Optimal Speed Limits for School Buses on Virginia's Highways

JACK D. JERNIGAN AND CHERYL W. LYNN

On Virginia's rural Interstate highways, there is a three-tiered speed limit: 45 mph for school buses, 55 mph for trucks, and 65 mph for other vehicles. On urban Interstate highways, school buses are restricted to 45 mph, but other traffic has a 55-mph speed limit. Speed theory suggests that restricting school buses to slower speeds will limit the potential severity of accidents that occur but that slower speeds may increase the probability that a school bus will become involved in a crash with a faster-moving vehicle. Forty-one states allow school buses to travel at least 55 mph on the Interstate highway system; 22 states allow school buses to travel 65 mph on rural Interstate highways. Surveys of school administrators, school bus drivers, and other interested groups indicated that a majority favor raising the speed limits for school buses to 55 mph on the rural Interstate highway system but retaining the 45-mph maximum limit on urban Interstate highways and on other systems. In 4 years there were only 17 school bus crashes on Virginia's Interstate highways, which resulted in only six injuries and no fatalities. These crashes were not attributable to the difference in speed limits or to collisions between heavy trucks and school buses. In addition, because Virginia's school buses are equipped with a speed governor that limits the maximum speed of the bus, a higher speed limit would require raising the speed allowed by the governor, which could have a deleterious effect on school bus safety on the primary and secondary systems. Thus, it was concluded that there are no compelling reasons for Virginia to raise the maximum speed limits for school buses from 45 mph and that there are reasons that caution against raising the speed limit.

On July 1, 1988, the maximum speed limit for passenger vehicles on Virginia's rural Interstate highway system was raised to 65 mph. One year later the speed limit for commercial buses (except those used as school buses) was also raised to 65 mph. The speed limits for trucks and school buses on rural Interstate highways remained unchanged, thereby resulting in a three-tiered speed limit for Virginia's rural Interstate highways: 45 mph for school buses, 55 mph for trucks, and 65 mph for other vehicles.

These changes generated some concern within the pupil transportation community that the new speed limit for passenger vehicles and commercial buses might place school buses at increased risk for accidents. Theory and traffic engineering research suggest that (a) the absolute speed at which a vehicle travels is directly related to the severity of an accident involving the vehicle and (b) the variance and distribution of the speeds of vehicles traveling on a given roadway are related to the likelihood of an accident occurring.

These relationships between speed and accidents create the presumption that the adoption of the higher speed limit could have increased the likelihood of crashes occurring between school buses and other vehicles. Officials within the Virginia Department of Education were sufficiently concerned about this possibility that they requested that a study of the effect of speed limit changes on school bus accident potential be conducted.

Although there are many possible criteria by which to assess the impact of changes in speed limits—such as convenience, economic benefits and costs associated with the resulting savings in time, and public opinion—the overriding consideration was that the optimal level of safety for students traveling in school buses be ensured. Thus, safety was the primary criterion used to assess whether school bus speed limits should be changed.

Because the safety record of school buses on Interstate highways is extraordinarily good, a conservative approach to investigating the speed limit question was adopted. Thus, compelling reasons for change would have to be indicated before any such recommendation would be made.

METHODOLOGY

An initial step in assessing Virginia's multitiered speed limits was to determine whether other states had established speed limits for school buses that were lower than those for other vehicles. Although 17 states regulate speed limits for school buses by statute, many others have provisions that allow restrictions on speed limits for school buses to be established by administrative regulation initiated by the agency responsible for overseeing student transportation in the state. It was decided that the best way to obtain comprehensive information about administrative rules was to survey the various agencies responsible for overseeing student transportation.

There is a consensus in the literature that stopping distances and crash severity are directly related to increases in travel speeds. Crash probability, however, is generally considered to be related to speed variance and the distribution of travel speeds on a given roadway. In the discussion of speed and speed variance, an analysis of the literature on crash probability and crash severity is provided, along with a description of how these issues relate to the question of establishing speed limit differentials.

In an attempt to measure the level of compliance by school buses with the 45-mph maximum speed limit, a speed survey of school buses traveling on Virginia's Interstate highways was conducted during morning and afternoon hours in the spring of 1989—hours when school buses were likely to be transporting students to and from school or special activities

Virginia Transportation Research Council, Box 3817 University Station, Charlottesville, Va. 22903-0817.

such as sporting events. A vehicle equipped with a properly calibrated speedometer followed school buses that were traveling on Interstate highways in various regions of the commonwealth. The sections of Interstate highways to be surveyed were chosen after conversations with Virginia Department of State Police division commanders, who identified general areas where school buses traveled on Interstate highways in their division's jurisdiction. The survey vehicle, which was positioned near the onramp to the Interstate highway, paced the school bus after both vehicles were up to speed. While the school bus was paced, characteristics of the bus—such as its size, whether it was loaded, and its school division—were noted. The speed traveled by the bus was measured many times between on- and offramps, and the average of these measurements was used to estimate the speed of the bus.

A recent report on school bus safety (*1*) included an extensive analysis of fatal crashes in which school buses were involved during 1982–1986. Detailed descriptions of each crash in which there was an in-bus fatality were used to analyze how the travel speeds of school buses may have been related to the crashes or their severity. Likewise, data on all crashes in Virginia involving school buses for the academic years 1985–1986 through 1987–1988 were analyzed to determine whether travel speeds of school buses were related to the crashes or their severity.

Finally, three groups (pupil transportation administrators, school bus drivers, and police agencies and other special interest groups) were surveyed. Each group was queried concerning school bus speed limits. The groups were asked several questions in common, along with a number of questions specific to their own interests and expertise.

ANALYSIS

Laws and Policies of the 50 States

Twenty-two states allow school buses to travel 65 mph on rural Interstate highways, and one state allows them to travel 60 mph. Eighteen states have established a 55-mph maximum speed limit for school buses, which represents a speed limit differential in 12 of these states. The remaining nine states have a speed limit differential for school buses. Four states allow school buses to travel 50 mph, four states allow them to travel 45 mph, and one state allows them to travel 35 mph.

In all, 28 states treat school buses the same as any other type of vehicle, and 22 have special provisions that establish a speed limit differential for school buses. Virginia is among the five states with maximum speed limits of 45 mph or less for school buses. Furthermore, Virginia and North Carolina are the only states that limit school bus speeds to 20 mph below that of most other traffic on rural Interstate highways.

Speed and Speed Variance

Many of the arguments that were made for and against differential speed limits for trucks may also apply to school buses. There are special considerations for school buses, however. Handling characteristics and occupant protection standards are different for school buses, thus affecting their crash and injury potential. These vehicles also carry students, whose lives have been entrusted to the schools. Another limitation of the comparison is that, in Virginia, the speed limit differential for school buses is sometimes 20 mph, not 10 mph as it is for trucks. Despite these differences, the truck differential analogy is useful in considering the school bus speed differential.

In the 1950s and 1960s, the use of differential speed limits was widespread in the United States, especially along the East Coast. At one time, more than half the eastern states had a differential speed limit for trucks. Virginia also has a history of establishing a differential maximum speed limit for passenger vehicles and for larger and heavier vehicles. In 1938, Virginia's first truck differential limit was imposed. The speed limit was set at 55 mph for passenger vehicles, 45 mph for trucks, and 35 mph for school buses.

The rationale on which the use of a speed differential is often based is that, if the speed for a class of vehicle is lowered, such vehicles are less likely to be involved in accidents, thereby resulting in improved traffic safety. The assumption is that the class of vehicle assigned the lower speed limit is associated with a lower level of safety when traveling at the speed assigned to other traffic. It remains to be determined whether this assumption is valid.

Although this assumption is based on the further assumption that differential speed limits reduce accident probability, previous research and accident experience have shown that this assumption is not valid. The speed that a vehicle travels is not correlated with the likelihood that it will be involved in an accident. Rather, speed is related to the severity of the accidents that occur. As the speed a vehicle travels increases, the severity of any crash involving the vehicle also increases, especially at speeds in excess of 60 mph (*2*). This assumption makes sense because the higher the speed traveled, the higher the energy that must be absorbed by the occupants and the vehicle in a collision. In fact, a 20 percent increase in speed from 50 to 60 mph results in a 44 percent increase in the kinetic energy that must be absorbed, thus dramatically increasing the severity of the consequences of an accident (*3*).

One factor that seems to affect the probability of a crash occurring is the speed of the vehicle in relation to the speed of all other vehicles on the road at the time. The greater the discrepancy between a vehicle's speed and the average speed of other vehicles on the same section of road, the more likely the vehicle is to be involved in an accident (*2*, *4–7*). When vehicles travel at widely varying speeds, the number of interactions, such as overtaking and passing, is maximized (*8*). Also, the closer a vehicle travels to the average speed, the fewer the interactions; therefore, the opportunities for a crash to occur are minimized. Thus, accident involvement rates have been shown to vary directly with speed variance, that is, how vehicles' speeds differ from the average speed. Also, the fatality rate tends to be highest for vehicles traveling at speeds that are either much higher or much lower than the average speed (*2*).

These speed characteristics are important to remember when considering the potential effects of a speed limit differential, which tends to increase speed variation. On Interstate highways, increasing speed variation would theoretically increase the number of rear-end and lane-change interactions between

school buses and other traffic, thereby increasing the potential for these types of accidents.

A special consideration of the speed limit differential in Virginia relates not to travel speeds on Interstate highways, but rather to travel speeds on primary and secondary systems. Virginia's public school buses currently have a governor that mechanically limits the maximum speed of a bus to 45 mph. If the maximum speed limit were increased, the governor would have to be adjusted to allow a bus to travel at the higher speed. A governor set at a higher speed would not only permit the operation of the vehicle at that speed on Interstate highways but would also give drivers the option of traveling faster on other roadways where such speeds are both illegal and inappropriate. Thus, an advantage of the current system is that a governor now limits school bus speeds to 45 mph.

School Bus Speed Survey

Although the speed governors installed on school buses should limit school bus speeds to 45 mph or less, a speed survey was conducted to determine the actual travel speeds of school buses on Virginia's Interstate highways. Table 1 shows that the average speed traveled by public school buses in Virginia was 48 mph. Although the number of observations was small, the speeds observed for Virginia's public school buses were substantially lower than those for Virginia's private school buses and those for school buses from other states that were traveling in Virginia. The minimum speed measured for Virginia public school buses was 43 mph, and the maximum was 58 mph. Of the 42 Virginia public school buses observed, however, 9 were traveling in excess of 50 mph. Because 20 percent of the school buses were exceeding 50 mph, it is clear that at least some speed governors were not working as intended.

The three Virginia private school buses that were observed were all paced at 55 mph, as were buses from North Carolina and Maryland. A school bus from Kentucky, however, was paced at 64 mph on a rural portion of Virginia's Interstate highways on which a 55-mph speed limit for all buses was clearly posted. In fact, in Kentucky the maximum speed limit for school buses is 55 mph, so the Kentucky bus was also clearly in violation of the limit established in its home state. Although the Maryland school bus was exceeding Virginia's maximum speed limit for school buses, 55 mph is the speed that Maryland allows its school buses to travel. Likewise, although the North Carolina school bus was a yellow bus, it was clearly marked as an activity bus. North Carolina allows such buses to travel as fast as 55 mph.

One conclusion that can be drawn from these data is that appropriately geared school buses that do not have a governor or whose governor is set high enough can travel at least 55 mph on Interstate highways. It is hypothesized that a governor functioned, at least in part, to increase compliance with Virginia's 45-mph maximum speed limit for school buses. If speed limits are raised on the Interstate highways, the maximum speed allowed by a governor will also have to be raised, thus allowing buses to travel, albeit illegally, at higher speeds on all roadways.

Accident Experience

Nationally, between 1982 and 1986 there were 26 crashes involving school buses in which there were in-bus fatalities (*1*). Of these, 5 occurred on Interstate highways. Two of these crashes are of the types potentially resulting from increases in speed or from increases in speed variance. In one case, a bus traveling at an excessive speed, much higher than the prevailing speed limit at the time, crashed into a fixed object. Had the crash occurred at a lower speed, the impact velocity would have been lower and the injuries might not have been so severe. However, this bus was traveling at a speed of 75 mph, far outside the speeds being considered in this study. In another crash, a bus traveling slower than the free-flowing traffic (40 mph) was struck from behind by a tractor-trailer. This type of crash is one that may occur when the travel speeds of various vehicle types vary significantly.

Over the 3-year period before the change in the rural Interstate highway speed limit for passenger vehicles, only 10 crashes occurred on Virginia's Interstate highways. These crashes accounted for only 0.4 percent of all school bus crashes in Virginia. Thus, it is difficult to draw any conclusions from these data other than that there is not a substantial school bus crash problem for Virginia's Interstate highways. There were no fatalities reported for school buses on Interstate highways in Virginia, and Table 2 indicates that nonfatal crashes were more likely to occur when a bus was traveling at speeds of 25 mph or less, even on Interstate highways.

Table 2 also indicates that it is unlikely that there are substantial problems on non-Interstate roads related to maximum speed limit policies for school buses. On the primary highways, 83.6 percent of school bus crashes occurred at speeds of 25 mph or less, and only 4.7 percent (14 crashes) of the 3-year total occurred at speeds in excess of 35 mph. If the maximum speed limit created a problem on primary highways, it should have been manifested by an increased number of crashes occurring when the school bus was traveling at its maximum speed. Thus, a substantial speed limit–related crash

TABLE 1 SURVEY OF TRAVEL SPEEDS FOR SCHOOL BUSES ON VIRGINIA'S INTERSTATE HIGHWAYS

School Bus Type	No. Observations	Average Speed
Kentucky	1	64
Maryland	1	55
North Carolina	1	55
Virginia Private	3	55
Virginia Public	42	48

TABLE 2 SPEED OF SCHOOL BUSES INVOLVED IN CRASHES BY LOCATION

Location	Speed			
	0-25 mph (%)	26-35 mph (%)	36-45 mph (%)	46 mph and over (%)
Interstate Highway	5 (50.0)	1 (10.0)	4 (40.0)	0
Primary Highway	249 (83.6)	35 (11.7)	6 (2.0)	8(2.7)
Secondary Road	845 (85.3)	106 (10.7)	4 (0.4)	36(3.6)
City/Town Street	946 (93.5)	42 (4.2)	1 (0.1)	23(2.3)
School Facility	121 (98.3)	— —	2 (1.6)	

problem cannot be documented for primary highways from these data, nor can such a problem be documented for secondary roads or for city or town streets.

If the speed limit differential between school buses and other traffic was a factor in these accidents, a preponderance of sideswipe and rear-end accidents would be expected. Indeed, Table 3 indicates that these maneuvers were involved in 80 percent of Interstate highway accidents involving school buses but accounted for only 40 percent of the crashes on primary roads and 24 percent of those on secondary roads.

In an attempt to determine whether the July 1988 increase in the speed limit for passenger vehicles had an impact on the incidence of school bus accidents on Interstate highways, an analysis was conducted of all school bus accidents on those highways between September 1985 and May 1989. Most of these accidents, both before and after the change in the maximum speed limit, resulted in no injuries.

If the increased speed limit differential between passenger vehicles and school buses had increased the probability of accidents, the number of accidents would have been expected to increase. This situation appears to be the case; 10 accidents occurred during the three previous school years, compared with 7 during the school year after the change was made. These numbers, however, are small and could reflect random fluctuations rather than a trend. However, if accident probability did increase, perhaps accident characteristics mirror this change. Assuming that the probability did increase, it would be expected that more accidents would occur in which vehicles other than school buses were traveling faster than the buses and either rear-ended or sideswiped them. Table 4 indicates that before the change in the rural Interstate highway speed limit for passenger vehicles, the most common type of collision involving a vehicle and a school bus was a sideswipe or angle-type accident. The next most common type of collision involved the other vehicles rear-ending school buses. These two accident types did not increase after the speed limit differential was increased. In fact, after the speed limit change, school buses more often rear-ended other vehicles rather than the other way around. Hence, although there were relatively few rural Interstate crashes both before and after the speed limit for passenger vehicles was increased on rural Interstate highways, configuration data do not support arguments that the increased speed limit differential resulted in more crashes.

Finally, a major fear about a speed limit differential for school buses is that very large vehicles might strike a bus from behind, causing serious injuries to students. Table 5 indicates that almost all Interstate highway school bus accidents involved cars, and none involved large trucks. In fact, the only large vehicles to strike school buses in the before and after periods were other school buses.

Opinion Surveys

As explained previously, each of the three groups surveyed (pupil transportation administrators, school bus drivers, and police agencies and other special interest groups) was asked several questions in common and then a number of questions specific to the interests and expertise of the individual group. The first common question concerned the ideal maximum speed limit for school buses on Interstate highways.

A majority of each of the three groups surveyed supported a 55-mph speed limit on rural Interstate highways but preferred 45 mph for urban Interstate highways. The majority of school bus drivers believed that their buses could travel safely on rural Interstate highways at 55 mph but that their vehicle could not adequately climb hills at that speed. The drivers' perceptions supported the hypothesis developed from the speed survey that a speed governor tends to limit travel speeds to about 45 mph. Both administrators and bus drivers were opposed to prohibiting school buses from traveling on Interstate highways.

DISCUSSION OF RESULTS

The guiding principle of this study was to identify speed limit policies that would ensure the safe travel of students on school buses. A synthesis of the data suggests clear directions for some policy issues, but directions for other issues remain unclear. Obviously, it is impossible to eliminate the risk of injury

TABLE 3 SCHOOL BUS CRASH CONFIGURATION BY LOCATION

Location	Sideswipe—Same Direction (%)	Rear End—Vehicle Striking Bus (%)	Other Collision (%)
Interstate Highway	4 (40.0)	4 (40.0)	2 (20.0)
Primary Highway	32 (10.7)	87 (29.2)	179 (60.1)
Secondary Road	69 (7.0)	173 (17.5)	749 (75.5)
City/Town Street	129 (12.7)	207 (20.5)	676 (66.8)
School Facility	21 (17.1)	9 (7.3)	93 (75.6)

TABLE 4 INTERSTATE HIGHWAY SCHOOL BUS CRASH CONFIGURATION, SEPTEMBER 1985 TO MAY 1989

Configuration	9/85 - 5/88 Before Change	6/88 - 5/89 After Change
Other Vehicle Rear-Ends Bus	3	1
Bus Rear-Ends Other Vehicle	0	4
Sideswipe or Angle	4	1
Bus Strikes Bus	1	1
Other Collision	2	0

or death in school bus travel; however, compared with other types of travel, school bus travel is extremely safe.

Placing school buses on high-speed highways comes with its own risks. On the one hand, the faster any vehicle travels, the greater the potential risk for injury or death if the vehicle in involved in a crash. A vehicle traveling far slower than the prevailing speed on a highway, however, is at a higher risk for being involved in a crash. Thus, neither slower nor faster is always better. Each has its own advantages and disadvantages.

All of the options concerning school bus speed limits were considered carefully, and several were eliminated. The option of allowing school buses to travel at a maximum of 60 or 65 mph on rural Interstate highways was eliminated. Although 22 states have a maximum speed limit of 65 mph and 1 has a maximum of 60 mph, these limits would be more than the limit for trucks in Virginia. A higher speed limit for school buses than for trucks would not reflect, and would be inconsistent with, the rationale for establishing a truck speed limit of 55 mph. A speed limit of 65 mph would also be inconsistent with Virginia's tradition of establishing a speed limit for school buses lower than that for passenger vehicles.

The option of lowering the current 45-mph maximum speed limit for school buses was also eliminated. Virginia is already among four states with a 45-mph maximum speed limit, and only South Carolina has a lower maximum speed limit. There is no indication from accident and speed data that Virginia's school buses are currently traveling too fast. Thus, lowering the maximum speed limit would likely increase crash risk without reducing potential crash severity.

Option 1: Increase School Bus Speed Limit to 55 mph

One option is to permit school buses to travel 55 mph on rural Interstate highways only or on both urban and rural Interstate highways. An advantage of this option is that the change would result in more uniformity with other states' statutes or regulations. Further, on the basis of previous research, the accident probability should decrease because the differential between passenger vehicle, truck, and school bus speed limits would be reduced. Virginia has traditionally had a speed limit differential between school buses and passenger vehicles, and this change would be in keeping with this tradition. The truck and school bus speed differential would be eliminated, but the passenger vehicle and school bus differential of 10 mph would remain. This alternative was strongly supported for rural Interstate highways by administrators, bus drivers, and police agencies and other special interest groups.

This option also has a number of disadvantages. For example, because school buses would be traveling faster than they currently are, accident severity would likely increase. This increase would probably be most severe in accidents involving school buses and large trucks. Having two tiers of speed limits would still allow a lot of speed variance in the system, thereby theoretically increasing crash probability over that for a uniform speed limit.

One clear-cut problem associated with increasing the speed limit for school buses on Interstate highways involves speed governors. Increasing the speed limit to 55 mph would also necessitate increasing the maximum speed allowed by a governor. Currently a governor is set at 45 mph, which is the maximum speed school buses can legally travel on other systems. If a governor is set at 55 mph, however, it will allow speeds higher than the maximum limits set for school buses on all other roadway systems. Thus, the effectiveness of a governor in controlling speeds on other systems would be reduced, and school bus speeds might increase on other systems, particularly primary highways.

Option 2: Increase School Bus Speed Limit to 50 mph

Another option would be to increase the maximum speed limit for school buses to 50 mph on rural Interstate highways only or on both urban and rural Interstate highways. Increas-

TABLE 5 OTHER VEHICLE TYPES INVOLVED IN INTERSTATE HIGHWAY SCHOOL BUS CRASHES, SEPTEMBER 1985 TO MAY 1989

Vehicle Type	Before Change (%)	After Change (%)
Car	8 (80.0)	5 (71.4)
Pickup Truck	1 (10.0)	1 (14.3)
Large Truck	0	0
School Bus	1 (10.0)	1 (14.3)

ing the limit to 50 mph on Interstate highways is supported by speed theory in that it would reduce the speed limit differential and therefore should reduce accident probability. However, this same theory lends more support to a 55-mph speed limit for school buses.

A disadvantage of raising the speed limit for school buses to 50 mph is that accident severity should increase, but not as much as it would with a 55-mph speed limit. Increasing the school bus speed limit to 50 mph would also reduce the effectiveness of a speed governor on other roadway systems but, again, not as much as with a 55-mph speed limit. In addition, increasing the limit to 50 mph would not eliminate the three-tiered speed limit system for rural Interstate highways.

Option 3: Maintain the School Bus Speed Limit at 45 mph

Another option would be to retain the 45-mph maximum speed limit for school buses on Interstate highways. An advantage of this option is that, according to speed theory, no increase in crash severity would result. Retaining the current speed limit would also maintain the effectiveness of a speed governor on other systems.

A disadvantage of maintaining the current speed limit is that Virginia's policies concerning school bus speed limits are unlike those adopted by most other states. Under this option Virginia would be among those states with the lowest maximum speed limit in the nation. Further, this option would do nothing to mitigate the problem of the 20-mph speed differential, which, according to theory, should result in increased crash probability.

CONCLUSIONS AND RECOMMENDATIONS

Although 45, 50, and 55 mph are all viable options for maximum speed limits for school buses on Virginia's Interstate highways, none of these options can eliminate the risks associated with transporting students. An underlying assumption in research is that, unless there is compelling evidence to indicate that a change is needed, the status quo should be maintained. Although the theoretical accident probability should have increased when the speed limit for most other vehicles was raised on rural Interstate highways, accident data from Virginia's 1 year of experience with the increased differential do not indicate that this increased probability was manifested. Thus, because there were only a few, relatively minor, school bus crashes on the Interstate highways under the current maximum school bus speed limit of 45 mph, and because there was not sufficient evidence to support the hypothesis that school bus accident probability increased when the 65-mph rural Interstate highway speed limit for most vehicles was implemented, the study team concluded that there was not enough compelling evidence to warrant a change in current speed limit policies pertaining to school buses in Virginia. In addition, one positive aspect of retaining the 45-mph Interstate speed limit for school buses involves the effectiveness of a speed governor. Retaining the 45-mph speed limit on Interstate highways precludes raising the limit on a speed governor, thereby preserving the efficacy of the device in contributing to speed limit compliance on other roads.

REFERENCES

1. *Special Report 222: Improving School Bus Safety.* TRB, National Research Council, Washington, D.C., 1989.
2. D. Solomon. *Accidents on Main Rural Highways Related to Speed, Driver and Vehicle.* FHWA, U.S. Department of Transportation, 1968.
3. B. Kelley. *Speed and Car Crashworthiness: Unfixing a Great Gulf.* Insurance Institute for Highway Safety, Washington, D.C., Nov. 1973.
4. P. Johnson, T. Klein, P. Levy, and D. Maxwell. *The Effectiveness of the 55 mph National Maximum Speed Limit.* NHTSA, U.S. Department of Transportation, 1976.
5. R. Michaels and C. Schneider. The Energy Crisis, Characteristics of Traffic Flows and Highway Safety. *Accident Analysis and Prevention*, Vol. 8, 1976.
6. *Speed and Accidents.* Research Triangle Institute, Durham, N.C., June 1976.
7. N. J. Garber and R. Gadirau. *Speed Variance and Its Influence on Accidents.* AAA Foundation for Traffic Safety, Washington, D.C., 1988.
8. E. Hauer. Accidents, Overtaking and Speed Control. *Accident Analysis and Prevention*, Vol. 3, 1971.

Publication of this paper sponsored by Committee on Traffic Law Enforcement.