Driver Age and Highway Safety

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ABSTRACT

A data base of more than 50,000 police-reported accidents on Michigan Interstate and trunkline highways in 1982 and an accident surrogate exposure method were used in an investigation of the relationship among driver characteristics, vehicle size, and relative accident involvement. The relationship between driver age and accident involvement was strong regardless of the vehicle weight category, with younger and older drivers involved more often. The relationship is strong for urban areas, but a strong trend is not evident in a rural driving environment. Different accident types revealed slightly different U-shaped curves, possibly demonstrating a sensitivity of driver age to the urban driving task.

The results of a part of a major research project are presented in this paper. The objective of the project was to identify and quantify the impact of vehicle size on the relative safety of various roadway geometric features. The research was conducted in four stages. The first stage was an investigation of available exposure methods for predicting expected accident frequency. The second stage was the investigation of the relationship between vehicle size and geometric design. The third stage was an analysis of the probability of injury in a highway accident as a function of vehicle size. Project results from these stages were presented at the 64th Annual Meeting of the TRB (1). The last stage was the investigation of the relationship between driver characteristics and vehicle size and is the subject of this paper.

Data used in this study are from police-reported accidents that occurred in Michigan in 1982. The Michigan Department of State Police keeps data on all reported accidents, and the Michigan Department of Transportation keeps data for those accidents that occur on the Interstate and trunkline systems. For this research, the vehicle identification number (VIN) of each vehicle involved in each accident was obtained from the Michigan State Police accident file and other accident information was obtained from the Michigan Department of Transportation. Thus only accidents that occurred on the Michigan Interstate and trunkline systems in 1982 were studied.

In 1982, 101,663 accidents were reported on these systems. Of this total, only accidents involving at least one passenger vehicle were analyzed, and accidents involving trucks or motorcycles were discarded. In Michigan, accident reports identify vehicle one (VEH 1) as the vehicle responsible for the accident and vehicle two (VEH 2) as the vehicle involved in but not responsible for an accident. A total of 77,306 accidents involved an automobile as VEH 1 and 55,978 accidents involved an automobile as VEH 2. Although some accidents involve more than two vehicles, only VEH 1 and VEH 2 were considered in this study. Single-automobile accidents are counted as VEH 1 accidents.

Processing the VINs by a program called VINDICATOR 83 provided vehicle characteristic data on 51,470 automobiles identified as VEH 1 and 38,284 automobiles identified as VEH 2.

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ESTIMATION OF EXPOSURE

Many accident and roadway geometric data files contain annual daily traffic (ADT) volumes. ADTs are a traditional means of estimating relative exposure. The underlying assumption is that the probability of an accident on a given highway segment is directly related to the number of vehicles traversing that segment. For this project a similar estimate of exposure was needed for each category of vehicle size and driver characteristic. Those volume data do not exist.

Several alternatives for estimating exposure rates were investigated including vehicle registration files, odometer readings on used cars, and an accident surrogate. The use of odometer readings on used cars was not pursued because the required labor was excessive and data acquired in this manner are probably biased against new vehicles.

The accident surrogate method was pursued. This method had been used in previous research, as was shown by Kuroda, Maleck, and Taylor in the previous work on this project. On the Michigan Department of State Police traffic accident reports, the investigating officer is instructed to use the VEH 1 position on the accident form for the vehicle and driver most responsible for initiating the accident. The VEH 2 position is used for pedestrians, bicyclists, and other motor vehicles. Assuming that the reports are properly completed, the second vehicle is often an innocent victim. For example, a vehicle that entered a signalized intersection during the green interval and that was hit by a vehicle from the crossroad (violating a red interval) would be categorized as VEH 2. It could be hypothesized that

1. The likelihood of a vehicle being an object (the second vehicle) of an accident is proportional to the exposure of that vehicle.
2. The likelihood of a vehicle being the object of an accident is equal to the likelihood of another vehicle being the object if the exposure of the two vehicles is the same.

These hypotheses imply that the number of VEH 2 accidents should be proportional to the exposure of any class of automobile or driver. This exposure

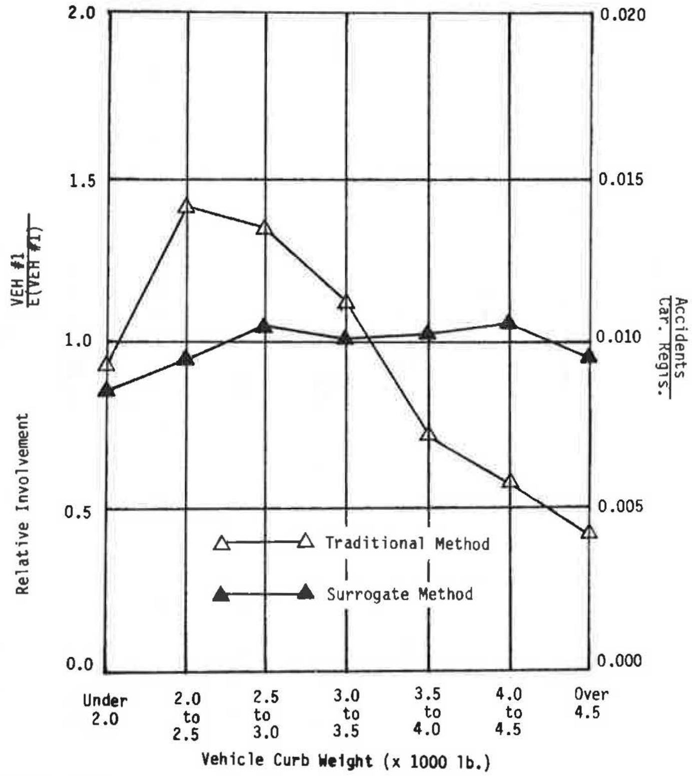

FIGURE 1 Prediction of accident involvement with different exposure methods.

approach permits an estimate of the exposure of various classes of automobiles or drivers if the accident data are available.

Figure 1 shows frequencies of VEH 1 accidents as a function of vehicle size for the 1982 Michigan accident sample. The more traditional method of using the registration distribution as the denominator produces the open triangle graph. The surrogate method of using the VEH 2 distribution as the denominator produces the solid triangle graph. The values plotted are the ratios of the observed frequency of VEH 1 accidents divided by the expected frequency of VEH 1 accidents commensurate with the assumed exposure. If the exposure measure were perfect (without bias), the line would fall along the 1.0 horizontal axis. It is apparent that the surrogate exposure method has less bias than the registration method.

DRIVER CHARACTERISTICS

After completion of the investigation of the relationship of accident involvement, vehicle characteristics, and highway geometry, a brief investigation was conducted of driver characteristics using the accident surrogate exposure method.

The relative involvement of drivers in accidents as a function of age and vehicle weight is given in Table 1. A strong relationship between driver age and weight of vehicle is not readily apparent. However, the age of the driver appears to affect the relative involvement in accidents for all vehicle weight classes. Thus a further inspection of driver age in relation to various types of accidents was conducted.

The relative involvement in injury and fatal accidents as a function of driver age is shown in Figure 2. A steady decline in relative involvement for both accident types is evident to age 30 or 34 with little change from age 30 until age 54. There is a sharp increase in relative involvement for the oldest age group.

Figure 3 shows relative accident involvement by driver age for accidents that occur in both urban and rural environments. A distinct difference can be seen between the curves. There is a gradual but con-

TABLE 1 Relative Accident Involvement by Driver Age and Vehicle Weight

Age of Driver (years)	Weight of Vehicle (lb)							Average for All Vehicle Weights[a]
	<2,000	2,000-2,499	2,500-2,999	3,000-3,499	3,500-3,999	4,000-4,499	>4,500	
0-24	1.12	1.12	1.15	1.18	1.23	1.23	1.16	1.18
25-34	0.79	0.87	0.92	0.88	0.90	1.00	1.11	1.00
35-44	0.82	0.80	0.85	0.86	0.88	0.91	0.88	0.86
45-54	0.75	0.72	0.81	0.89	0.88	0.97	0.76	0.85
55-64	0.91	0.90	0.87	0.90	0.92	1.01	0.87	0.92
≥65	1.45	1.17	1.23	1.20	1.28	1.31	1.12	1.24
Average for drivers of all ages[a]	0.93	0.94	1.00	1.00	1.02	1.08	0.98	

[a]Averages are affected by variations in sample sizes.

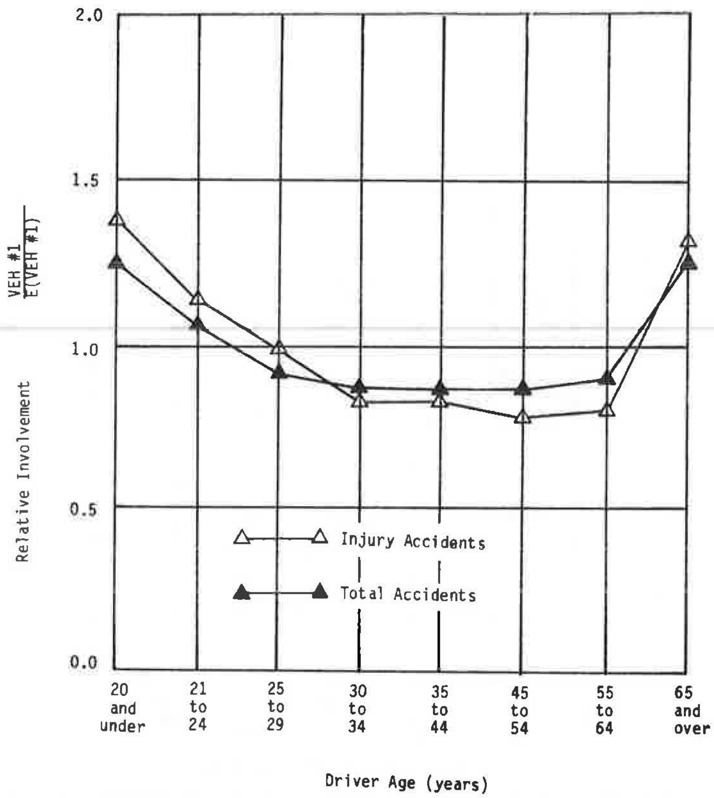

FIGURE 2 Relative accident involvement by driver age for total and injury accidents.

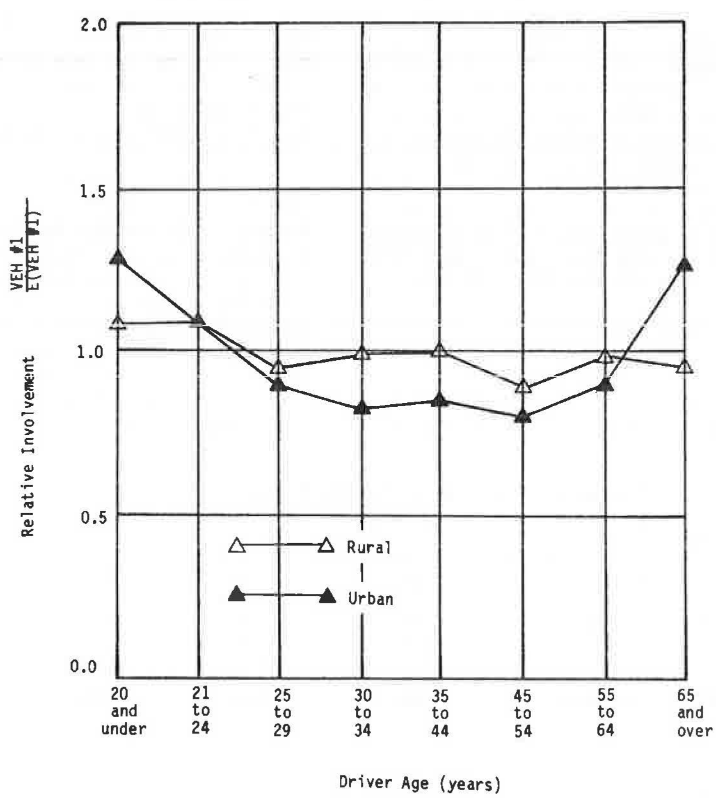

FIGURE 3 Relative accident involvement by driver age for urban and rural accidents.

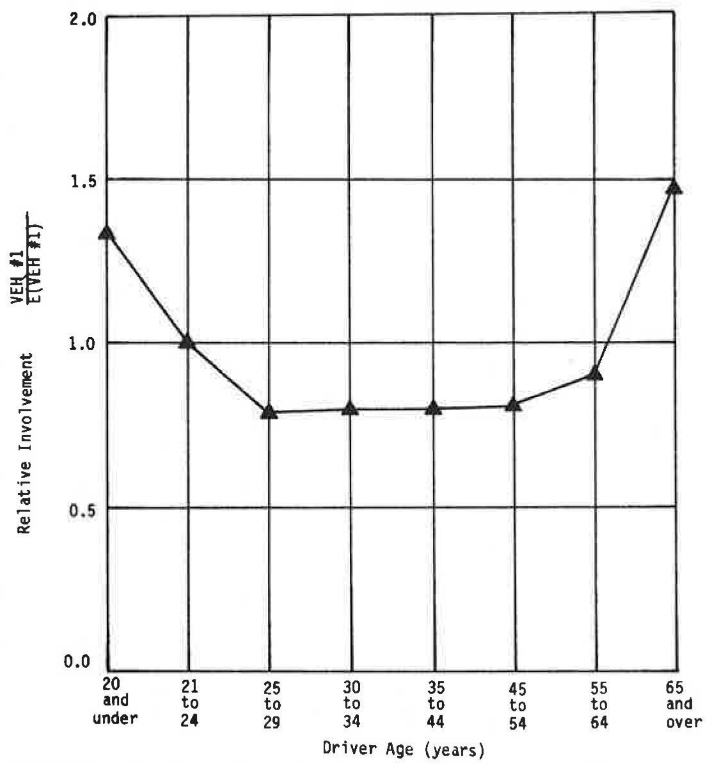

FIGURE 4 Relative accident involvement by driver age for right-angle accidents.

sistent decrease in rural accident involvement with increasing driver age. In contrast, there is a U-shaped curve for accidents in urban areas, with younger and older drivers overrepresented.

Figures 4-8 show the relative involvement of drivers (by age group) in right-angle, rear-end, left-turn, parking-backing, and head-on accidents, respectively. Strong U-shaped relationships appear for each accident type. These patterns are probably influenced by the trend noted for urban accidents. The differences between the curves may show that the driving tasks associated with these types of acci-

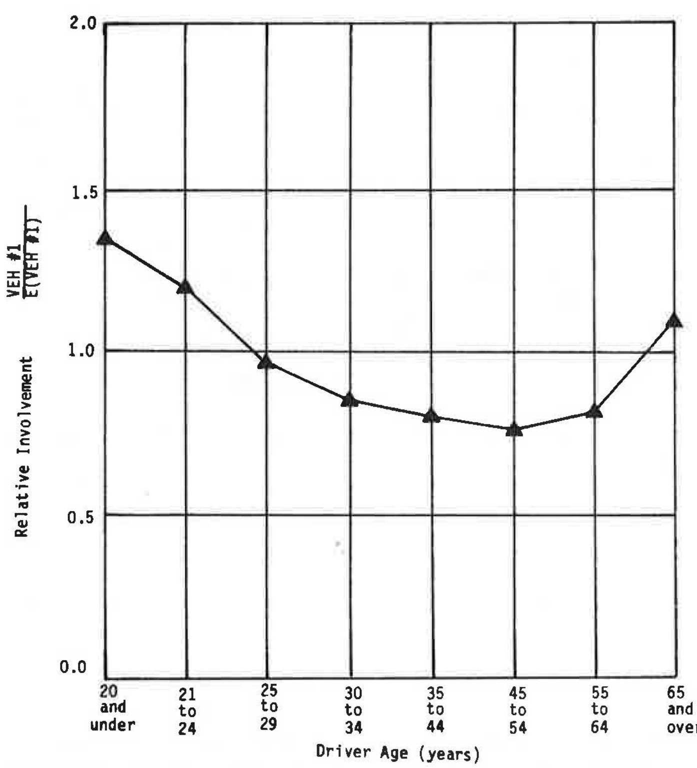

FIGURE 5 Relative accident involvement by driver age for rear-end accidents.

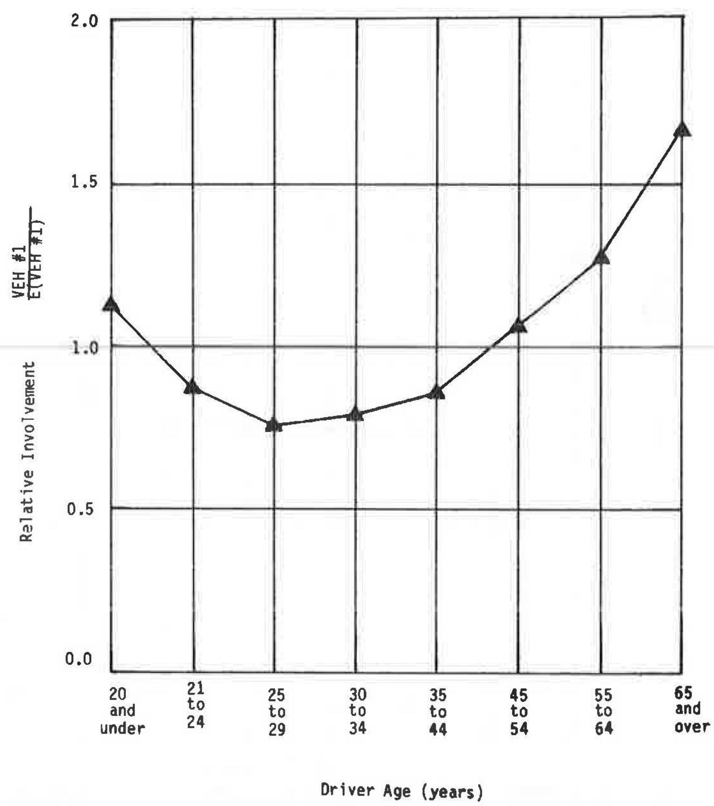

FIGURE 6 Relative accident involvement by driver age for left-turn accidents.

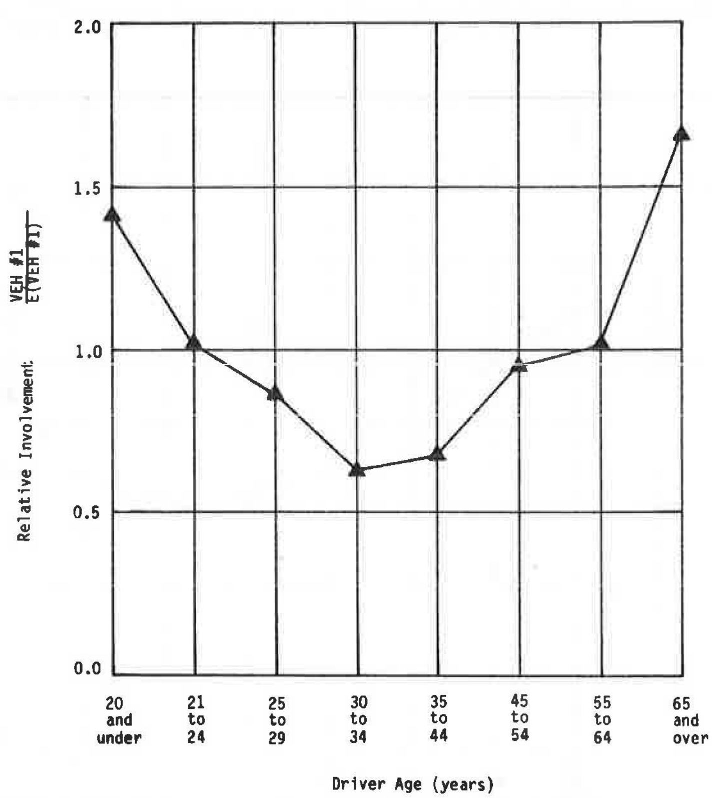

FIGURE 7 Relative accident involvement by driver age for parking-backing accidents.

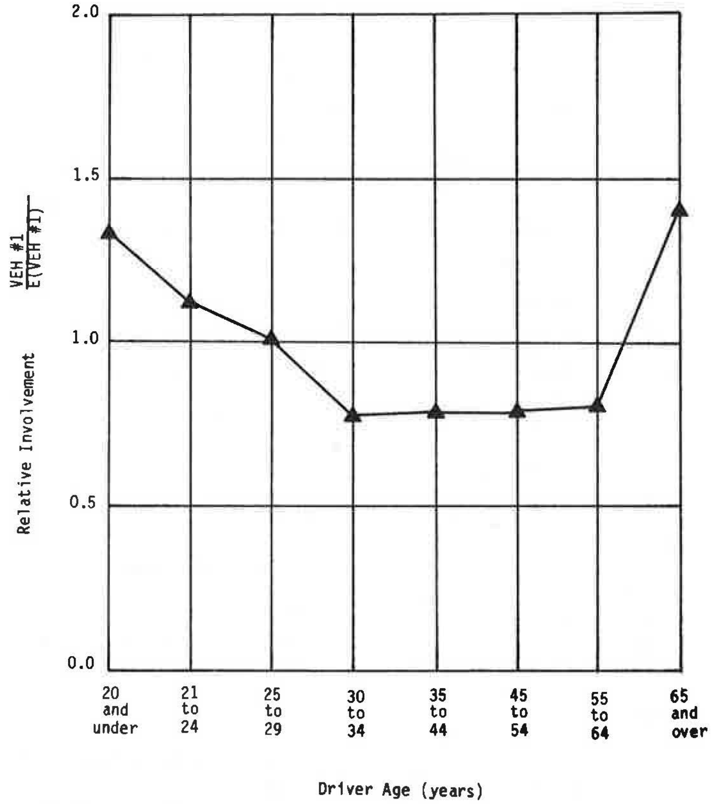

FIGURE 8 Relative accident involvement by driver age for head-on accidents.

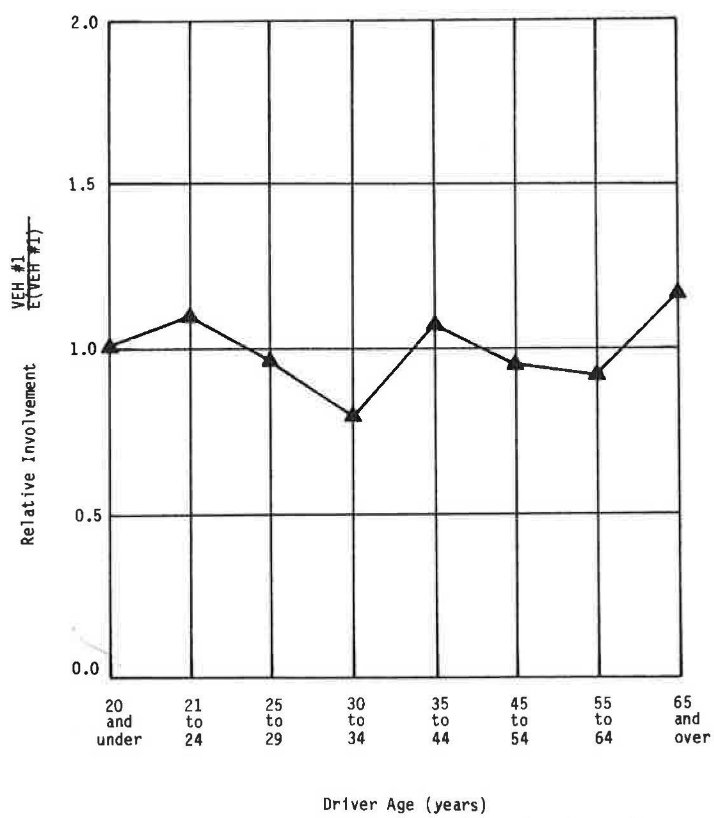

FIGURE 9 Relative involvement by driver age for pedestrian-cyclist accidents.

dents are more sensitive to driver age than is generally believed. For instance, Figure 5 shows that there is a steady decline in relative involvement in rear-end accidents with increasing age to ages 45 to 54 years and only a small rise in relative involvement for drivers older than 55 years. This curve may be attributed to several factors associated with rear-end accidents such as anticipatory skills or excessive speed. However, Figure 6 shows that there is a steady rise in relative involvement with age in left-turn accidents from ages 25 to 29 years, perhaps showing the effects of deteriorating skills associated with left-turn movements.

Figure 9 shows the relationship between driver age and relative involvement in pedestrian-cyclist accidents. The U-shaped pattern witnessed for other accident types is not evident for pedestrian-cyclist accidents. This finding may be due to the relatively small sample size for this accident type--approximately 500 pedestrian-cyclist accidents were in the total sample, as opposed to more than 1,100 head-on accidents and between 3,000 and 10,000 accidents of other types. The flat curve for pedestrian-cyclist accidents may also lend support to the general conclusion that the major fault of most such accidents does not lie with the automobile driver.

Further analysis of these trends is desirable. However, with the available accident sample, the other accident types, subcategories of accident types (i.e., urban left-turn accidents), and smaller ranges of driver age that would have helped clarify the emerging trends were not analyzed because of small sample sizes.

CONCLUSIONS

The relationship between driver age and relative involvement in accidents appears very strong in urban driving conditions, with younger and older drivers more heavily involved. Conversely, a strong trend is not evident in a rural driving environment. Although similar U-shaped curves resulted for several accident types from the available data, differences did arise that show the probable influence of the driving task on accident involvement. There were not sufficient data to investigate further categories of accident type and driver age and clarify these differences, however.

ACKNOWLEDGMENT

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REFERENCE

1. K. Kuroda, W.C. Taylor, and T.L. Maleck. Impact of Vehicle Size on Highway Safety. Presented at 64th Annual Meeting of the Transportation Research Board, Washington, D.C., 1985.

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