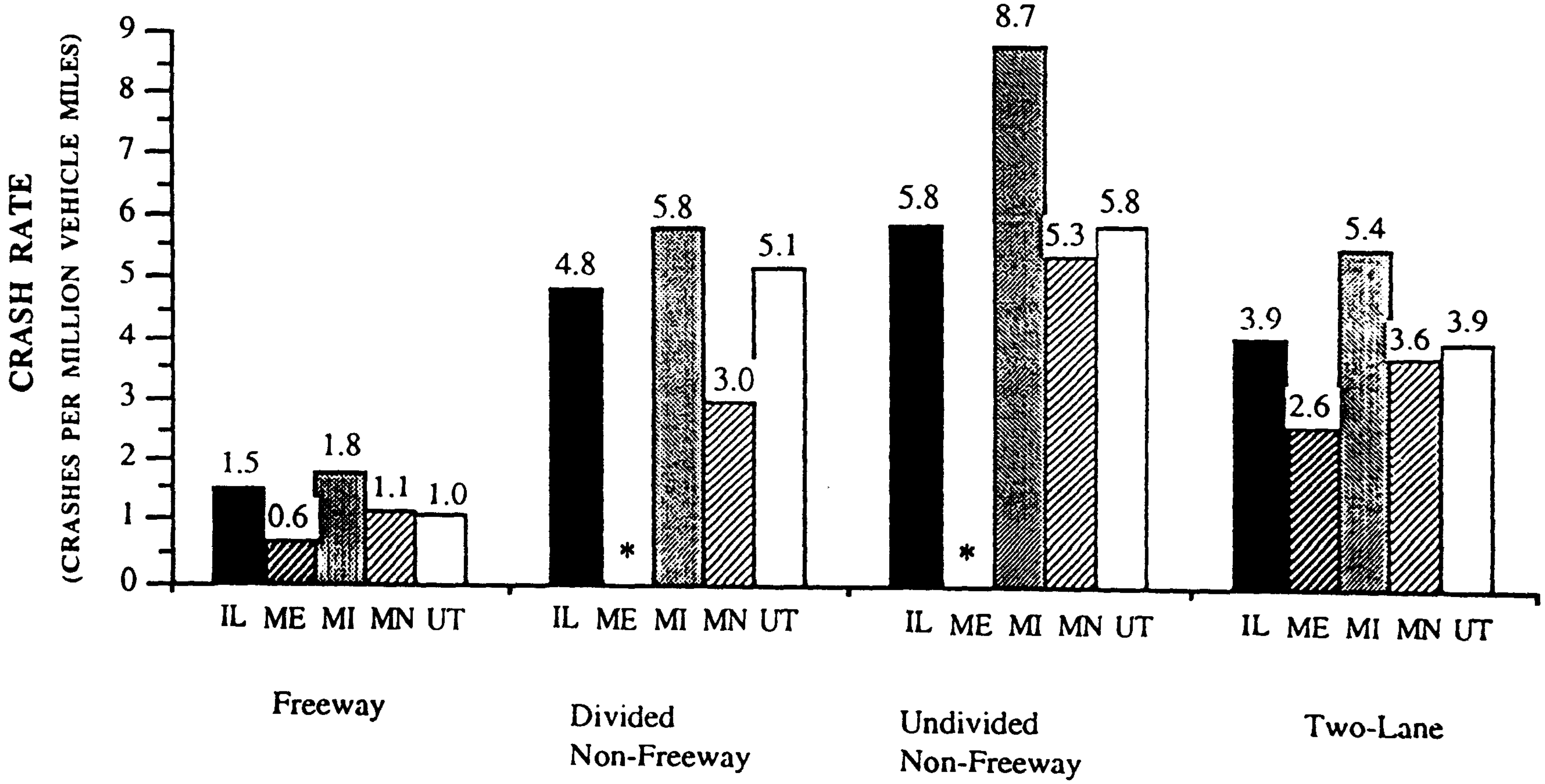
RURAL AREAS



* Not shown because of small sample size (< 50 miles)

Figure 6. Rural crash rates by roadway class.

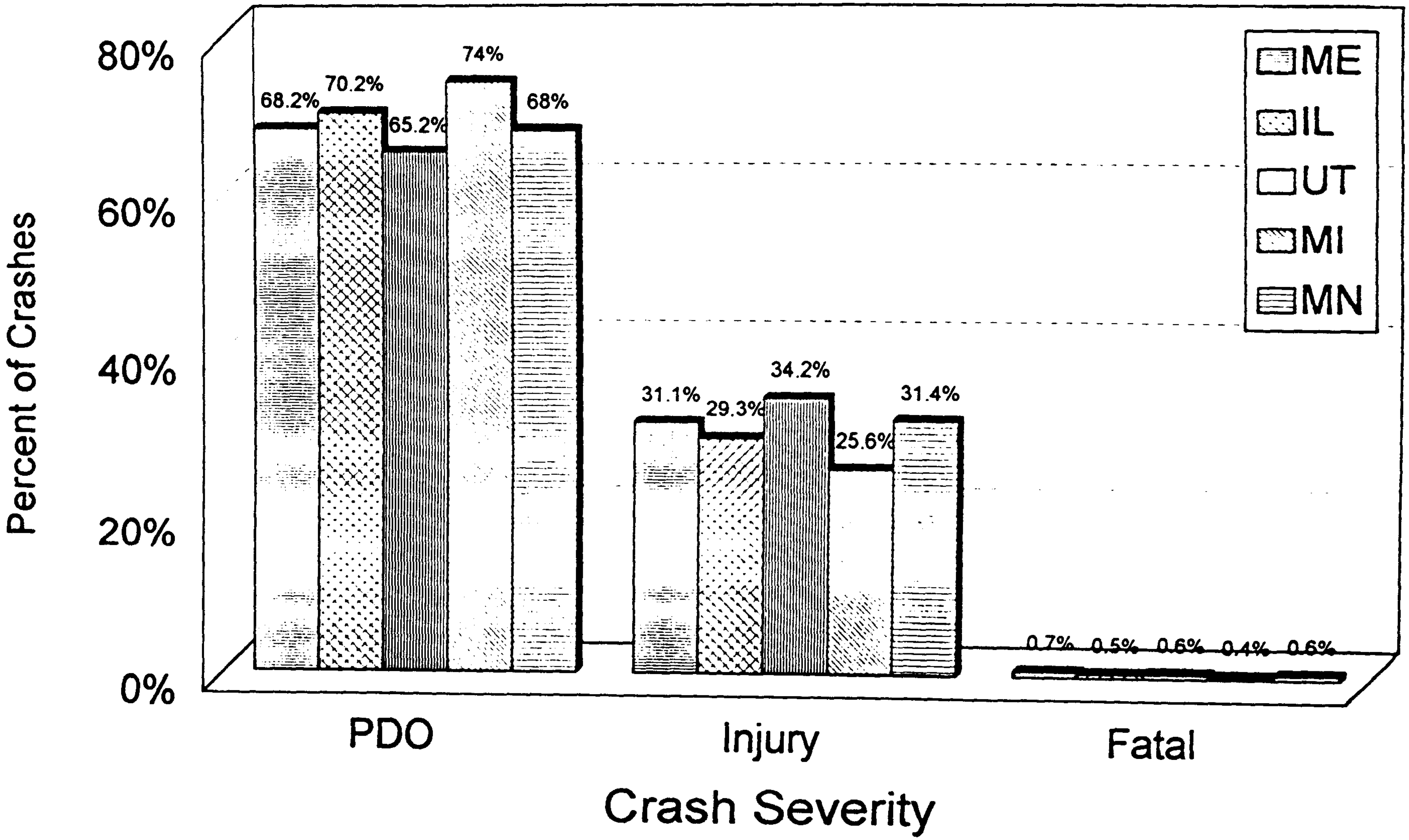
URBAN AREAS



* Not shown because of small sample size (< 50 miles)

Figure 7. Urban crash rates by roadway class.

Figure 8. Distribution of crash severity by state.



accidents compared to states with several large cities and less rural mileage). Also, rural crashes tend to more often be run-off-road, head-on, and other types which are typically more severe than rear-end and sideswipe crashes common in urban areas.

One might conjecture that the slightly higher percentage of injury accidents in Utah, Maine, and Minnesota, could possibly reflect a somewhat higher percentage of rural crashes in those states compared to Michigan and Illinois. Indeed, a comparison of the percentage of urban and rural accidents in the HSIS database (see table 1) confirms that fact for Maine and Minnesota, with 68.0 and 63.5 percent of their crashes, respectively, occurring in rural areas. However, only 21.7 percent of the Utah crashes were designated in rural areas (and more is discussed on Utah crash severity later). The states with lower overall crash severities, Michigan and Illinois had 35.4 percent and 18.0 percent of their crashes, respectively in rural areas.

The distribution of crashes by road surface condition (icy, dry, or wet) is shown in figure 9 for each of the five HSIS states. As can be seen, the percentage of icy accidents varies considerably from about 8.5 percent in Utah and Illinois to 26.6 percent in Maine, while Michigan and Minnesota had 14.4 percent and 17.8 percent, respectively. Of course, these trends may be expected, since Maine, Minnesota, and Michigan typically have more snow and ice than the other two states.

States with the highest percentage of wet pavement crashes include Minnesota (24.4%), Illinois (21.7%), and Michigan (21.5%), while Utah (16.8%), and Maine (15.3%) had lower percentages. Information on rainfall intensities by state and county, etc. would be useful for comparison with these crash percentages in terms of crash experience as a proportion of time the pavement was wet (e.g., to determine whether crashes are overrepresented during periods of wet pavement). The percentages of dry pavement accidents reveal values between 54.5 percent in Minnesota to 74.2 percent in Utah, again possibly reflecting the percentage of time in which pavements are dry in those states.

Crash distributions by light condition are shown in figure 10. States with the highest percent of nighttime crashes include Maine and Michigan (each with 37.8%), followed by Minnesota (34.6%), Illinois (34.1%), and Utah (26.4%). These percentages could largely reflect the distribution of vehicle exposure by time of day from state-to-state. A small percentage (less than 5%) of unknown light conditions was also found in each of these states.

A separate analysis was conducted of the crash types, that is, the percentages of run-off-road, head-on, rear-end and other accident types as shown in table 2 and figure 11. A few observations for these accident types are as follows:

- <u>Run-off-Road Fixed Object</u> - Maine had by far the highest percentage of these accident types (32.2%) with other states having 8.2 percent (Utah), 8.6 percent

Figure 9. Distribution of Crashes by road surface and state.

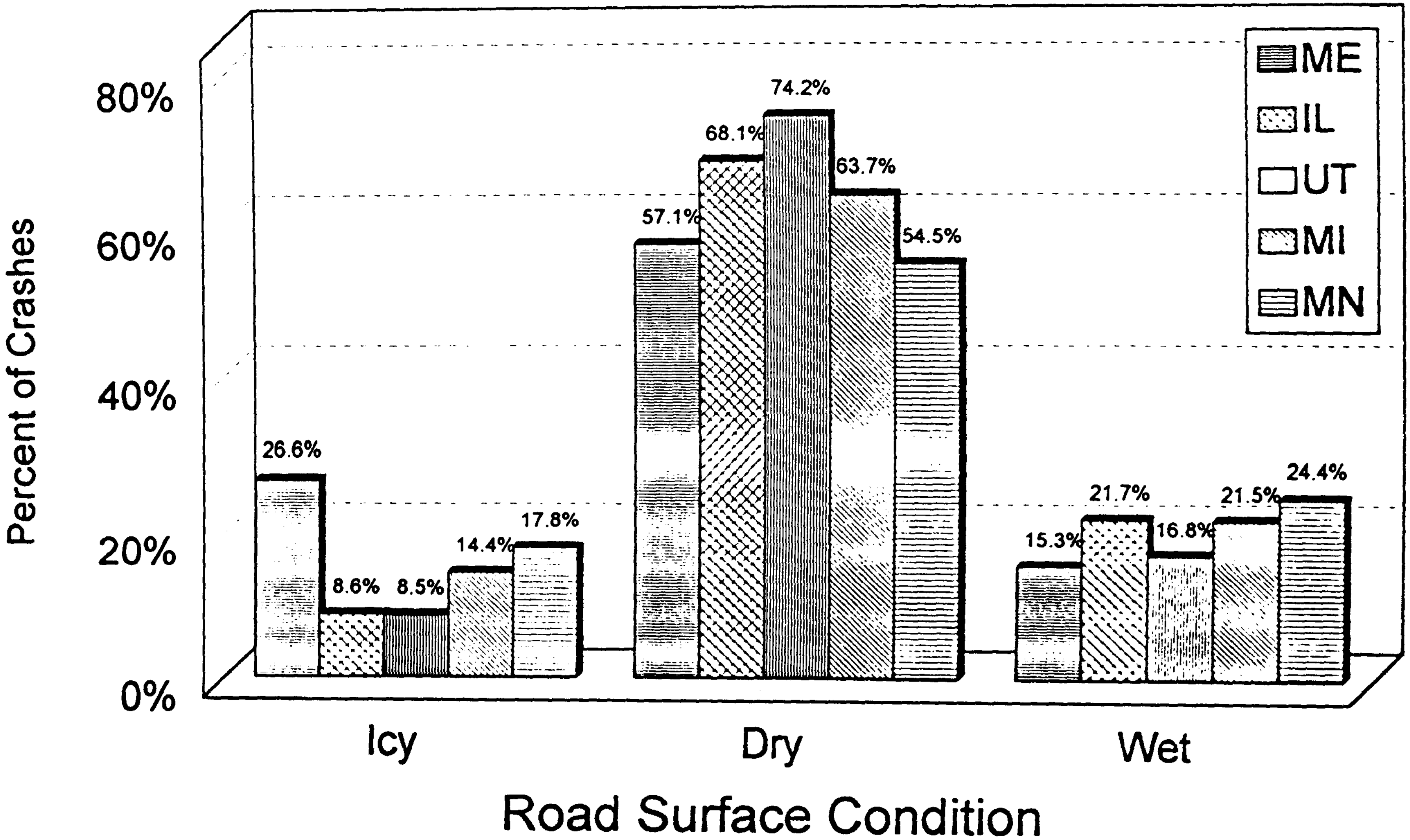


Figure 10. Distribution of crashes by light condition and state.

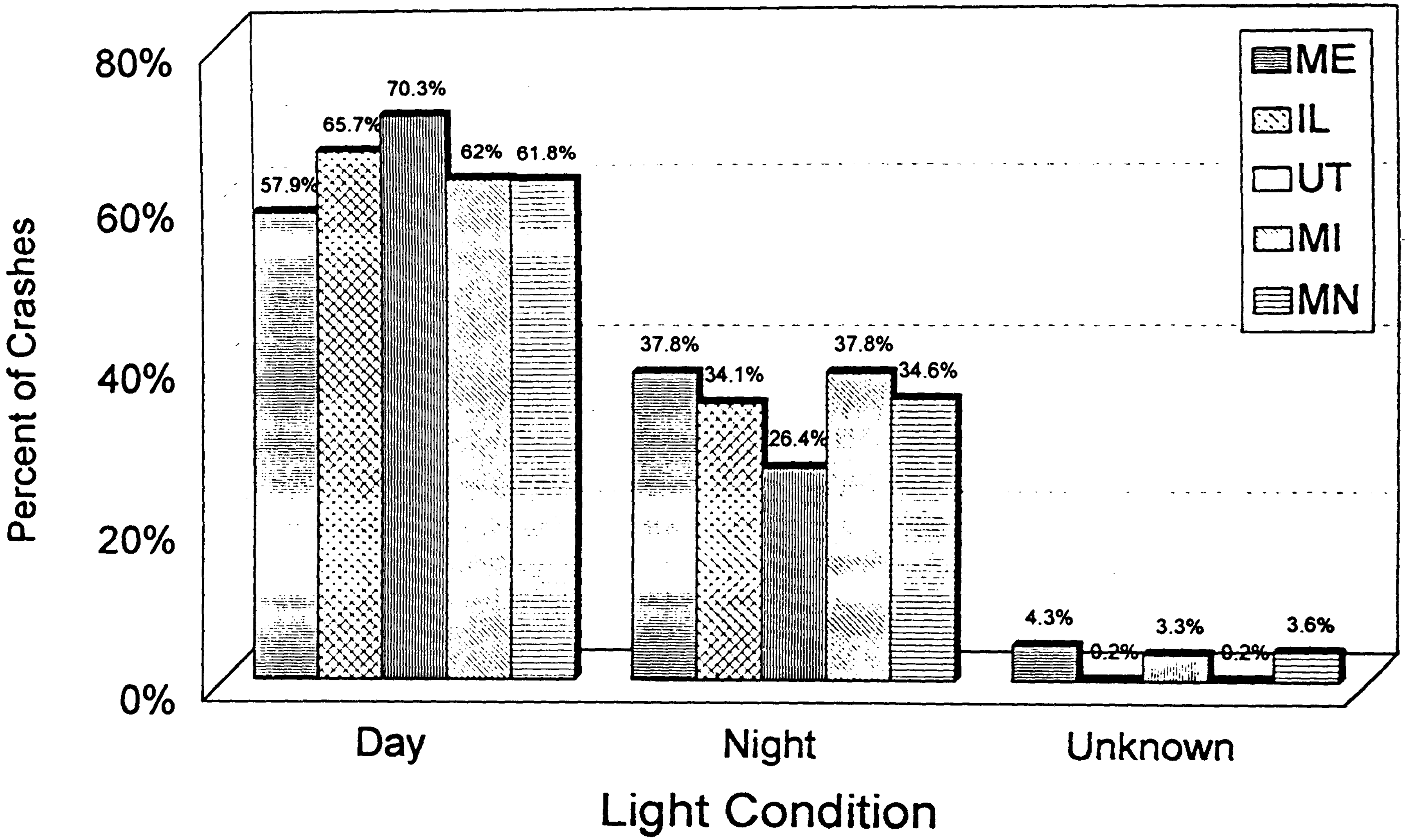


Table 2. Summary of accident type distributions by state for all roadway classes combined.

	State (Accident Sample (Size))				
Accident Type	Maine (21,620)	Illinois (129,299)	Utah (34,155)	Michigan (128,832)	Minnesota (72,725)
Run-off-road - Fixed Object	32.2	8.6	8.2	11.7	10.3
Run-off-Road - Rollover	1.8	1.5	0.7	2.9	4.4
Run-off-Road - Other	0.4	2.0	3.2	0.8	1.8
Head-On/Opp. Dir. Sideswipe	6.6	2.2	1.8	2.0	3.7
Rear-End/Same Dir. Sideswipe	27.5	43.2	30.0	35.9	27.7
Backing and Parking	2.3	1.6	4.1	3.0	5.7
Pedestrian/Bicyclist	1.6	1.6	3.1	1.2	2.6
Angle and Turning	7.6	31.9	25.8	25.0	25.0
Animal	11.7	5.3	6.5	14.5	6.1
Other	8.3	2.1	16.6	3.0	12.6
Totals	100.0	100.0	100.0	100.0	100.0

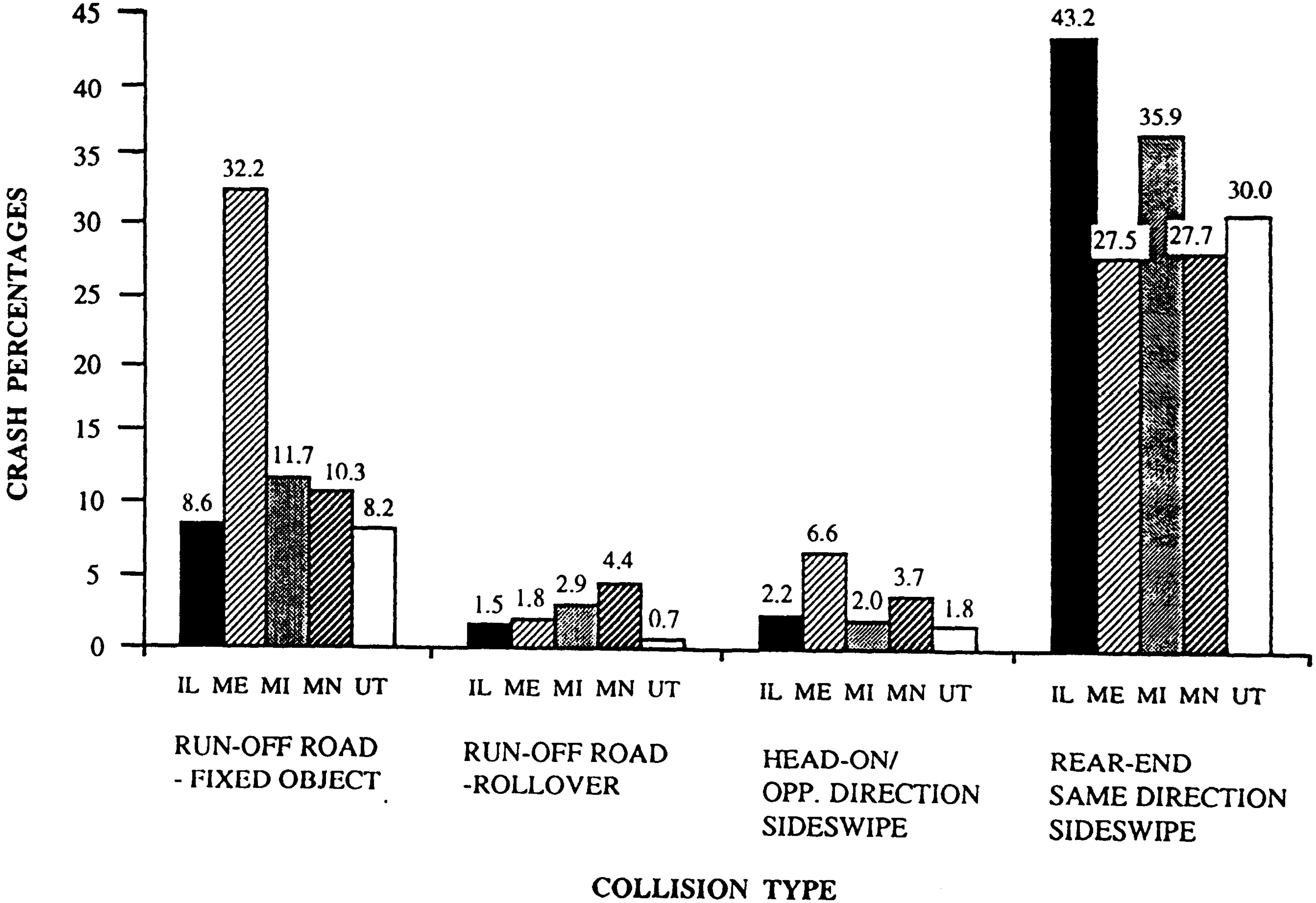


Figure 11. Crash percentages for selected crash types by state.

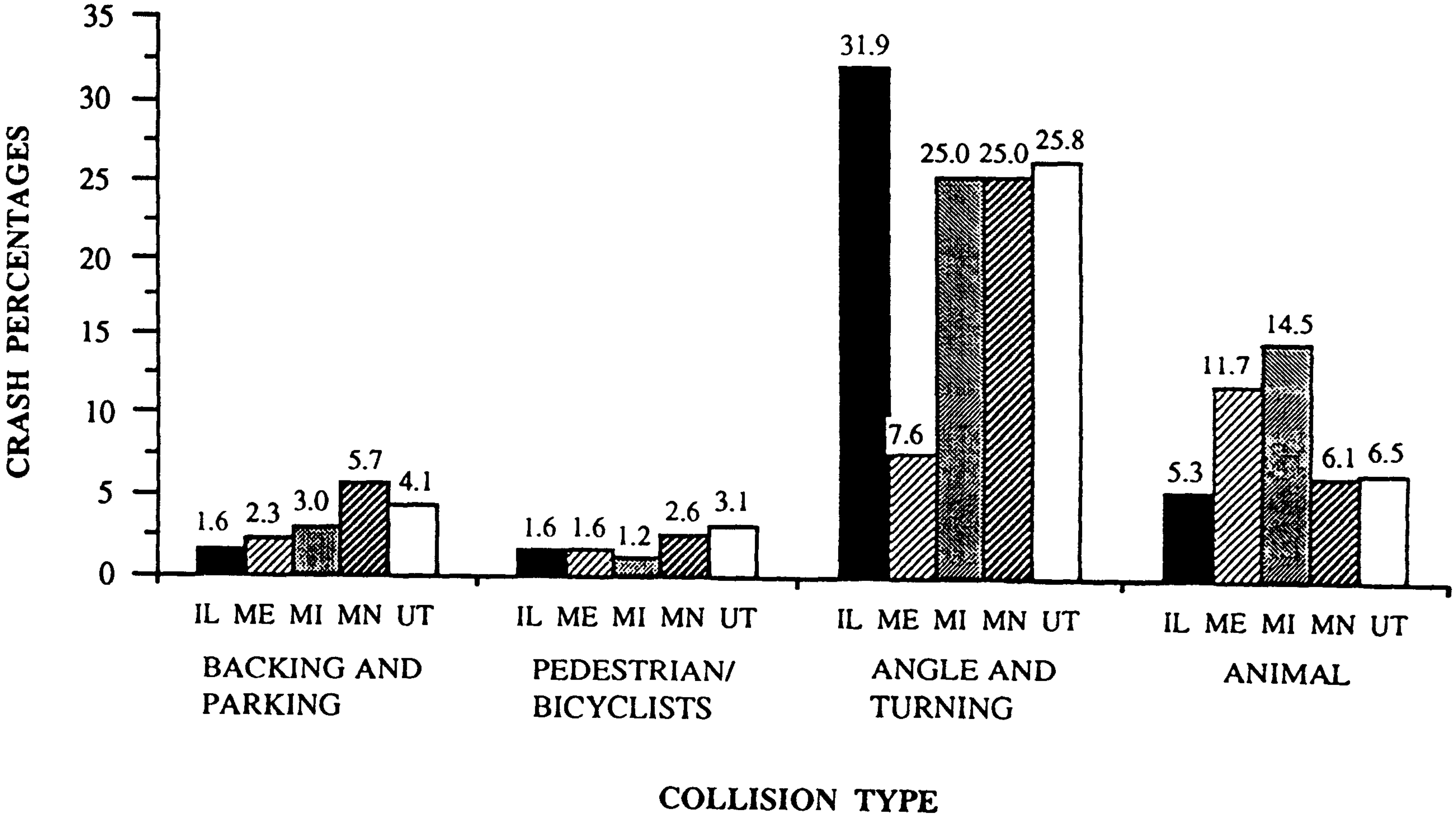


Figure 11. Crash percentages for selected crash types by state (continued).

(Illinois), 10.3 percent (Minnesota), and 11.7 percent (Michigan). Again, this high percentage in Maine could partly be due to the fact that 68 percent of all the Maine accidents analyzed occurred in rural areas, and rural crashes are more likely to involve run-off-road vehicles than urban crashes. The lowest percentages of fixed-object crashes found in Utah (8.2%) and Illinois (8.6%), correspond to the low percentages of rural crashes in those two states (21.7% and 18.0%, respectively).

- Run-off-Road Rollover Crashes - The state of Minnesota had the highest percentage of reported rollover crashes, with 4.4 percent. The other states had rollover crashes ranging from only 0.7 percent (Utah) to 2.9 percent (Michigan). The reported percent of rollover crashes in a given state depends not only on the condition of the roadsides (e.g., steep roadsides would generally contribute to a higher proportion of rollover crashes than flatter slopes), but also on the crash report form (i.e., having a code designation that a crash was a rollover) and the care used by reporting police officers in accurately coding rollovers.
- Run-off-Road Other - This crash type was designated where a vehicle was said to have run off the road but no clear indication was given as to the type of object struck or that a rollover occurred. This accident type ranged only from 0.4 percent (Maine) to 3.2 percent (Utah).
- Head-On and Opposite Direction Sideswipe - These two accident types were grouped together for two reasons. First of all, one state (Maine) grouped the two together in the file and so they could not be separated out. Also, these two accident types often occur in much the same way; that is, two vehicles are approaching each other from the opposite direction and they either collide head-on or the front of one vehicle collides with the side of the other, such as on a horizontal curve. Overall, this accident type ranged from 1.8 percent (Utah) to 6.6 percent (Maine).
- Rear-End and Same Direction Sideswipe - Again, Maine did not separate out these two accident types and they are relatively similar in their nature, so they were grouped together. This particular accident type may be expected to generally occur in higher percentages in urban areas than in rural areas (i.e, since urban areas typically have more congested stop-and-go conditions and more stop signs and traffic signals than rural areas, which often result in rear-end crashes). This is borne out by the fact that Illinois had the highest percentage of this accident type (43.2%) and also had the highest percentage of its crash sample which occurred in urban areas (82.0%), compared to the other states. Not surprisingly, the lowest percentage of rear-end/same direction sideswipe crashes occurred in Maine (27.5%), which also had the lowest percentage of urban crashes (32.0%)

- Backing and Parking Crashes - These crash types combined accounted for a relatively low crash percentages of between 1.6 percent (Illinois) to 5.7 percent (Minnesota).
- Pedestrian and Bicyclist Accidents - These crash types accounted for between 1.2 percent (Michigan) and 3.1 (Utah).
- Angle and Turning - Angle and turning crashes most frequently occur at intersections and also at driveway entrances. Therefore, these types of crashes are more prevalent in urban areas than in rural areas. The lowest percentage of these crash types occurred in the state of Maine with only 7.6 percent. It is interesting to note again, that Maine had the lowest percentage of its crashes which occurred in urban areas, compared to the other states. The highest percentage of angle and turning crashes was found in Illinois (31.9%), which had the highest percentage of its accidents in urban areas compared with the other states. Angle and turning accidents accounted for between 25 and 26 percent of the crashes in each of the other three states.
- Animal Accidents - Within the five HSIS states, the percentage of crashes that have involved vehicles striking some sort of animal ranges from 5.3 percent in Illinois to 14.5 percent in Michigan. This high percentage of animal accidents in Michigan corresponds to an earlier analysis of deer crashes, as was conducted in a previous HSIS analysis.
- Other Accidents - This category represented simply a catch-all for any crashes in the data base that could not be identified as one of the other types listed above. Note that only 2.1 percent of Illinois crashes were designated as "other" compared to 16.6 percent in Utah. Certainly, there are types of crashes other than those designated above (e.g., vehicle strikes train, person falls out of the back of a pickup truck), but the ability to classify an accident into the above categories depends largely on the level of detail given for collision type variables in the different states. Also, the categories of different accident type variables varied widely between state report forms.

The designation of crashes into the above categories required that two or more different accident variables in each state be reviewed and then judgments were made to classify accidents to match those categories to the extent possible. Certainly, some variations in the accident percentages given above result from the inability to perfectly match accidents in each state to the same definitions. However, it is also believed that some of the accident percentages differ simply because of the different kinds of driving, area types, vehicle types, climate, driving attitudes, and roadway conditions from one state to another. For example, while southeastern Michigan is highly urbanized in and around the Detroit area, much of the state roadway system included in HSIS corresponds to rural areas in the middle to upper portion of the state, which is heavily populated by deer. This leads to a high percentage of deer crashes compared to some of the other HSIS states.

The percentage of rollover accidents and fixed object accidents depends not only on the percentage of crashes in rural areas, but also on the general design of roadsides on rural roads. For example, roads which typically have flat sideslopes and roadsides relatively clear of trees and other rigid objects would be expected to have a lower percentage of fixed object crashes than those with generally poor roadside design. Also, states with HSIS roadway sections having generally wider lanes and shoulders, and better roadway alignment, would be expected to perhaps have a lower percentage of run-off-road and head-on crashes in rural areas. Further, states with higher percentage of mileage of urban street systems with close signal spacing and heavily covered with driveway entrances would be expected to have a higher percentage of rear-end, angle, and turning crashes. The reader should remember also, that the accident samples used in this study corresponded only to accidents which occurred to HSIS roadway sections in those states. Therefore, the accident distributions discussed above would not include accidents on non-HSIS roadway sections in any of the five HSIS states.

Crash Types by Roadway Class

The previous discussions dealt with overall crash rates by roadway type and also the percentages of accidents between states. A more detailed analysis was also conducted of the crash percentages and rates for each of the eight roadway types. The following is a discussion of some of these general trends by state.

Percentages and crash rates were computed as shown in Appendix B of accident characteristics by roadway type, and the highlights of these results are summarized in table 3. The information in table 3 presents selected accident types or categories (injury, icy, wet, night, fixed object, rollover, etc.) for each of the eight roadway classes. Within various matrix cells, abbreviations of states (IL, ME, MI, MN, and UT) are given which indicate situations where a selected accident type exceeds the average percentage of crashes for a given roadway type within the state. One may use table 3 in two different ways. First of all, note that the first column (urban freeways) indicates that all five states are listed as having an overrepresentation of rear-end/same direction sideswipe accidents; while rural freeways (fifth column) has no states with an overrepresentation of this accident type. A second way of using the table would be to look horizontally from left to right across the table. For example,

Table 3. Summary of over-represented accident types by roadway class.

Selected Accident Types	Urban				Rural			
	Freeway	2-Lane	Multi-Lane		Freeway	2-Lane	Multi-Lane	
			Divided	Undivided			Divided *	Undivided
Injury	IL ME MI UT		MI MN UT	MI MN UT	IL ME	IL ME MN	IL MI MN	IL ME MI MN
Icy	ME MI MN UT	MI MN			IL ME MI MN UT	IL ME MI MN UT	IL MI MN UT	IL MN UT
Wet	MI MN	IL ME MN UT	IL ME MI MN UT	IL ME MI MN UT				IL MI ME
Night	IL ME UT				IL ME MI MN UT	IL ME MI MN UT	IL MN UT	IL UT
Fixed Object	IL MI MN UT	ME			IL ME MI MN UT	IL ME MI MN UT	IL MI MN	IL MN UT
Rollover	MI UT				IL ME MI MN UT	IL ME MI MN UT	IL MI MN	IL UT
Head-On/ Opp. Dir. SS		IL ME MI MN UT		IL		IL ME MI MN UT	UT	IL MI UT
Rear-End/ S. Dir. SS	IL ME MI MN UT	ME	IL ME MI MN UT	IL ME MI MN UT			MI	ME
Backing/ Parking		IL ME MI MN UT	IL MI	IL MI UT			ME UT	
Pedestrian/ Bicyclist		IL ME MI MN UT	IL MI UT	MI MN UT				ME
Angle		IL ME MI MN UT	IL ME MI MN UT	IL ME MI MN UT			MI UT	IL ME MI
Animal					IL ME MI MN UT	IL ME MI MN UT	IL MN UT	IL ME UT

* Note: Rural multilane divided roadways in Maine were not included due to their low accident sample (< 200 crashes).

fixed object crashes are most likely to be overrepresented in one or more states for roadway classes of urban freeway (four states), rural freeway (five states), rural two-lane roads (five states); with three states each having an overrepresentation of this accident type on rural multi-lane divided and rural multi-lane undivided roads. Again, a state is listed in the matrix if the percentage of the accident type exceeds the average percent of that accident type for all roadway classes combined within that state.

Several interesting trends can be observed based from the summary of information in table 3. In terms of specific roadway types, one may observe the following:

- Urban Freeways - This roadway type generally has a problem with injury accidents and icy weather accidents (four states each) with some problem involving wet weather accidents (two states) and nighttime accidents (three states). Fixed-object accidents (four states) and rear-end/same direction sideswipe accidents (five states) are also major problems of this roadway type. These kinds of accident problems are reasonable to expect, due to the typically high volumes of traffic and the stop-and-go nature of that traffic during congested conditions on urban freeways, which can certainly lead to rear-end crashes, particularly under wet and icy conditions or at night. The overrepresentation of injury crashes could also be partly a result of high vehicle speeds. The problems involving fixed-object crashes may be the combined result of high vehicle volumes and speeds, in conjunction with the limited right-of-way on urban freeways which often corresponds to close placement of light poles and other roadside objects relatively close to the travel lanes.
- Urban Two-Lane Roads - These roadway types are seen to have problems with wet weather crashes (four states), head-on/opposite direction sideswipe crashes (five states), backing and parking crashes (five states), pedestrian and bicyclist crashes (five states), and angle collisions (five states). These types are reasonable to expect, since urban two-lane roads often carry relatively high traffic volumes in sometimes congested environments with frequently spaced intersections and driveways and on-street parking. Such conditions can easily result in the angle and backing/parking crashes. The head-on/opposite direction sideswipe crashes could be the result of moderate-to-high vehicle volumes and the lack of medians. The overrepresentation of wet weather crashes could partly be the result of the frequent stops required of drivers on urban streets at intersections and driveways, which may be more difficult or risky during wet pavement conditions. The crash problems with pedestrians and bicyclists are typically found in urban areas on local streets where pedestrian and bicyclist volumes are the greatest.

- Multi-lane Divided and Undivided Roadways - These roadway types are characterized by relatively high traffic volumes and sometimes moderate -to -high vehicle speeds, particularly in fringe and outlying urban areas. Injury accidents are overrepresented in three states, while wet weather accidents are overrepresented in all five states for these roadway types. This could also be the result of relatively high traffic volumes combined with frequent stops at traffic signals, where wet pavement makes such stops more prone to crashes. This is supported by the overrepresentation of rear-end/same direction sideswipe crashes, which are further over-represented in all five states on these two roadway classes. Angle accidents are also overrepresented in all five states on these roadway classes, which may be the result of moderately high traffic volume on the mainline combined with crossing volumes from sidestreets (particularly at unsignalized intersections) and /or from vehicles turning into and out of driveways along multi-lane urban facilities. Three states also show an overrepresentation of pedestrian and bicyclist crashes on these roadway types which again are common problems, since pedestrians often have problems crossing wide multi-lane streets safely.
- Rural Freeways - This roadway class is characterized by high vehicle speeds and typically high vehicle volumes. Common crash types under such conditions as shown in table 3 include fixed object accidents (five states), rollover crashes (five states), and animal accidents (five states). Other problems found in the HSIS data include a high incidence of nighttime crashes (five states) which may partly be the result of little or no nighttime lighting on rural freeways. The overrepresentation of icy pavement conditions may be partly the result of generally high vehicle speeds on rural freeways, which increases the crash risks while driving on slippery pavement conditions. Rural freeways also had an overrepresentation of injury crashes in two states.
- Rural Two-Lane Roads - Particular problems on these roadway types include crashes involving fixed objects, rollovers, head-on/opposite direction sideswipe collisions, and animal accidents. These crash types are well documented in the literature as common problems on two-lane rural roads. Also, nighttime crashes are a problem, due perhaps in part to the general lack of adequate nighttime lighting on these road types. Icy pavement problems also exist on rural two-lane roads, which may be the result of generally high vehicle speeds on these road types combined with the difficulty of highway agencies to quickly and adequately provide snow and ice removal on such a large sample of roadway miles. Injury accidents are also overrepresented on these road types in three of the five states, which may be

expected due to high vehicle speeds and the generally high severity of run-off-road, rollover, and head-on accidents which are common to these roadway types.

- Rural Divided and Undivided Multi-Lane Roads - As with freeways, these roadway types often carry relatively large volumes of traffic at high speeds, except that signalized intersections and driveways are common along many of these routes (not full access control as with freeways). Common accident problems found in table 3 include animal accidents (due to the rural nature of these roadways), angle accidents (in two or three of the states), and fixed object and rollover accidents (in several states each). These roadway types also tend to be overrepresented in injury accidents, perhaps due to relatively high vehicle speeds. Icy pavement conditions are also overrepresented (where perhaps high vehicle speeds present problems for vehicles slowing or stopping on icy roads). Wet weather accidents were also found to be a problem in three states on rural multi-lane undivided roadways.

It is interesting to also review table 3 in terms of the consistency of overrepresented accident types between states. In many cases, the same accident problems are found among three or more states for a given roadway class. Similarly, many of the cells in table 3 have no state indicated, which suggests that no state had an overrepresentation of that particular accident type on the given roadway class. While there are a few cells with one or two states indicated, the table does show relatively good consistency in terms of the distribution of accident types on common roadway classes between the five states. Details of the accident percentages which were used in developing this table are found in Appendix B, along with crash rates for each crash type and roadway class.

Discussion of Analysis Problems and Adjustments

During the process of calculating accident rates for various roadway classes by state, several problems were found. Specifically, rates for some states and categories seemed unrealistically high or low, compared to what was "expected." Contacts were made with the state HSIS coordinators in each state to verify results and/or to determine possible data problems that may be resulting in incorrect rates. The following is a discussion by state of data problems and adjustments which were made.

Michigan

As discussed earlier, crash rates in the state of Michigan were found to be higher than corresponding rates in other states for each roadway type. In some cases, the crash rates in Michigan clearly exceeded any other state. For example, on urban undivided non-freeways, the crash rate in Michigan was 8.7, compared to the rates of 5.3 to 5.8 in the other three states (where sufficient sample sizes were available). On two-lane roads, Michigan had a rate of 3.1 compared to rates of 1.3 to 1.9 for the other four states. Also, crash rates on some rural Michigan roadway classes far exceeded those in other states (due partly to high numbers of deer crashes in Michigan). Therefore, questions were raised in regard to why the accident rates in Michigan exceeded corresponding rates from other states.

Discussions were held with Don Mercer of the Michigan Department of Transportation to compare rates calculated by the UNC Highway Safety Research Center with those computed by Michigan DOT. As shown in Appendix C, comparison rates were provided to HSRC for each roadway class of concern. As shown in table 4, the rates computed by HSRC were within five to ten percent of those collected for Michigan DOT, except for urban freeways, where HSRC computed a rate of 1.77 compared to a rate of 2.75 by Michigan DOT. Further discussions with Mr. Mercer revealed the possible reason for this difference; that is, the Michigan DOT calculated rates on urban freeways include crashes related to the interchange, the interchange ramps, and possibly even crashes in some cases involving the intersection of the ramp and the cross street. The HSRC analysis did not access the interchange file for urban freeways, which certainly could have increased the accident sample considerably, and thus, increase the crash rates for urban freeways.

In looking at the other Michigan comparisons, a 15 percent difference was also found between two other categories, that is, rural freeways and rural multi-lane divided highways. It is not totally clear why these differences existed, except for different procedures in matching crashes with roadway sections and in the exact samples used in the computations.

In summary, no further efforts were made by HSRC to further refine or adjust overall accident rates by roadway type in Michigan. Certainly, efforts could be made in the future, if desired, to obtain urban freeway crashes within interchanges to add to the current urban freeway rate.

Minnesota

While Michigan rates were questioned due to the fact that they were higher than the rates for other states for each roadway class, questions were raised concerning the low crash rates in Minnesota compared with other states. For example, this was a particular issue on rural divided non-freeways, where such sections had a rate of 0.9 in Minnesota compared to

Table 4. Comparison of crash rates of Michigan DOT vs. HSRC calculated rates.

Roadway Class	Crash Rate (Crashes/MVM)		*Percent Differences
	Computed by HSRC	Michigan	
Urban freeway	1.77	2.75	-36%
Urban two-lane	5.41	5.06	+7%
Urban, multilane divided	5.75	5.38	+7%
Urban, multilane undivided	8.73	8.31	+5%
Rural freeway	1.34	1.17	+15%
Rural two-lane	3.11	2.97	+5%
Rural, multilane divided	2.72	2.37	+15%
Rural, multilane undivided	4.43	4.29	+3%

Note: A negative sign means HSRC rates are lower than MDOT rates, whereas a positive sign means HSRC rates are higher than MDOT rates.

rates of 1.6 in Illinois and 2.7 in Michigan. Also, rural two-lane roads had a rate of only 1.3 in Minnesota, compared with rates of 1.7 to 1.9 in three other states, and a rate of 3.1 in Michigan.

It should be mentioned that a previous in-depth analysis on this issue of Minnesota crash rates was addressed by Warren Hughes as part of an earlier HSIS activity. Based on that analysis, no clear answers could be found to explain these lower Minnesota rates. The consistently low rates in Minnesota compared with the other HSIS states were found for a variety of roadway types, traffic volume groups, and other roadway characteristics, and was not thought to be particularly a problem of low crash reporting levels nor of overestimating traffic volumes (which could have yielded lower than expected rates). In short, no further detailed efforts were made in the current effort to address this issue.

Utah

Utah was one of those states which had crash rates which seemed to fall well within the rates of other states for virtually every roadway class. Therefore, there were no specific roadway classes in which serious questions were raised regarding the likely accuracy or reliability of the Utah crash rate.

There was one question raised, however, about the percentage of injury crashes found in Utah. As shown in table 3, as discussed earlier, most of the states had a higher than average percentage of injury accidents in rural roadway classes, whereas in Utah, only urban freeways, urban multi-lane divided and urban multi-lane undivided roadways had injury percentages greater than average for that state. However, one might expect a higher likelihood of serious injury accidents occurring on rural roadways, where vehicle speeds tend to be higher than on urban sections.

Discussions were held with Mr. David Blake of the Utah DOT in this regard. While no clear answer was found, several possible explanations were discussed. One likely explanation regarded the possibility that lower severity (property damage only) crashes were less likely to be recorded by the police in urban areas than in rural areas. Such underreporting of low severity urban crashes could explain the higher than expected percentage of injury crashes in urban areas compared to rural areas. If this were in fact a large part of the reason, it is not clear why such underreporting of urban crashes would not occur to the same degree in the other states. It should be mentioned, for example, that in the city of Detroit, Michigan, police officers often do not complete crash reports on property damage only accidents, so one might expect Michigan to have a similar problem. A review of table 3 coincidentally does show that Michigan had a higher proportion of injury crashes on urban freeways, urban multi-lane divided, and urban undivided roadways which would support this theory.

It was also mentioned by Mr. Blake that many of the so-called urban sections in Utah actually may be more high speed and rural in nature than perhaps some urban sections in other states. This could also partly explain relatively high severities if, in fact, crashes on those sections occur at similarly high speeds as many rural situations (and also depending on the crash types which occur). In summary, no further efforts were made to investigate crash rates or injury percentages in Utah.

Maine

The accident rates for Maine were reviewed, which led to several observations. First of all, insufficient samples of roadway (less than 50 miles) were available on nonfreeway divided and undivided roadways (both rural and urban areas), so accident rates were not computed for those categories. Next, it was observed that the crash rates for Maine were approximately within the expected ranges for rural freeways and rural two-lane roads. However, initial data runs had given inflated accident rates for some categories, such as for rural freeways, where an initial rate was computed as 1.8, compared with an expected rate of less than 1.0. Also, urban freeways had a rate which was initially higher than expected (approximately 1.5).

Discussions were held with Mr. Ron Emery of the Maine DOT regarding the appropriate measure of section length which should be used in the calculations of rates. Initially the "total" mileage variable (SEG-LNG) was used which generated the high rates. After discussions with Mr. Emery, we understand that this mileage variable will give, for example, a total length of two miles on a one mile segment of freeway (i.e., one mile northbound and one mile southbound). However, the data variable (NSEG-LNG) would give the desired section length for use in our own calculations.

After making this revision, the computed accident rate for rural freeways of 0.89 agreed closely with the value of 0.84 found by the Maine DOT for their urban freeways links (labelled by Maine DOT as "four lane divided with full access control") in their publication, "Accident Rate Tables" 1990-1992). The rates computed by HSRC were still 25 percent less than those Maine DOT rates for urban freeways (0.63 vs. 0.84, respectively). A comparison was also made between crash rates on rural two-lane roads as computed by HSRC and rates on "links" (i.e., segments which do not include nodes) of two lane principal arterials. On two-lane urban sections, rates were nearly identical between HSRC and Maine DOT (i.e., 2.59 vs. 2.52, respectively). On rural two lane roads, the HSRC rate was 1.90, compared to 1.19, as computed by the Maine DOT. This difference was thought to be the result of the fact that the Maine DOT rate is for principal arterial two-lane roads, whereas the HSRC rate is on all two-lane roads in the Maine HSIS file. This file includes mostly lower class two-lane roads, which would be expected to have a higher rate than principal arterials. A separate check was made to determine whether this was the reason for different crash rates on rural two-lane roads. Indeed, the HSRC-computed crash rate on rural Principal Arterial two-lane roads was found to be 1.28, which agrees closely with the Maine DOT rate of 1.19. The HSRC-computed crash rate for other (non-Principal Arterial) rural two-lane roads on the Maine state roadway system was higher, at 2.15. These rates do confirm close agreement between HSRC rates and Maine DOT rates for roadway "links" on several roadway classes. Note that crashes at "nodes" (i.e., intersections and interchanges) were not included in these comparisons.

One other issue which was addressed in Maine involved the high percentage of run-off-road fixed object accidents (32.2%) compared to percentages of 2.2 to 11.4 percent in the other four states. Due to the highly rural nature of the crashes in Maine compared to some of the other states, it may be expected that Maine would have a higher percentage of fixed object crashes for that reason alone.

Illinois

A review of the initial crash rates computed in Illinois revealed one major question of concern. This concern centered around the unrealistically low crash rate of 0.28 on rural Illinois freeways. In other states, the crash rate for rural freeways was two to four times higher than in Illinois. Discussions were held with Mr. John Blair of the Illinois DOT regarding this issue, and several problems were uncovered jointly by Mr. Blair and Ms. Carolyn Williams as follows:

1. The roadway file had numerous overlapping sections (this was usually seen as a long section, followed by an overlapping short section) which caused accidents to "cluster" to the first section or be "skipped."
2. Some sections of roadway for a given county and route had beginning milepost which were much greater than any milepost listed for that same segment on the accident file.
3. Some accidents occurred in sections of roadway that were not on the roadway file.
4. Accidents occurring on ramps (RD_FEAT=10) would not milepost to the roadway file.

Several solutions to this problem were found and used:

1. Overlapping sections were generated by the State in an attempt to update certain sections of roadway. When new records were added, the program which processed the file did not treat the new record as an update to a current record but as a new record. A program was written to correct the problem.

2. Sections of Roadway that have a beginning milepost greater than 99.99 (i.e., 100.00 or 209.39) did not match with the accident file. The accident file milepost highest number is 99.99 which generally represented non-mileposted accidents. The program which matched accidents to Roadway segments had to be re-written to ignore the first digit of all sections whose beginning and ending milepost were greater than 99.99. This situation occurred mostly on Rural Freeways and therefore accounted for the low rates for that classification of roadway.

3. The Illinois Roadway file does not contain an inventory of all roads in the state. The file also has some gap sections. These are sections that are on non-state maintained roads. Therefore, a section of roadway may appear artificially long. Sections longer than 10 miles were deleted. This resulted in deleting only about 20 roadway sections.

4. Those accidents with RdFEAT 10 (i.e., on ramps) were deleted when an analysis required matching with the roadway file.

Attached in Appendix D is a one page listing of route 336 that showed inconsistent categories among adjacent sections as well as numerous overlapping records in beginning and ending milepoint.

After these corrections are made, revised crash rates were produced for each roadway class and summarized in table 5 between the initial (incorrect) crash rates and the revised (corrected) rates. As shown in table 5, the resulting crash rates on rural freeways were doubled from 0.28 to 0.56, while the rate on urban freeways was increased by 20 percent (from 1.23 to 1.48). Only minor revisions were seen in a few other roadway type categories. A comparison of the crash rates on rural freeways have shown the HSRC computer rate of 0.56 agrees closely with the rate of 0.6 determined by the Illinois DOT.

Summary and Conclusions

The purpose of this analysis was to investigate the crash rates and characteristics of the five HSIS states by roadway class. Some of the highlights of this analysis effort are summarized below:

1. Crash rates were generated for each of eight roadway classes for the five HSIS states, and have revealed a considerable amount of variation even within common roadway classes. In most of the roadway classes, however, there was reasonable agreement among most states in terms of crash rate, with one or two state outliers in some cases. Some of the variations in rates may be certainly explained by possible differences in police reporting practices (e.g., police in some urban areas may not be reporting many of the minor crashes), as well as the different nature of the highway systems, geographic conditions, driving populations, and other factors from state-to-state. Another seemingly clear difference between crash data using this analysis between states involved the fact that three of the states (Michigan, Utah, and Illinois) had between 65 and 82 percent of their crashes occurring in

Table 5. Summary of preliminary and corrected accident rates on Illinois roadway classes.

Roadway Class	Preliminary Rates (acc/mvm)	Corrected Rates (acc/mvm)	Percent Change
Urban freeways	1.23	1.48	20.3
Urban, 2-lane	3.77	3.94	4.5
Urban, multilane, divided	4.75	4.78	0.6
Urban, multilane, undivided	5.73	5.77	0.7
Rural freeways	0.28	0.56	100.0
Rural, 2-lane	1.75	1.78	1.7
Rural, multilane, divided	1.56	1.58	1.3
Rural, multilane, undivided	2.45	2.50	2.0

urban areas, while Maine and Minnesota had 68 and 63 percent of their crashes occurring in rural areas, respectively. Another difference in crash rates for some categories may be traced to the fact that for two of the states (Michigan and Maine), many of the interchange crashes were not included in the calculations of rates on freeways. Further analysis of interchange crashes may be possible, if desired.

2. A review of the crash characteristics by severity, light condition, road surface condition, and collision type revealed relatively similar crash percentages overall between the five states in most but not all situations. There was some variation, such as a higher percent of ice related crashes in Maine, Minnesota, and Michigan, compared to Illinois and Utah, and such differences are not only explainable, but expected due to the differences of climates in those states. Some differences in percent of serious injury crashes was expected, due at least in part to the types of roadway (urban or rural areas) in which the crashes occurred. The analysis of collision type revealed some similarities in some categories and more diverse percentages in others. For example, the percent of fixed object crashes ranged closely between 8.2 and 11.7 percent in four of the five states, while Maine's fixed object accident types accounting for 32.2 percent of its crashes (perhaps due largely to the rural nature of the crashes in that state).

3. A detailed analysis was also conducted of crash percentages and rates within each of the eight roadway classes. These comparisons showed reasonably good agreement of the types of crashes that predominantly occur within different roadway classes for the five states, although differences were found in some situations. The process of assigning accidents within 11 common collision types presented a real challenge, but appeared to be reasonably successful.

4. A review of accident rates and characteristics resulted in a considerable amount of analysis questions, and then numerous data checks and modifications were needed within certain states. Some data problems were found which were corrected as part of this activity, while a better understanding was gained of the specific variables that were most appropriate to use (e.g., the appropriate section length variable in Maine) for calculations of accident rates.

5. This process of determining crash rates and characteristics by roadway type was time consuming and at times difficult. However, it also was considered to be successful in providing reasonable accident rate comparisons within the five HSIS states. Certainly, additional fine-tuning of such rates may be justified in the future for some data categories. However, the information produced in this report is believed to provide a good baseline of accident rates for further use in better understanding HSIS crash trends. Also, common collision type codes are now available for the five states for future safety analysis purposes (e.g., to determine the effect of certain roadway features on various collision types). Also, these rates and characteristics in the five existing HSIS states can be used as a baseline for comparison of future proposed HSIS states.

APPENDIX A

PROGRAMMING LOGIC USED TO DETERMINE COLLISION TYPES

```
/*CLASSIFY MAINE ACCIDENT TYPES*/

/* by light condition*/

 IF LIGHT = 2        THEN TOTDAY  = TOTDAY  + 1;
    ELSE IF LIGHT IN(2,3,4,5,6) THEN TOTNITE = TOTNITE + 1;
    ELSE                          UNKLITE = UNKLITE + 1;

/* by road surface condition */

 IF RDCOND  =  1      THEN TOTDRY = TOTDRY + 1;
    ELSE IF RDCOND IN(2,5)
                             THEN TOTWET = TOTWET + 1;
    ELSE IF RDCOND IN(3,4,8,9)
                             THEN TOTICY = TOTICY + 1;
    ELSE                          SURF_OTH = SURF_OTH + 1;

/*by accident type */


  IF ACCTYPE = 10  OR (ACCTYPE = 7 AND  (FIXOBJ GE 1 AND FIXOBJ LE 20))
                        THEN FOACC   = FOACC   + 1;
  ELSE IF  ACCTYPE = 12      .
                   THEN ROLLACC = ROLLACC + 1;

  ELSE IF ACCTYPE = 3   THEN HOACC  = HOACC  + 1;

  ELSE IF ACCTYPE = 2
                        THEN REACC = REACC + 1;

  ELSE IF MANEUV1 = 18 OR MANEUV2 = 18 OR
           MANEUV3 = 18  THEN REACC  = REACC  + 1;

  ELSE IF MANEUV1 IN(8,12,13,14)
         OR MANEUV2 IN(8,12,13,14)
         OR MANEUV3 IN(8,12,13,14)
                        THEN BPACC  = BPACC  + 1;
  ELSE IF ACCTYPE = 5
                   THEN PEDACC=PEDACC + 1;
  ELSE IF
          (MANEUV1IN(41,42,43,44,45,46,46,48,49,50,51,52,53,54,55,56,57,
             58,59,60,96,71,72,73,74,75,76,77,78,79,80,
             81,82,83,84,85,86,87,88,89,90,
             91,92,93,94,95,96,97,98)
                           THEN PEDACC = PEDACC + 1;
  ELSE IF
          (MANEUV2IN(41,42,43,44,45,46,46,48,49,50,51,52,53,54,55,56,57,
             58,59,60,96,71,72,73,74,75,76,77,78,79,80,
             81,82,83,84,85,86,87,88,89,90,
             91,92,93,94,95,96,97,98)
                          THEN PEDACC = PEDACC + 1;
  ELSE IF
          (MANEUV3IN(41,42,43,44,45,46,46,48,49,50,51,52,53,54,55,56,57,
             58,59,60,96,71,72,73,74,75,76,77,78,79,80,
             81,82,83,84,85,86,87,88,89,90,
             91,92,93,94,95,96,97,98)
                           THEN PEDACC = PEDACC + 1;
  ELSE IF NUMVEHS >= 2  THEN
         DO;
         IF  MANEUV1 IN(3,4,5,6,7)
             OR MANEUV2 IN(3,4,5,6,7)
             OR MANEUV3 IN(4,4,5,6,7)
                       THEN ANGACC = ANGACC + 1;
```

```
        ELSE IF
           CONTR1_1 IN(2,5,10)   OR
           CONTR2_1 IN(2,5,10)
                     THEN ANGACC = ANGACC + 1;
        ELSE IF
           CONTR1_2 IN(2,5,10)   OR
           CONTR2_2 IN(2,5,10)
                     THEN ANGACC = ANGACC + 1;
        ELSE IF
           CONTR1_3 IN(2,5,10)   OR
           CONTR2_3 IN(2,5,10)
                     THEN ANGACC = ANGACC + 1;
        ELSE
             OTHACC = OTHACC + 1;
        END;
ELSE IF ACCTYPE = 7 AND ( FIXOBJ LT  1 OR  FIXOBJ GT 20)
                       THEN RORACC  =RORACC + 1;

ELSE IF ACCTYPE  = 7
                       THEN RORACC  =RORACC + 1;
ELSE IF ACCTYPE = 6 THEN TRNACC = TRNACC + 1;

ELSE IF ACCTYPE = 8 THEN ANACC  = ANACC  + 1;

ELSE                    OTHACC = OTHACC + 1;
```

```
/* CLASSIFY MICHIGAN ACCIDENT TYPES */

 /*by light condition*/

      IF LIGHT   = 1     THEN TOTDAY   = TOTDAY  + 1;
  ELSE IF LIGHT GE 2 AND LIGHT LE 4 THEN TOTNITE + 1;
  ELSE      UNKLITE = UNKLITE + 1;

/*by road surface condition */

      IF RDSURF = 1      THEN TOTDRY = TOTDRY + 1;
  ELSE IF RDSURF = 2     THEN TOTWET = TOTWET + 1;
  ELSE IF RDSURF = 3     THEN TOTICY = TOTICY + 1;
  ELSE       SURF_OTH = SURF_OTH + 1;

 /*by accident type*/

      IF ACCTYPE = 141 OR  TWO_VEH = 1
                         THEN HOACC    = HOACC    + 1;
  ELSE IF ACCTYPE = 543 OR TWO_VEH = 3
                         THEN SSOACC   = SSOACC   + 1;
  ELSE IF ACCTYPE = 342 OR TWO_VEH = 4
                         THEN SSSACC   = SSSACC   + 1;
  ELSE IF ACCTYPE = 147 OR TWO_VEH = 2
                         THEN REACC    = REACC    + 1;
  ELSE IF ACCTYPE IN (030,048,049) OR TWO_VEH = 6
                         THEN BPACC    = BPACC    + 1;
  ELSE IF ACCTYPE IN( 345,346,447,144,244,444,545,645,646) OR TWO_VEH = 5
                         THEN ANGACC   = ANGACC   + 1;

  ELSE IF ACCTYPE = 060  THEN FOACC    = FOACC    + 1;
  ELSE IF ACCTYPE = 010  THEN ROLLACC = ROLLACC + 1;
  ELSE IF ACCTYPE = 070  THEN RORACC   = RORACC   + 1;
  ELSE IF ACCTYPE = 050 OR ACCTYPE = 090
                         THEN PEDACC   = PEDACC   + 1;
  ELSE IF ACCTYPE = 020  THEN TRNACC   = TRNACC   + 1;
  ELSE IF ACCTYPE = 080  THEN ANACC    = ANACC    + 1;
  ELSE                        OTHACC   = OTHACC   + 1;
```

```
/CLASSIFY ILLINOIS ACCIDENT TYPES*/

  /*by light condition*/

 IF LIGHT = 1 THEN TOTDAY=TOTDAY +1;
    ELSE IF LIGHT in(2,3,4,5,6)
                        THEN TOTNITE=TOTNITE+1;
    ELSE UNKLITE = UNKLITE + 1;

  /*by road surface conditon*/

 IF RD_SURF IN(2,5) THEN TOTWET = TOTWET + 1;

    ELSE IF RD_SURF = 1 THEN TOTDRY = TOTDRY + 1;

    ELSE IF RD_SURF IN(3,4) THEN TOTICY = TOTICY + 1;

    ELSE SURF_OTH = SURF_OTH + 1;

/*by accident type*/

        IF COL_TYPE=37                   THEN FOACC = FOACC + 1;
   ELSE IF COL_TYPE=32                   THEN ROLLACC=ROLLACC+1;
   ELSE IF COL_TYPE=38 OR COL_TYPE=39
                                         THEN RORACC= RORACC+ 1;
   ELSE IF COL_TYPE=13 OR COL_TYPE=43  THEN HOACC = HOACC + 1;
   ELSE IF COL_TYPE=15 OR COL_TYPE=45  THEN SSOACC= SSOACC+ 1;
   ELSE IF COL_TYPE=14 OR COL_TYPE=44  THEN SSSACC= SSSACC+ 1;
   ELSE IF COL_TYPE=11 OR COL_TYPE=12 OR COL_TYPE=41 OR
                          COL_TYPE=42  THEN REACC = REACC + 1;
   ELSE IF COL_TYPE=10 OR COL_TYPE=40  THEN BPACC = BPACC + 1;
   ELSE IF COL_TYPE=03 OR COL_TYPE=05 OR COL_TYPE=33 OR
                          COL_TYPE=35  THEN PEDACC= PEDACC+ 1;
   ELSE IF COL_TYPE=16 OR COL_TYPE=17 OR COL_TYPE=46 OR
                          COL_TYPE=47  THEN ANGACC= ANGACC+ 1;
   ELSE IF COL_TYPE=04 OR COL_TYPE=34  THEN TRNACC= TRNACC+ 1;
   ELSE IF COL_TYPE=06 OR COL_TYPE=36  THEN ANACC = ANACC + 1;
   ELSE                                     OTHACC= OTHACC+ 1;
```

```
/*CLASSIFY UTAH ACCIDENT TYPES*/

/*by light condition */

 IF LIGHT  IN('1','2')
                    THEN TOTDAY   = TOTDAY  + 1;
   ELSE IF LIGHT IN('3','4')
                    THEN TOTNITE = TOTNITE + 1;
   ELSE                  UNKLITE = UNKLITE + 1;

/* by road surface condition */

 IF RDSURF  = '1'     THEN TOTDRY = TOTDRY + 1;
   ELSE IF RDSURF IN('2', '3')
                              THEN TOTWET = TOTWET + 1;
   ELSE IF RDSURF IN('4','5')
                              THEN TOTICY = TOTICY + 1;
   ELSE                       SURF_OTH = SURF_OTH + 1;

/*by accident type */

  IF  ACC_TYPE = '8'
                    THEN ROLLACC = ROLLACC + 1;
  ELSE IF ACC_TYPE IN ('6','R','L','9')
       AND COLLTYPE ='6'
                    THEN FOACC  = FOACC   + 1;

  ELSE IF ACC_TYPE IN ('R','L','9')
       AND (OBJSTRK IN('A','B','C','D','E','F','I','H',
       'J','K','L','O','P','Q','R','S'))
                          THEN FOACC  = FOACC   + 1;
  ELSE IF ACC_TYPE IN ('R','L','9')
       AND NOT (OBJSTRK IN('A','B','C','D','E','F','I','H',
       'J','K','L','O','P','Q','R','S','T'))
                          THEN RORACC  =RORACC + 1;
  ELSE IF COLLTYPE = '01'
                          THEN HOACC  = HOACC  + 1;
  ELSE IF COLLTYPE = '07'
                          THEN SSSACC = SSSACC + 1;
  ELSE IF COLLTYPE = '06'
                          THEN SSOACC = SSOACC + 1;
  ELSE IF COLLTYPE IN ('03','04' ,'05')
                           THEN REACC  = REACC  + 1;
  ELSE IF COLLTYPE IN ('26','18')
                          THEN BPACC  = BPACC  + 1;
  ELSE IF ACC_TYPE ='1' OR ACC_TYPE = '4'
                          THEN PEDACC = PEDACC + 1;
  ELSE IF COLLTYPE IN
   ('08','09','10','11','12','13','14','15','19','20',
      '21','22','23','24','25')
                          THEN ANGACC = ANGACC + 1;

  ELSE IF ACC_TYPE = '3' THEN TRNACC = TRNACC + 1;

  ELSE IF ACC_TYPE IN('5','D') THEN ANACC  = ANACC  + 1;

  ELSE                         OTHACC = OTHACC + 1;
```

```
/*CLASSIFY MINNESOTA ACCIDENT TYPES*/

    /* by light condtion*/

   IF LIGHTCON = 1
                    THEN  TOTDAY = TOTDAY + 1;
   ELSE IF LIGHTCON IN(2,3,4,5,6)
                    THEN TOTNITE = TOTNITE + 1;
   ELSE
        UNKLITE = UNKLITE + 1;


    /* by road surface condtion*/

   IF RDSURF = 1
                   THEN TOTDRY = TOTDRY + 1;
   ELSE IF RDSURF IN(2,3)
                   THEN TOTWET = TOTWET + 1;
   ELSE IF RDSURF = 4
                   THEN  TOTICY = TOTICY + 1;
   ELSE
         SURF_OTH = SURF_OTH + 1;

/* by accident type*/

IF ACCTYPE = 04                  THEN TRNACC = TRNACC + 1;

    ELSE IF ACCTYPE IN(05, 06)   THEN PEDACC = PEDACC + 1;

    ELSE IF ACCTYPE IN(07,13 )   THEN ANACC = ANACC+ 1;

    ELSE IF ACCTYPE = 03    THEN BPACC = BPACC + 1;

    ELSE IF ACCDIGM = 01 THEN REACC = REACC+ 1;

    ELSE IF ACCDIGM = 02 THEN SSSACC = SSSACC + 1;

    ELSE IF ACCDIGM IN (03,05 ,06) THEN ANGACC = ANGACC + 1;

    ELSE IF ACCDIGM = 08   THEN HOACC = HOACC + 1;

    ELSE IF ACCDIGM = 09   THEN SSOACC = SSOACC + 1;

    ELSE IF ACCTYPE = 08 THEN FOACC = FOACC + 1;

    ELSE IF ((ACCDIGM IN(04,07)) AND ACCTYPE = 10)
                         THEN ROLLACC = ROLLACC + 1;

    ELSE IF ACCDIGM IN (04,07) OR  LOC_HARM IN (2,3,4)
                      THEN RORACC = RORACC + 1;

    ELSE OTHACC = OTHACC + 1;
```

APPENDIX B

DETAILED CRASH PERCENTAGES AND RATES BY STATE AND ROADWAY TYPE

MAINE 1991 ACCIDENT RATE SUMMARY BY HIGHWAY CLASSFICATION

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OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	ACC_MVMT
1	UR-FREEWAYS	404	63.65	535.748	340	0.63463
2	UR-2-LANE-RDS	25483	2381.77	2289.760	5929	2.58935
3	UR-MUL LN DIV	269	21.65	89.048	208	2.33581
4	UR MUL LN UN/DIV	463	33.87	191.305	438	2.28954
5	RU-FREEWAYS	744	317.10	1731.519	1546	0.89286
6	RU-2 LANE RDS	52594	18974.49	6792.181	12914	1.90130
7	RU-MUL LN DIV	100	9.16	31.117	40	1.28546
8	RU-MUL LN UN/DIV	212	38.02	151.149	205	1.35628
		========	========	============	======	
		80269	21839.71	11811.828	21620	

OBS	PDO_MVMT	INJ_MVMT	FAT_MVMT	ICY_MVMT	DRY_MVMT	WET_MVMT	DAY_MVMT
1	0.42371	0.20345	0.007466	0.18852	0.35651	0.08773	0.35464
2	1.91155	0.67081	0.006988	0.47822	1.62681	0.46773	1.74123
3	1.71817	0.61764	0.000000	0.23583	1.67325	0.42673	1.70694
4	1.63613	0.64818	0.005227	0.24045	1.57341	0.46523	1.73545
5	0.58099	0.30147	0.010395	0.30840	0.45567	0.12590	0.47704
6	1.25041	0.63367	0.017226	0.57905	1.03457	0.26251	1.01116
7	0.86768	0.41777	0.000000	0.06427	0.89982	0.32136	0.86768
8	0.92624	0.43004	0.000000	0.16540	0.95932	0.23156	0.87331

OBS	NIT_MVMT	FIX_MVMT	ROL_MVMT	ROR_MVMT	HO_MVMT	REN_MVMT	BP_MVMT
1	0.25945	0.12693	0.011199	0.001867	0.00933	0.22212	0.00187
2	0.76340	0.40572	0.009608	0.001747	0.17818	1.16213	0.13495
3	0.53903	0.16845	0.011230	0.000000	0.12353	1.40373	0.00000
4	0.49136	0.20909	0.000000	0.000000	0.07841	1.12909	0.02614
5	0.37193	0.30667	0.016748	0.008085	0.01213	0.20906	0.00173
6	0.79783	0.78708	0.050205	0.010748	0.14016	0.34657	0.02621
7	0.38564	0.12855	0.000000	0.000000	0.06427	0.83555	0.03214
8	0.43004	0.19186	0.000000	0.000000	0.03970	0.58221	0.01323

OBS	PED_MVMT	ANG_MVMT	TRN_MVMT	ANA_MVMT	OTH_MVMT
1	0.003733	0.00747	.00000000	0.06533	0.18479
2	0.086909	0.33322	.00043673	0.09783	0.17862
3	0.022460	0.34813	.00000000	0.07861	0.17968
4	0.020909	0.65341	.00000000	0.04182	0.13068
5	0.000578	0.00058	.00000000	0.10742	0.22986
6	0.020023	0.09894	.00029446	0.29902	0.12205
7	0.000000	0.12855	.00000000	0.03214	0.06427
8	0.026464	0.24479	.00000000	0.19186	0.06616

MAINE 1991 ACCIDENT RATE PERCENTAGES BY HIGHWAY CLASSFICATION

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OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	PDO_PCT	INJ_PCT
1	UR-FREEWAYS	404	63.65	535.748	340	66.8	32.1
2	UR-2-LANE-RDS	25483	2381.77	2289.760	5929	73.8	25.9
3	UR-MUL LN DIV	269	21.65	89.048	208	73.6	26.4
4	UR MUL LN UN/DIV	463	33.87	191.305	438	71.5	28.3
5	RU-FREEWAYS	744	317.10	1731.519	1546	65.1	33.8
6	RU-2 LANE RDS	52594	18974.49	6792.181	12914	65.8	33.3
7	RU-MUL LN DIV	100	9.16	31.117	40	67.5	32.5
8	RU-MUL LN UN/DIV	212	38.02	151.149	205	68.3	31.7
		========	========	===========	======		
		80269	21839.71	11811.828	21620		

OBS	FAT_PCT	ICY_PCT	DRY_PCT	WET_PCT	DAY_PCT	NIT_PCT	FIX_PCT	ROL_PCT	ROR_PCT
1	1.2	29.7	56.2	13.8	55.9	40.9	20.0	1.8	0.3
2	0.3	18.5	62.8	18.1	67.2	29.5	15.7	0.4	0.1
3	0.0	10.1	71.6	18.3	73.1	23.1	7.2	0.5	0.0
4	0.2	10.5	68.7	20.3	75.8	21.5	9.1	0.0	0.0
5	1.2	34.5	51.0	14.1	53.4	41.7	34.3	1.9	0.9
6	0.9	30.5	54.4	13.8	53.2	42.0	41.4	2.6	0.6
7	0.0	5.0	70.0	25.0	67.5	30.0	10.0	0.0	0.0
8	0.0	12.2	70.7	17.1	64.4	31.7	14.1	0.0	0.0

OBS	HO_PCT	REN_PCT	BP_PCT	PED_PCT	ANG_PCT	TRN_PCT	ANA_PCT	OTH_PCT
1	1.5	35.0	0.3	0.6	1.2	0.0	10.3	29.1
2	6.9	44.9	5.2	3.4	12.9	0.0	3.8	6.9
3	5.3	60.1	0.0	1.0	14.9	0.0	3.4	7.7
4	3.4	49.3	1.1	0.9	28.5	0.0	1.8	5.7
5	1.4	23.4	0.2	0.1	0.1	0.0	12.0	25.7
6	7.4	18.2	1.4	1.1	5.2	0.0	15.7	6.4
7	5.0	65.0	2.5	0.0	10.0	0.0	2.5	5.0
8	2.9	42.9	1.0	2.0	18.0	0.0	14.1	4.9

MAINE 1991 ACCIDENT TOTALS BY HIGHWAY CLASSFICATION

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OBS	ROAD	TOTACC	PDOACC	INJACC	FATACC	INJAACC	INJBACC	INJCACC	SURF_OTH	TOTICY	TOTDRY
1	UR-FREEWAYS	340	227	109	4	12	43	54	1	101	191
2	UR-2-LANE-RDS	5929	4377	1536	16	166	584	786	38	1095	3725
3	UR-MUL LN DIV	208	153	55	0	1	13	41	0	21	149
4	UR MUL LN UN/DIV	438	313	124	1	16	45	63	2	46	301
5	RU-FREEWAYS	1546	1006	522	18	76	271	175	5	534	789
6	RU-2 LANE RDS	12914	8493	4304	117	541	1814	1949	171	3933	7027
7	RU-MUL LN DIV	40	27	13	0	0	5	8	0	2	28
8	RU-MUL LN UN/DIV	205	140	65	0	10	20	35	0	25	145
		=====	=====	====	===	===	====	====	===	====	=====
		21620	14736	6728	156	822	2795	3111	217	5757	12355

OBS	TOTWET	TOTDAY	TOTNITE	UNKLITE	FOACC	ROLLACC	ROACC	HOACC	REACC	BPACC	PEDACC	ANGACC	TRNACC	ANACC	OTHACC
1	47	190	139	11	68	6	1	5	119	1	2	4	0	35	99
2	1071	3987	1748	194	929	22	4	408	2661	309	199	763	1	224	409
3	38	152	48	8	15	1	0	11	125	0	2	31	0	7	16
4	89	332	94	12	40	0	0	15	216	5	4	125	0	8	25
5	218	826	644	76	531	29	14	21	362	3	1	1	0	186	398
6	1783	6868	5419	627	5346	341	73	952	2354	178	136	672	2	2031	829
7	10	27	12	1	4	0	0	2	26	1	0	4	0	1	2
8	35	132	65	8	29	0	0	6	88	2	4	37	0	29	10
	====	=====	====	===	====	===	==	====	====	===	===	====	=	====	====
	3291	12514	8169	937	6962	399	92	1420	5951	499	348	1637	3	2521	1788

MICHIGAN 1991 ACCIDENT RATE SUMMARY BY HIGHWAY CLASSFICATION

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OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	ACC_MVMT	PDO_MVMT
1	urban freeway	1844	426.81	11212.84	19828	1.76833	1.24678
2	urban two lane	6854	666.83	1606.34	8691	5.41044	4.11245
3	urb mult div	1545	238.52	3183.00	18314	5.75369	4.10933
4	urb mult undiv	4149	621.85	4171.89	36436	8.73370	6.25137
5	rural freeway	2463	1429.25	9624.04	12853	1.33551	1.03480
6	rural two lane	30618	5802.17	8279.09	25773	3.11302	2.49967
7	rur mult div	832	224.57	1208.43	3290	2.72254	2.00343
8	rur mult undiv	1206	180.93	822.68	3647	4.43308	3.11908
		========	========	========	======		
		49511	9590.93	40108.30	128832		

OBS	INJ_MVMT	FAT_MVMT	ICY_MVMT	DRY_MVMT	WET_MVMT	DAY_MVMT	NIT_MVMT
1	0.51646	0.005083	0.32909	1.02222	0.41096	1.11087	0.65291
2	1.27557	0.022411	0.78688	3.46689	1.13114	3.62128	1.77422
3	1.63117	0.013195	0.51335	3.90072	1.31511	4.10745	1.62928
4	2.46076	0.021573	0.82936	5.70653	2.16161	6.39567	2.31502
5	0.29426	0.006442	0.36211	0.77067	0.19898	0.67103	0.66230
6	0.59439	0.018963	0.48846	2.04890	0.56202	1.32539	1.77991
7	0.70339	0.015723	0.40797	1.74028	0.56520	1.69807	1.01785
8	1.28969	0.024311	0.57130	2.80790	1.03929	2.83950	1.58385

OBS	FIX_MVMT	ROL_MVMT	ROR_MVMT	HO_MVMT	SSO_MVMT	SSS_MVMT	REN_MVMT
1	0.36895	0.05547	0.028182	0.01133	0.003121	0.022474	1.04889
2	0.53911	0.06972	0.029259	0.12575	0.028637	0.021789	1.27495
3	0.39083	0.02859	0.020735	0.02890	0.005341	0.052466	2.75464
4	0.42810	0.03140	0.029004	0.14718	0.028285	0.084614	3.43274
5	0.31130	0.14246	0.025353	0.01185	0.001870	0.020054	0.34923
6	0.39727	0.15654	0.018239	0.11740	0.014374	0.006643	0.31513
7	0.35666	0.08110	0.029791	0.02565	0.004965	0.032273	0.98144
8	0.37074	0.05835	0.019449	0.08995	0.026742	0.029173	1.29820

OBS	BP_MVMT	PED_MVMT	ANG_MVMT	TRN_MVMT	ANA_MVMT	OTH_MVMT
1	0.03068	0.00544	0.12486	.0000000	0.03104	0.03790
2	0.40714	0.12139	1.96907	.0018676	0.64930	0.17244
3	0.20075	0.10179	2.04650	.0009425	0.03550	0.08671
4	0.36458	0.19512	3.46989	.0009588	0.09157	0.43026
5	0.03283	0.00249	0.05860	.0001039	0.33302	0.04634
6	0.03370	0.01172	0.44932	.0008455	1.53845	0.05339
7	0.02979	0.01903	0.77125	.0008275	0.35335	0.03641
8	0.07536	0.04376	1.68231	.0012155	0.54335	0.19449

MICHIGAN 1991 ACCIDENT TOTALS BY HIGHWAY CLASSFICATION

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OBS	ROAD	TOTACC	PDOACC	INJACC	FATACC	INJAACC	INJBACC	INJCACC	SURF_OTH
1	urban freeway	19828	13980	5791	57	769	1417	3605	68
2	urban two lane	8691	6606	2049	36	349	609	1091	41
3	urb mult div	18314	13080	5192	42	593	1160	3438	78
4	urb mult undiv	36436	26080	10266	90	1360	2583	6323	151
5	rural freeway	12853	9959	2832	62	584	905	1343	36
6	rural two lane	25773	20695	4921	157	1187	1493	2241	113
7	rur mult div	3290	2421	850	19	163	226	461	11
8	rur mult undiv	3647	2566	1061	20	198	299	564	12
		======	======	======	======	=======	=======	=======	========
		128832	95387	32962	483	5203	8692	19066	510

OBS	TOTICY	TOTDRY	TOTWET	TOTDAY	TOTNITE	UNKLITE	FOACC	ROLLACC	RORACC	HOACC
1	3690	11462	4608	12456	7321	51	4137	622	316	127
2	1264	5569	1817	5817	2850	24	866	112	47	202
3	1634	12416	4186	13074	5186	54	1244	91	66	92
4	3460	23807	9018	26682	9658	96	1786	131	121	614
5	3485	7417	1915	6458	6374	21	2996	1371	244	114
6	4044	16963	4653	10973	14736	64	3289	1296	151	972
7	493	2103	683	2052	1230	8	431	98	36	31
8	470	2310	855	2336	1303	8	305	48	16	74
	======	======	======	======	=======	=======	=====	=======	======	=====
	18540	82047	27735	79848	48658	326	15054	3769	997	2226

OBS	SSOACC	SSSACC	REACC	BPACC	PEDACC	ANGACC	TRNACC	ANACC	OTHACC
1	35	252	11761	344	61	1400	0	348	425
2	46	35	2048	654	195	3163	3	1043	277
3	17	167	8768	639	324	6514	3	113	276
4	118	353	14321	1521	814	14476	4	382	1795
5	18	193	3361	316	24	564	1	3205	446
6	119	55	2609	279	97	3720	7	12737	442
7	6	39	1186	36	23	932	1	427	44
8	22	24	1068	62	36	1384	1	447	160
	======	======	=====	=====	======	======	======	=====	======
	381	1118	45122	3851	1574	32153	20	18702	3865

MICHIGAN 1991 ACCIDENT RATE PERCENTAGES BY HIGHWAY CLASSFICATION

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OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	PDO_PCT	INJ_PCT	FAT_PCT
1	urban freeway	1844	426.807	11212.84	19828	70.5	29.2	0.3
2	urban two lane	6854	666.826	1606.34	8691	76.0	23.6	0.4
3	urb mult div	1545	238.523	3183.00	18314	71.4	28.3	0.2
4	urb mult undiv	4149	621.852	4171.89	36436	71.6	28.2	0.2
5	rural freeway	2463	1429.254	9624.04	12853	77.5	22.0	0.5
6	rural two lane	30618	5802.167	8279.09	25773	80.3	19.1	0.6
7	rur mult div	832	224.567	1208.43	3290	73.6	25.8	0.6
8	rur mult undiv	1206	180.934	822.68	3647	70.4	29.1	0.5

OBS	ICY_PCT	DRY_PCT	WET_PCT	DAY_PCT	NIT_PCT	FIX_PCT	ROL_PCT	ROR_PCT	HO_PCT
1	18.6	57.8	23.2	62.8	36.9	20.9	3.1	1.6	0.6
2	14.5	64.1	20.9	66.9	32.8	10.0	1.3	0.5	2.3
3	8.9	67.8	22.9	71.4	28.3	6.8	0.5	0.4	0.5
4	9.5	65.3	24.8	73.2	26.5	4.9	0.4	0.3	1.7
5	27.1	57.7	14.9	50.2	49.6	23.3	10.7	1.9	0.9
6	15.7	65.8	18.1	42.6	57.2	12.8	5.0	0.6	3.8
7	15.0	63.9	20.8	62.4	37.4	13.1	3.0	1.1	0.9
8	12.9	63.3	23.4	64.1	35.7	8.4	1.3	0.4	2.0

OBS	SSO_PCT	SSS_PCT	REN_PCT	BP_PCT	PED_PCT	ANG_PCT	TRN_PCT	ANA_PCT	OTH_PCT
1	0.2	1.3	59.3	1.7	0.3	7.1	0.0	1.8	2.1
2	0.5	0.4	23.6	7.5	2.2	36.4	0.0	12.0	3.2
3	0.1	0.9	47.9	3.5	1.8	35.6	0.0	0.6	1.5
4	0.3	1.0	39.3	4.2	2.2	39.7	0.0	1.0	4.9
5	0.1	1.5	26.1	2.5	0.2	4.4	0.0	24.9	3.5
6	0.5	0.2	10.1	1.1	0.4	14.4	0.0	49.4	1.7
7	0.2	1.2	36.0	1.1	0.7	28.3	0.0	13.0	1.3
8	0.6	0.7	29.3	1.7	1.0	37.9	0.0	12.3	4.4

OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	ACC_MVMT	PDO_MVMT
1	ur-freeways	305	157.28	3004.79	3103	1.03268	0.69489
2	ur-2-lane	2336	1075.63	2358.46	9181	3.89280	2.55167
3	ur mul ln div	1000	287.50	2244.50	11450	5.10135	3.23680
4	ur mul ln un/div	374	115.89	537.69	3092	5.75052	3.75681
5	ru-freeways	535	830.90	2579.48	2428	0.94128	0.60322
6	ru-2 lane rds	4243	9795.13	2505.24	4198	1.67569	1.12484
7	ru-mul ln div	93	35.43	89.47	228	2.54821	1.86645
8	ru-mul ln un/div	300	202.90	242.27	475	1.96059	1.44052
		========	========	========	======		
		9186	12500.66	13561.91	34155		

OBS	INJ_MVMT	FAT_MVMT	ICY_MVMT	DRY_MVMT	WET_MVMT	DAY_MVMT	NIT_MVMT
1	0.33247	0.005325	0.17206	0.69888	0.15708	0.71885	0.27889
2	1.33180	0.009328	0.30571	2.82303	0.74795	2.93073	0.83572
3	1.84718	0.017376	0.20094	3.87703	0.99710	3.79416	1.14546
4	1.97511	0.018598	0.25479	4.36682	1.09915	4.35380	1.19957
5	0.31906	0.018996	0.18415	0.66409	0.08917	0.52569	0.39620
6	0.52490	0.025946	0.20557	1.30446	0.15887	0.94242	0.66501
7	0.68176	0.000000	0.23470	2.00057	0.30176	1.50881	0.97234
8	0.50769	0.012383	0.32195	1.50243	0.12795	0.98649	0.88330

OBS	FIX_MVMT	ROL_MVMT	ROR_MVMT	HO_MVMT	SSO_MVMT	SSS_MVMT	REN_MVMT
1	0.14277	0.013312	0.04892	0.003661	0.001997	0.06556	0.35676
2	0.17681	0.016112	0.05427	0.041129	0.049609	0.06360	1.09266
3	0.08599	0.016930	0.03609	0.029405	0.026286	0.12519	1.85564
4	0.08183	0.009299	0.06695	0.037196	0.039056	0.18226	1.69056
5	0.23222	0.014344	0.13259	0.006590	0.002714	0.03489	0.09731
6	0.40515	0.036324	0.13212	0.027941	0.034328	0.01397	0.13611
7	0.13412	0.000000	0.10059	0.033529	0.078235	0.02235	0.41353
8	0.32195	0.020638	0.07842	0.028893	0.049531	0.01651	0.19812

OBS	BP_MVMT	PED_MVMT	ANG_MVMT	TRN_MVMT	ANA_MVMT	OTH_MVMT
1	0.01498	0.00266	0.16141	.0000000	0.01964	0.20101
2	0.27094	0.17723	1.29364	.0033920	0.06657	0.58682
3	0.15014	0.19603	1.50367	.0017821	0.06638	1.00780
4	0.36638	0.24921	2.03463	.0037196	0.01674	0.97268
5	0.01783	0.00504	0.07056	.0000000	0.18957	0.13762
6	0.04231	0.01676	0.20477	.0003992	0.44507	0.18042
7	0.12294	0.06706	0.81587	.0000000	0.43588	0.32411
8	0.04540	0.05366	0.17748	.0000000	0.73058	0.23940

OBS	ROAD	TOTACC	PDOACC	INJACC	FATACC	INJAACC
1	ur-freeways	3103	2088	999	16	223
2	ur-2-lane	9181	6018	3141	22	617
3	ur mul ln div	11450	7265	4146	39	762
4	ur mul ln un/div	3092	2020	1062	10	186
5	ru-freeways	2428	1556	823	49	338
6	ru-2 lane rds	4198	2818	1315	65	474
7	ru-mul ln div	228	167	61	0	13
8	ru-mul ln un/div	475	349	123	3	36
		======	======	======	======	=======
		34155	22281	11670	204	2649

OBS	INJBACC	INJCACC	SURF_OTH	TOTICY	TOTDRY	TOTWET
1	285	491	14	517	2100	472
2	1040	1484	38	721	6658	1764
3	1210	2174	59	451	8702	2238
4	332	544	16	137	2348	591
5	279	206	10	475	1713	230
6	480	361	17	515	3268	398
7	24	24	1	21	179	27
8	45	42	2	78	364	31
	=======	=======	========	======	======	======
	3695	5326	157	2915	25332	5751

OBS	TOTDAY
1	2160
2	6912
3	8516
4	2341
5	1356
6	2361
7	135
8	239
	======
	24020

OBS	TOTNITE	UNKLITE	FOACC	ROLLACC	RORACC	HOACC	SSOACC	SSSACC
1	838	105	429	40	147	11	6	197
2	1971	298	417	38	128	97	117	150
3	2571	363	193	38	81	66	59	281
4	645	106	44	5	36	20	21	98
5	1022	50	599	37	342	17	7	90
6	1666	171	1015	91	331	70	86	35
7	87	6	12	0	9	3	7	2
8	214	22	78	5	19	7	12	4
	=======	=======	=====	=======	======	=====	======	======
	9014	1121	2787	254	1093	291	315	857

OBS	REACC	BPACC	PEDACC	ANGACC	TRNACC	ANACC	OTHACC
1	1072	45	8	485	0	59	604
2	2577	639	418	3051	8	157	1384
3	4165	337	440	3375	4	149	2262
4	909	197	134	1094	2	9	523
5	251	46	13	182	0	489	355
6	341	106	42	513	1	1115	452
7	37	11	6	73	0	39	29
8	48	11	13	43	0	177	58
	=====	=====	======	======	======	=====	======
	9400	1392	1074	8816	15	2194	5667

OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	PDO_PCT
1	ur-freeways	305	157.28	3004.79	3103	67.3
2	ur-2-lane	2336	1075.63	2358.46	9181	65.5
3	ur mul ln div	1000	287.50	2244.50	11450	63.4
4	ur mul ln un/div	374	115.89	537.69	3092	65.3
5	ru-freeways	535	830.90	2579.48	2428	64.1
6	ru-2 lane rds	4243	9795.13	2505.24	4198	67.1
7	ru-mul ln div	93	35.43	89.47	228	73.2
8	ru-mul ln un/div	300	202.90	242.27	475	73.5

OBS	INJ_PCT	FAT_PCT	ICY_PCT	DRY_PCT	WET_PCT	DAY_PCT	NIT_PCT
1	32.2	0.5	16.7	67.7	15.2	69.6	27.0
2	34.2	0.2	7.9	72.5	19.2	75.3	21.5
3	36.2	0.3	3.9	76.0	19.5	74.4	22.5
4	34.3	0.3	4.4	75.9	19.1	75.7	20.9
5	33.9	2.0	19.6	70.6	9.5	55.8	42.1
6	31.3	1.5	12.3	77.8	9.5	56.2	39.7
7	26.8	0.0	9.2	78.5	11.8	59.2	38.2
8	25.9	0.6	16.4	76.6	6.5	50.3	45.1

OBS	FIX_PCT	ROL_PCT	ROR_PCT	HO_PCT	SSO_PCT	SSS_PCT	REN_PCT
1	13.8	1.3	4.7	0.4	0.2	6.3	34.5
2	4.5	0.4	1.4	1.1	1.3	1.6	28.1
3	1.7	0.3	0.7	0.6	0.5	2.5	36.4
4	1.4	0.2	1.2	0.6	0.7	3.2	29.4
5	24.7	1.5	14.1	0.7	0.3	3.7	10.3
6	24.2	2.2	7.9	1.7	2.0	0.8	8.1
7	5.3	0.0	3.9	1.3	3.1	0.9	16.2
8	16.4	1.1	4.0	1.5	2.5	0.8	10.1

OBS	BP_PCT	PED_PCT	ANG_PCT	TRN_PCT	ANA_PCT	OTH_PCT
1	1.5	0.3	15.6	0.0	1.9	19.5
2	7.0	4.6	33.2	0.1	1.7	15.1
3	2.9	3.8	29.5	0.0	1.3	19.8
4	6.4	4.3	35.4	0.1	0.3	16.9
5	1.9	0.5	7.5	0.0	20.1	14.6
6	2.5	1.0	12.2	0.0	26.6	10.8
7	4.8	2.6	32.0	0.0	17.1	12.7
8	2.3	2.7	9.1	0.0	37.3	12.2

V

ILLINOIS 1991 ACCIDENT RATE SUMMARY BY HIGHWAY CLASSFICATION

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OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	ACC_MVMT
1	ur-freeways	1794	477.38	10213.42	15156	1.48393
2	ur-2-lane rds	10023	1645.07	6127.18	24114	3.93558
3	ur mul ln div	6856	1077.74	8757.86	41870	4.78085
4	ur mul ln un/div	2908	621.42	4321.01	24943	5.77249
5	ru-freeways	1552	1364.61	6636.25	3693	0.55649
6	ru-2 lane rds	41729	10017.01	9856.39	17590	1.78463
7	ru-mul ln div	1561	317.40	1019.61	1607	1.57609
8	ru-mul ln un/div	257	50.84	130.55	326	2.49711
		========	========	========	======	
		66680	15571.47	47062.27	129299	

OBS	PDO_MVMT	INJ_MVMT	FAT_MVMT	ICY_MVMT	DRY_MVMT	WET_MVMT	DAY_MVMT
1	1.02395	0.45274	0.007245	0.11788	1.12098	0.23596	0.91908
2	2.79150	1.13135	0.012730	0.30993	2.60299	0.94872	2.75543
3	3.38496	1.38356	0.012332	0.36664	3.29213	1.06122	3.31223
4	4.14047	1.61791	0.014117	0.41194	3.77435	1.50127	4.08539
5	0.38576	0.16410	0.006630	0.11934	0.36406	0.06660	0.25376
6	1.20125	0.55690	0.026480	0.20941	1.19811	0.32892	0.94000
7	1.07100	0.49234	0.012750	0.17261	1.12004	0.26481	0.89446
8	1.65453	0.81194	0.030639	0.30639	1.52431	0.63577	1.62389

OBS	NIT_MVMT	FIX_MVMT	ROL_MVMT	ROR_MVMT	HO_MVMT	SSO_MVMT	SSS_MVMT
1	0.56357	0.25359	0.01909	0.02056	0.004896	0.003819	0.38704
2	1.16873	0.26440	0.02611	0.05206	0.044882	0.069690	0.21511
3	1.46177	0.22848	0.01210	0.03346	0.021124	0.034255	0.40695
4	1.66975	0.31821	0.00856	0.02384	0.063411	0.089100	0.55705
5	0.30213	0.14481	0.06103	0.05259	0.002712	0.002411	0.05666
6	0.84118	0.24269	0.10278	0.12256	0.032872	0.050018	0.04667
7	0.68065	0.16477	0.06081	0.06179	0.007846	0.009808	0.10200
8	0.86556	0.24511	0.04596	0.12256	0.068939	0.076598	0.06894

OBS	REN_MVMT	BPD_MVMT	ANG_MVMT	TRN_MVMT	ANA_MVMT	OTH_MVMT
1	0.67490	0.00597	0.02918	.0000979	0.02781	0.052382
2	1.36817	0.12453	1.50852	.0022849	0.10592	0.066099
3	1.85616	0.05115	1.93369	.0009135	0.04567	0.070451
4	1.95371	0.14001	2.36750	.0013886	0.03680	0.088637
5	0.06133	0.00181	0.00693	.0000000	0.12703	0.037672
6	0.28449	0.02029	0.39436	.0012175	0.42886	0.046163
7	0.32071	0.00883	0.47077	.0009808	0.30894	0.049038
8	0.74300	0.03064	0.81194	.0000000	0.23746	0.022980

ILLINOIS 1991 ACCIDENT TOTALS BY HIGHWAY CLASSFICATION

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14:20 Tuesday, May 24, 1994

OBS	ROAD	TOTACC	PDOACC	INJACC	FATACC	INJAACC	INJBACC	INJCACC
1	ur-freeways	15156	10458	4624	74	1062	1165	2397
2	ur-2-lane rds	24114	17104	6932	78	1336	1901	3695
3	ur mul ln div	41870	29645	12117	108	2214	2992	6911

4	ur mul ln un/div	24943	17891	6991	61	1295	1844	3852
5	ru-freeways	3693	2560	1089	44	398	367	324
6	ru-2 lane rds	17590	11840	5489	261	1732	2070	1687
7	ru-mul ln div	1607	1092	502	13	160	160	182
8	ru-mul ln un/div	326	216	106	4	32	36	38
		======	======	======	======	=======	=======	=======
		129299	90806	37850	643	8229	10535	19086

OBS	SURF_OTH	TOTICY	TOTDRY	TOTWET	TOTDAY	TOTNITE	UNKLITE	FOACC	ROLLACC	RORACC
1	93	1204	11449	2410	9387	5756	13	2590	195	210
2	453	1899	15949	5813	16883	7161	70	1620	160	319
3	533	3211	28832	9294	29008	12802	60	2001	106	293
4	367	1780	16309	6487	17653	7215	75	1375	37	103
5	43	792	2416	442	1684	2005	4	961	405	349
6	475	2064	11809	3242	9265	8291	34	2392	1013	1208
7	19	176	1142	270	912	694	1	168	62	63
8	4	40	199	83	212	113	1	32	6	16
	========	======	======	======	======	=======	=======	=====	=======	======
	1987	11166	88105	28041	85004	44037	258	11139	1984	2561

OBS	HOACC	SSOACC	SSSACC	REACC	BPACC	PEDACC	ANGACC	TRNACC	ANACC	OTHACC
1	50	39	3953	6893	61	47	298	1	284	535
2	275	427	1318	8383	763	538	9243	14	649	405
3	185	300	3564	16256	448	757	16935	8	400	617
4	274	385	2407	8442	605	537	10230	6	159	383
5	18	16	376	407	12	10	46	0	843	250
6	324	493	460	2804	200	115	3887	12	4227	455
7	8	10	104	327	9	10	480	1	315	50
8	9	10	9	97	4	3	106	0	31	3
	=====	======	======	=====	=====	======	======	======	=====	======
	1143	1680	12191	43609	2102	2017	41225	42	6908	2698

OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	PDO_PCT	INJ_PCT	FAT_PCT
1	ur-freeways	1794	477.38	10213.42	15156	69.0	30.5	0.5
2	ur-2-lane rds	10023	1645.07	6127.18	24114	70.9	28.7	0.3
3	ur mul ln div	6856	1077.74	8757.86	41870	70.8	28.9	0.3
4	ur mul ln un/div	2908	621.42	4321.01	24943	71.7	28.0	0.2
5	ru-freeways	1552	1364.61	6636.25	3693	69.3	29.5	1.2
6	ru-2 lane rds	41729	10017.01	9856.39	17590	67.3	31.2	1.5
7	ru-mul ln div	1561	317.40	1019.61	1607	68.0	31.2	0.8
8	ru-mul ln un/div	257	50.84	130.55	326	66.3	32.5	1.2

OBS	ICY_PCT	DRY_PCT	WET_PCT	DAY_PCT	NIT_PCT	FIX_PCT	ROL_PCT	ROR_PCT	HO_PCT
1	7.9	75.5	15.9	61.9	38.0	17.1	1.3	1.4	0.3
2	7.9	66.1	24.1	70.0	29.7	6.7	0.7	1.3	1.1
3	7.7	68.9	22.2	69.3	30.6	4.8	0.3	0.7	0.4
4	7.1	65.4	26.0	70.8	28.9	5.5	0.1	0.4	1.1
5	21.4	65.4	12.0	45.6	54.3	26.0	11.0	9.5	0.5
6	11.7	67.1	18.4	52.7	47.1	13.6	5.8	6.9	1.8
7	11.0	71.1	16.8	56.8	43.2	10.5	3.9	3.9	0.5
8	12.3	61.0	25.5	65.0	34.7	9.8	1.8	4.9	2.8

OBS	SSO_PCT	SSS_PCT	REN_PCT	BP_PCT	PED_PCT	ANG_PCT	TRN_PCT	ANA_PCT	OTH_PCT
1	0.3	26.1	45.5	0.4	0.3	2.0	0.0	1.9	3.5
2	1.8	5.5	34.8	3.2	2.2	38.3	0.1	2.7	1.7
3	0.7	8.5	38.8	1.1	1.8	40.4	0.0	1.0	1.5

4	1.5	9.7	33.8	2.4	2.2	41.0	0.0	0.6	1.5
5	0.4	10.2	11.0	0.3	0.3	1.2	0.0	22.8	6.8
6	2.8	2.6	15.9	1.1	0.7	22.1	0.1	24.0	2.6
7	0.6	6.5	20.3	0.6	0.6	29.9	0.1	19.6	3.1
8	3.1	2.8	29.8	1.2	0.9	32.5	0.0	9.5	0.9

OBS	ROAD	TOTACC	PDOACC	INJACC	FATACC	INJAACC	INJBACC	INJCACC
1	ur-freeways	7732	5678	2035	19	82	605	1348
2	ru-freeways	1998	1462	516	20	34	212	270
3	ru-2 lane rds	14990	9604	5146	240	807	2119	2220
4	ru-ml div n/frwy	1861	1202	642	17	51	253	338
5	ru-ml und n/frwy	283	187	94	2	10	38	46
6	ur-ml div n/frwy	9915	6395	3494	26	351	1140	2003
7	ur-ml u/div n/frwy	9677	6276	3392	9	400	1113	1879
8	ur-2-lane	26269	18665	7532	72	956	2857	3719
		======	======	======	======	=======	=======	=======
		72725	49469	22851	405	2691	8337	11823

OBS	SURF_OTH	TOTICY	TOTDRY	TOTWET	TOTDAY	TOTNITE	UNKLITE	FOACC	ROLLACC	RORACC
1	176	1665	3857	2034	4954	2624	154	1519	377	166
2	60	764	876	298	973	958	67	396	401	132
3	530	2928	9018	2514	7836	6492	662	2362	1782	532
4	30	395	1075	361	1026	779	56	265	227	78
5	4	51	171	57	192	86	5	31	11	6
6	243	1174	5719	2779	6741	2949	225	581	124	84
7	353	960	5275	3089	6544	2863	270	348	21	47
8	956	5024	13660	6629	16672	8390	1207	1969	280	284
	========	======	======	======	======	=======	=======	=====	=======	======
	2352	12961	39651	17761	44938	25141	2646	7471	3223	1329

OBS	HOACC	SSOACC	SSSACC	REACC	BPACC	PEDACC	ANGACC	TRNACC	ANACC	OTHACC
1	70	41	1137	3132	94	20	343	0	200	633
2	18	6	115	267	40	2	41	0	370	210
3	383	354	770	1726	401	178	2311	44	2576	1571
4	25	16	92	228	18	7	442	1	307	155
5	4	6	22	56	14	7	69	0	14	43
6	126	70	652	3241	138	228	3228	5	233	1205
7	188	127	591	2305	411	489	3395	11	62	1682
8	692	546	1546	4231	3034	960	8353	31	693	3650
	=====	======	======	=====	=====	======	======	======	=====	======
	1506	1166	4925	15186	4150	1891	18182	92	4455	9149

OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC
1	ur-freeways	893	351.31	6919.34	7732
2	ru-freeways	384	696.80	3005.80	1998
3	ru-2 lane rds	46406	35050.41	11346.97	14990
4	ru-ml div n/frwy	3934	753.52	2055.87	1861
5	ru-ml und n/frwy	335	59.14	96.37	283
6	ur-ml div n/frwy	5344	544.83	3315.52	9915
7	ur-ml u/div n/frwy	1980	489.41	1824.46	9677
8	ur-2-lane	55407	10816.82	7210.67	26269

OBS	ROAD	NBR_SECT	NBR_MILE	MVMT	TOTACC	ACC_MVMT
1	ur-freeways	893	351.31	6919.34	7732	1.11745
2	ru-freeways	384	696.80	3005.80	1998	0.66472
3	ru-2 lane rds	46406	35050.41	11346.97	14990	1.32106
4	ru-ml div n/frwy	3934	753.52	2055.87	1861	0.90521
5	ru-ml und n/frwy	335	59.14	96.37	283	2.93659
6	ur-ml div n/frwy	5344	544.83	3315.52	9915	2.99048
7	ur-ml u/div n/frwy	1980	489.41	1824.46	9677	5.30404
8	ur-2-lane	55407	10816.82	7210.67	26269	3.64307
		========	========	========	======	
		114683	48762.24	35775.01	72725	

OBS	PDO_MVMT	INJ_MVMT	FAT_MVMT	ICY_MVMT	DRY_MVMT	WET_MVMT	DAY_MVMT
1	0.82060	0.29410	0.002746	0.24063	0.55742	0.29396	0.71596
2	0.48639	0.17167	0.006654	0.25418	0.29144	0.09914	0.32371
3	0.84639	0.45351	0.021151	0.25804	0.79475	0.22156	0.69058
4	0.58467	0.31228	0.008269	0.19213	0.52289	0.17559	0.49906
5	1.94043	0.97541	0.020753	0.52921	1.77441	0.59147	1.99232
6	1.92881	1.05383	0.007842	0.35409	1.72492	0.83818	2.03316
7	3.43992	1.85918	0.004933	0.52618	2.89127	1.69310	3.58681
8	2.58853	1.04456	0.009985	0.69675	1.89441	0.91933	2.31213

OBS	NIT_MVMT	FIX_MVMT	ROL_MVMT	ROR_MVMT	HO_MVMT	SSO_MVMT	SSS_MVMT
1	0.37923	0.21953	0.05448	0.023991	0.01012	0.005925	0.16432
2	0.31872	0.13175	0.13341	0.043915	0.00599	0.001996	0.03826
3	0.57214	0.20816	0.15705	0.046885	0.03375	0.031198	0.06786
4	0.37891	0.12890	0.11042	0.037940	0.01216	0.007783	0.04475
5	0.89239	0.32168	0.11414	0.062260	0.04151	0.062260	0.22829
6	0.88945	0.17524	0.03740	0.025335	0.03800	0.021113	0.19665
7	1.56923	0.19074	0.01151	0.025761	0.10304	0.069610	0.32393
8	1.16355	0.27307	0.03883	0.039386	0.09597	0.075721	0.21440

OBS	REN_MVMT	BPD_MVMT	ANG_MVMT	TRN_MVMT	ANA_MVMT	OTH_MVMT
1	0.45264	0.01359	0.04957	.0000000	0.02890	0.09148
2	0.08883	0.01331	0.01364	.0000000	0.12310	0.06987
3	0.15211	0.03534	0.20367	.0038777	0.22702	0.13845
4	0.11090	0.00876	0.21499	.0004864	0.14933	0.07539
5	0.58109	0.14527	0.71599	.0000000	0.14527	0.44620
6	0.97752	0.04162	0.97360	.0015081	0.07028	0.36344
7	1.26339	0.22527	1.86082	.0060292	0.03398	0.92192
8	0.58677	0.42077	1.15842	.0042992	0.09611	0.50619

OBS	PDO_PCT	INJ_PCT	FAT_PCT	ICY_PCT	DRY_PCT	WET_PCT	DAY_PCT
1	73.4	26.3	0.2	21.5	49.9	26.3	64.1
2	73.2	25.8	1.0	38.2	43.8	14.9	48.7
3	64.1	34.3	1.6	19.5	60.2	16.8	52.3
4	64.6	34.5	0.9	21.2	57.8	19.4	55.1
5	66.1	33.2	0.7	18.0	60.4	20.1	67.8
6	64.5	35.2	0.3	11.8	57.7	28.0	68.0
7	64.9	35.1	0.1	9.9	54.5	31.9	67.6
8	71.1	28.7	0.3	19.1	52.0	25.2	63.5

OBS	NIT_PCT	FIX_PCT	ROL_PCT	ROR_PCT	HO_PCT	SSO_PCT	SSS_PCT
1	33.9	19.6	4.9	2.1	0.9	0.5	14.7
2	47.9	19.8	20.1	6.6	0.9	0.3	5.8
3	43.3	15.8	11.9	3.5	2.6	2.4	5.1
4	41.9	14.2	12.2	4.2	1.3	0.9	4.9
5	30.4	11.0	3.9	2.1	1.4	2.1	7.8
6	29.7	5.9	1.3	0.8	1.3	0.7	6.6
7	29.6	3.6	0.2	0.5	1.9	1.3	6.1
8	31.9	7.5	1.1	1.1	2.6	2.1	5.9

OBS	REN_PCT	BP_PCT	PED_PCT	ANG_PCT	TRN_PCT	ANA_PCT	OTH_PCT
1	40.5	1.2	0.3	4.4	0.0	2.6	8.2
2	13.4	2.0	0.1	2.1	0.0	18.5	10.5
3	11.5	2.7	1.2	15.4	0.3	17.2	10.5
4	12.3	1.0	0.4	23.8	0.1	16.5	8.3
5	19.8	4.9	2.5	24.4	0.0	4.9	15.2
6	32.7	1.4	2.3	32.6	0.1	2.3	12.2
7	23.8	4.2	5.1	35.1	0.1	0.6	17.4
8	16.1	11.5	3.7	31.8	0.1	2.6	13.9

APPENDIX C

MICHIGAN CORRESPONDENCE AND CRASH RATE INFORMATION

STATE OF MICHIGAN

TRANSPORTATION COMMISSION
BARTON W LA BELLE
RICHARD T WHITE
ROBERT M ANDREWS
JACK L GINGRASS
JOHN C KENNEDY
IRVING J RUBIN
LH 0-0 (3/93)

JOHN ENGLER, GOVERNOR

DEPARTMENT OF TRANSPORTATION

TRANSPORTATION BUILDING, 425 WEST OTTAWA POST OFFICE BOX 30050, LANSING, MICHIGAN 48909
PHONE (517) 373-2090 TDD (517) 373-0012 FAX (517) 373-0167

PATRICK M. NOWAK, DIRECTOR

November 22, 1993

Charles Zegeer
Highway Safety Research Center
The University of North Carolina
123½ East Franklin Street CB 3430
Chapel Hill, North Carolina 27599-3430

File: 38-1-2

Dear Charlie,

As you requested, I compared the accident rates you calculated with our own 1991 rate tables. The enclosed table compares the two sets of rates. Bar charts of our rates are also enclosed.

With the excepts of the freeway and rural divided rates, your rates are just a few percentage points higher than ours. Those small differences could be explained if your rates are based on years before 1991, since the accident count decreased 8 percent between 1990 and 1991.

We find considerable differences in rates within the urban roadway type for different numbers of lanes:

Roadway Type	Length in miles	Acc/100 MVM
Urban Freeway		
4 Lane	164.0	163
6 Lane	179.6	335
8 Lane	60.4	332
Urban Divided		
4 Lane	80.5	514
6 Lane	29.0	602
8 Lane	68.5	519
Urban Multi-Lane		
3 Lane	36.8	698
4 Lane	290.0	814
5 Lane	233.5	853
6 Lane	9.9	512
7 Lane	43.1	953
9 Lane	9.8	1,190

For the Urban Multi-Lane highways, most of the odd-number laneage roads include a two-way center lane for left turns. There aren't corresponding dramatic differences by laneage for other roadway types.

Even with our rates, Michigan has much higher rates than do the other states, except for rural freeways and rural divided (our rate is lower than Utah's). I wonder if this could be due in part to the level of reporting. Michigan's property damage threshold is quite low: $200 through 1991; $400 beginning in 1992. Our trunkline accident rates are inflated about five percent because the trunkline accident count includes accidents that occurred on crossroads within 100 feet of a trunkline.

Also enclosed is a map of Michigan's permanent traffic recorder locations, as requested, with a printed list of the stations' Control Sections and Milepoints.

Sincerely,

Donald J. Mercer
Supervising Engineer
Modeling & Analysis Subunit

enclosure

Michigan Trunkline Accident Rates, 1991

Route Class	Number of Accidents				Miles	Accidents	UNC-HSRC Values	
	Fatal	Pers Inj	PDO	Total	of Road	per 100 MVM	Acc/MVM	Difference from MDOT
RURAL								
Freeway	62	2,834	9,957	12,853	1,428.3	117	1.3	11% Higher
Divided	19	852	2,420	3,291	225.0	237	2.7	14% Higher
One-way	0	13	41	54	1.9			
Multi-Lane Undivided	19	1,041	2,484	3,544	171.3	429	4.4	3% Higher
2 Lane Undivided	159	4,881	20,537	25,577	5,765.8	297	3.1	4% Higher
TOTAL	**259**	**9,621**	**35,439**	**45,319**	**7,592.3**	**208**		
URBAN								
Freeway	55	5,739	13,860	19,654	424.3	275	1.8	35% Lower
Divided	41	4,608	10,921	15,570	198.0	538	5.8	8% Higher
One-way	4	1,161	4,131	5,296	108.7	746		
Multi-Lane Undivided	91	10,281	26,120	36,492	623.1	831	8.7	5% Higher
2 Lane Undivided	36	2,057	6,576	8,669	666.3	506	5.4	7% Higher
TOTAL	**227**	**23,846**	**61,608**	**85,681**	**2,020.4**	**509**		
TRUNKLINE TOTAL	**486**	**33,467**	**97,047**	**131,000**	**9,612.7**	**339**		

Notes

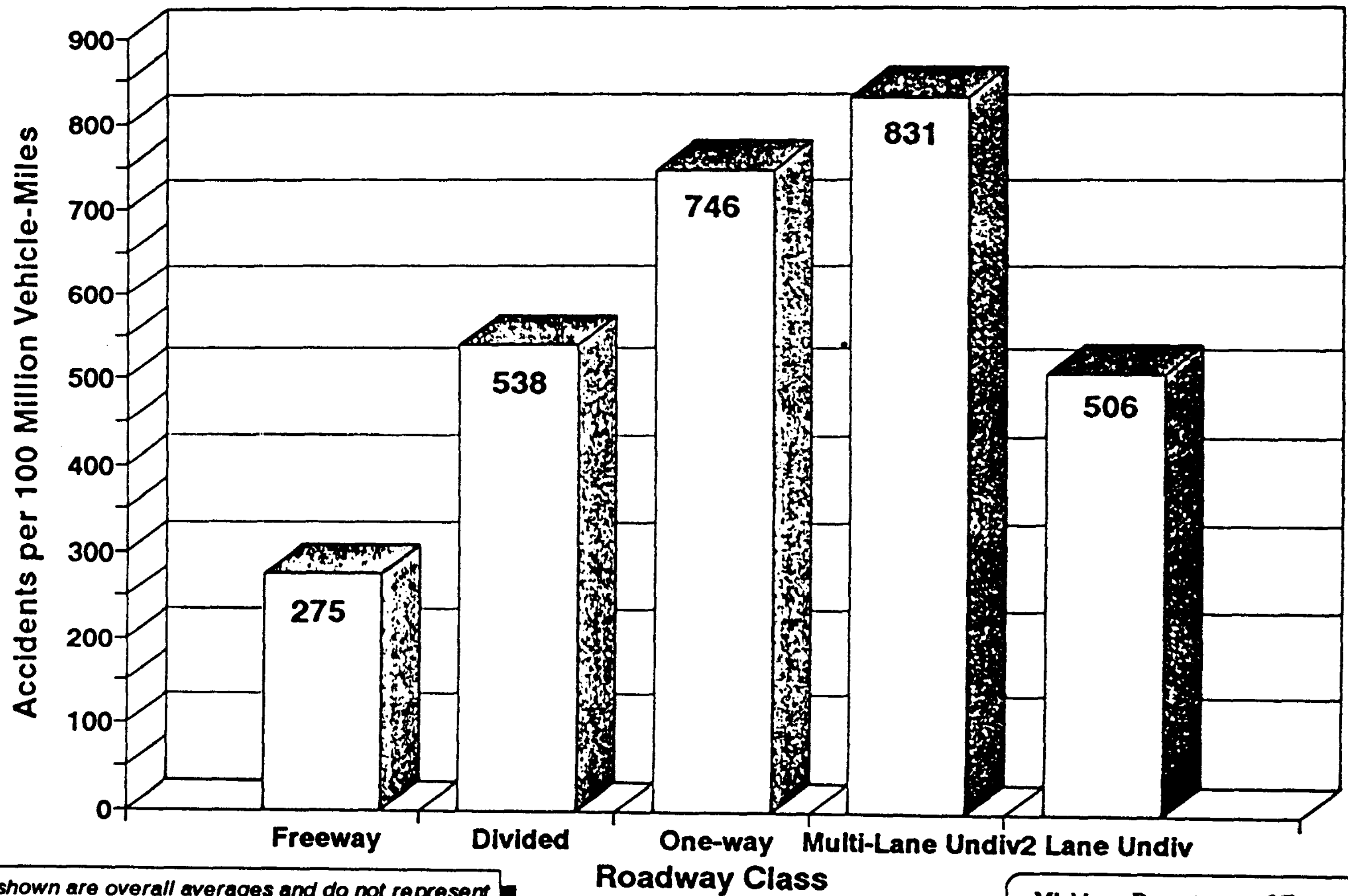
(1) Rates are in accidents per 100-million vehicle-miles.

(2) Table excludes routes for which the roadway class or traffic volume is not in file.

(3) Accident rates shown are overall weighted averages and do not represent the expect rates at specific locations. The rate at a specific location typically varies considerably from the overall average rate.

Michigan Department of Transportation
Traffic and Safety Division

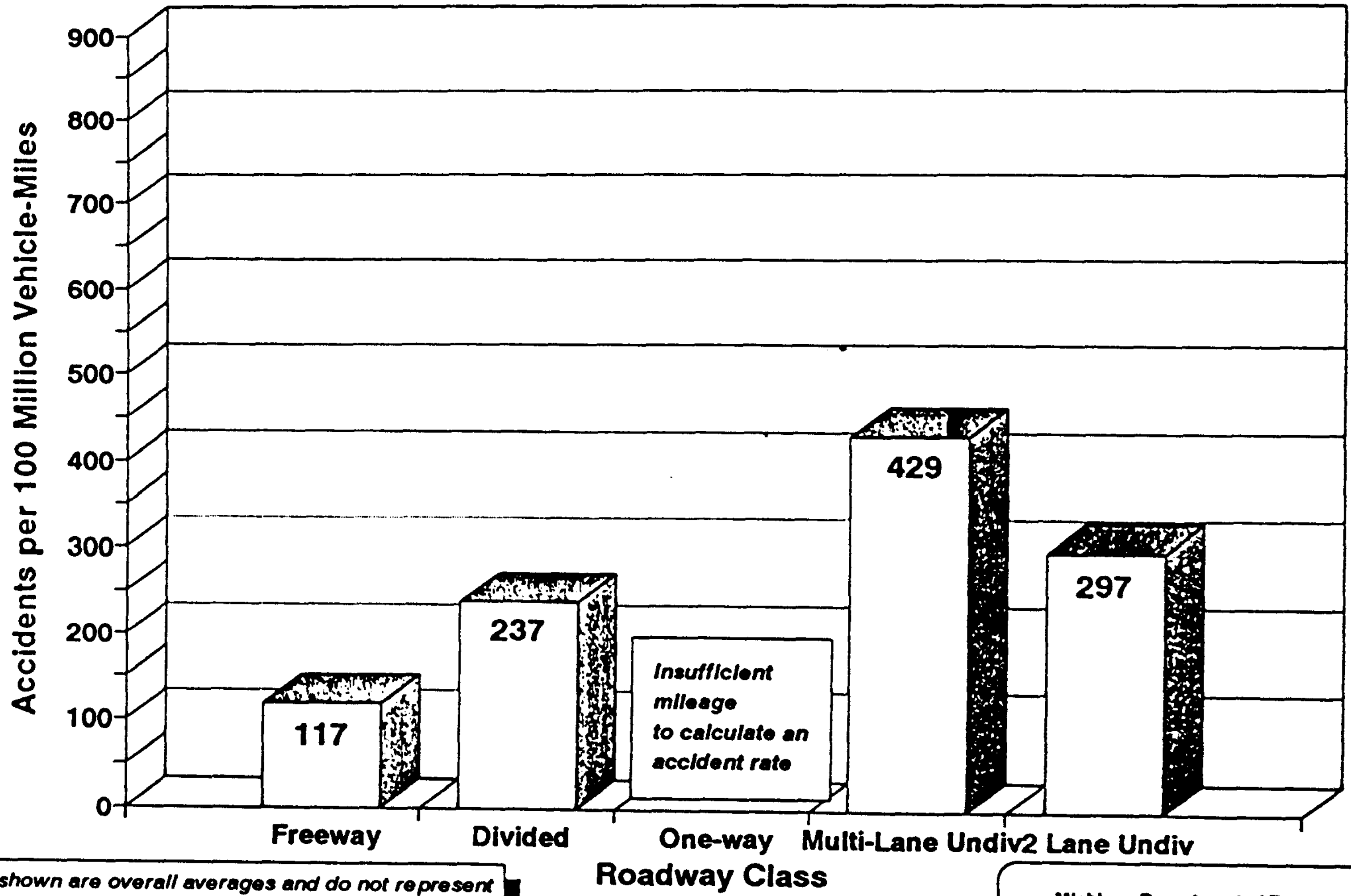
Michigan Traffic Accident Rates
Urban Trunkline Highways, 1991



Rates shown are overall averages and do not represent the expected rates at specific locations.

Michigan Department of Transportation
Traffic and Safety Division

Michigan Traffic Accident Rates
Rural Trunkline Highways, 1991



Rates shown are overall averages and do not represent the expected rates at specific locations.

Michigan Department of Transportation
Traffic and Safety Division

APPENDIX D

EXAMPLE OF INITIAL DATA PROBLEM ON ROUTE 336 IN ILLINOIS

ROUTE 336 BY CATAGORY

OBS	ROAD		S_RTENBR	BEGIN	END	DIR_OPERS	NBR_LNS	URB_AREA	MED_TYPE	ADT	ACC_CNTL	FUNC_CLS	SEC_LNGT
1	unknown		336	0.00	1.60	2	2	0	1	4850	2	30	1.60
2	ru-freeways		336	1.60	1.80	2	4	0	1	4850	2	30	0.20
3	ru-freeways		336	1.80	1.83	2	4	0	1	3300	2	30	0.03
4	ru-freeways		336	1.83	1.87	2	4	0	1	3300	2	30	0.04
5	ru-freeways		336	2.27	2.29	2	4	0	1	2375	2	30	0.02
6	ru-freeways		336	2.29	2.35	2	4	0	1	2375	2	30	0.06
7	ru-freeways		336	2.33	7.90	2	4	0	1	3000	2	30	5.57
8	ru-freeways		336	7.90	9.22	2	4	0	1	3000	2	30	1.32
9	ru-freeways		336	9.16	9.28	2	4	0	1	2575	2	30	0.12
10	ru-freeways		336	9.22	9.64	2	4	0	1	2150	2	30	0.42
11	ru-2 lane rds		336	9.64	9.92	2	2	0	0	2150	0	30	0.28
12	ru-2 lane rds		336	9.92	9.95	2	2	0	0	2450	0	30	0.03
13	ru-2 lane rds		336	9.95	10.50	2	2	0	0	2750	0	30	0.55
14	ru-freeways		336	10.45	10.79	2	4	0	1	2750	2	30	0.34
15	ru-2 lane rds		336	10.50	10.84	2	2	0	0	2750	0	30	0.34
16	ru-freeways		336	10.83	11.05	2	4	0	1	2750	2	30	0.22
17	ru-2 lane rds		336	10.84	11.07	2	2	0	0	2750	0	30	0.23
18	ru-freeways		336	10.85	11.07	2	4	0	1	2750	2	30	0.22
19	ru-2 lane rds		336	11.07	11.49	2	2	0	0	2750	0	30	0.42
20	ru-freeways		336	11.42	11.90	2	4	0	1	2750	2	30	0.48
21	ru-2 lane rds		336	11.49	12.85	2	2	0	0	2750	0	30	1.36
22	ru-freeways		336	11.95	13.15	2	4	0	1	2750	2	30	1.20
23	ru-2 lane rds		336	12.85	13.20	2	2	0	0	2750	0	30	0.35
24	ru-2 lane rds		336	13.20	13.22	2	2	0	0	1750	0	30	0.02
25	ru-2 lane rds		336	13.22	13.59	2	2	0	0	750	0	30	0.37
26	ru-freeways		336	13.54	13.82	2	4	0	1	750	2	30	0.28
27	ru-2 lane rds		336	13.59	13.87	2	2	0	0	750	0	30	0.28
28	ru-2 lane rds		336	13.87	13.89	2	2	0	0	2450	0	30	0.02
29	ru-2 lane rds		336	13.89	13.90	2	2	0	0	2450	0	30	0.01
30	ru-2 lane rds		336	13.90	14.51	2	2	0	0	4150	0	30	0.61
31	ru-freeways		336	14.05	14.51	2	4	0	1	4150	2	30	0.46
32	ru-2 lane rds		336	14.51	14.66	2	2	0	0	3475	0	30	0.15
33	ru-freeways		336	14.61	14.90	2	4	0	1	2775	2	30	0.29
34	ru-2 lane rds		336	14.66	15.02	2	2	0	0	2775	0	30	0.36
35	ru-freeways		336	14.95	15.14	2	4	0	1	2775	2	30	0.19
36	ru-2 lane rds		336	15.02	15.21	2	2	0	0	2775	0	30	0.19
37	ru-2 lane rds		336	15.21	15.26	2	2	0	0	3150	0	30	0.05
38	ru-2 lane rds		336	15.26	15.64	2	2	0	0	3550	0	30	0.38
39	ru-freeways		336	15.53	15.64	2	4	0	1	3550	2	30	0.11
40	ru-2 lane rds		336	15.64	16.31	2	2	0	0	3550	0	30	0.67
41	ru-freeways		336	15.99	16.31	2	4	0	1	3550	2	30	0.32
42	ru-2 lane rds		336	16.31	16.77	2	2	0	0	3550	0	30	0.46
43	ru-freeways		336	16.72	16.94	2	4	0	1	3550	2	30	0.22
44	ru-2 lane rds		336	16.77	17.14	2	2	0	0	3550	0	30	0.37
45	ru-freeways		336	17.09	17.46	2	4	0	1	3550	2	30	0.37
46	ru-2 lane rds		336	17.14	18.32	2	2	0	0	3550	0	30	1.18
47	ru-freeways		336	17.51	18.32	2	4	0	1	3550	2	30	0.81
48	ru-2 lane rds		336	18.32	18.39	2	2	0	0	3550	0	30	0.07
49	unknown	0	336	18.39	68.66	1	1	0	0	1600	2	30	50.27
50	unknown	0	336	68.66	68.71	1	1	0	0	1600	2	30	0.05