

Great Lakes Center for  
Truck and Transit Research

# THE ACCIDENT EXPERIENCE OF YOUNGER TRUCK DRIVERS

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16. Abstract The purpose of the project is to identify the special problems related to the high accident involvement of younger truck drivers and to suggest possible countermeasures. In this project, younger drivers are those in the 18-21 age group and the older driver group selected for comparison are those in the prime of their driving careers, ages 30 to 49. The project consisted of a driver survey, analysis of traffic violations, analysis of the accident record, and examination of police reports covering selected accident types.  Driver records and accident data from Michigan were used primarily. The survey was done on Michigan CDL holders. Accident data from North Carolina supplemented the Michigan data, and police reports from both Michigan and North Carolina were reviewed.  Young drivers had significantly more traffic violations than older drivers, with higher proportions of unsafe speed, reckless/careless, and failure to yield violations. Accident types with significant younger truck driver overinvolvement included single-vehicle loss of control, rear-end truck striking, and truck backed into other. Case review of accident reports showed problems with following too closely; failure to anticipate the actions of other road users; problems with vehicle control, as in low-speed offtracking accidents; and possible attentional overload, as in some loss of control accidents.					
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## **Executive summary**

The purpose of the present study is to seek insight into the nature of the overrepresentation of young truck drivers in traffic accidents. What is the nature of the younger truck driver experience? How does their driving experience, including moving violations, differ from older, more experienced drivers? In what types of accidents are younger drivers overrepresented? What kinds of driving or other errors are they making that contribute to accident involvement? A related goal is to identify factors associated with the overinvolvement of younger truck drivers that may be susceptible to correction through training, supervision, or assignment. In other words, by understanding why young truck drivers seem to have more problems than older ones, it may be possible to address the problems by appropriate means.

Because of the relative lack of background information about young truck drivers, this project took a broad-based approach. It included (1) a driver survey, (2) analysis of driver history files, (3) analysis of the accident record, and (4) detailed examination of individual police-reported traffic accidents. The purpose of the driver survey was to provide background about the population of CDL-holders and some indication as to how the employment of younger drivers differs from older drivers. The survey was designed to answer simple but fundamental questions, including how many CDL-holders actively use the CDL, the kind of training they have had, the type of truck they drive, and the type of firm for which they drive. Driver history files supplied information about traffic violations and accidents, and the accident files permitted a search for characteristic accident modes. Finally, examination of individual traffic accidents provided details not available from computerized accident files about the way accidents occurred. The accident scene diagram and narrative provides additional information about the sequence of events and the relative position through time of all vehicles in the accident.

Drivers in three age groups are considered here: 18-21, 22-24, and 30-49. The most important population is the CDL-holders under 21. However, there are not enough 19-to-20 year old CDL-holders, so 21-year olds are added to establish the population of younger drivers. Accordingly, throughout this report, the term "younger drivers" refers to drivers age 18 to 21. The second group of drivers considered here, those 22 to 24, probably share

many characteristics with the younger drivers and was included in order to increase sample sizes where necessary. The final group is the reference or comparison group. Truck drivers 30-49 years old represent the population of mature drivers. Throughout the report, they will be referred to as "older drivers," but the term is relative only. These are mature drivers in the prime of their careers.

Most of the data used in the project came from the state of Michigan. Michigan supplied driver history files, which were used to generate the sample for the driver survey along with some of the analysis of traffic violations. Michigan accident data and police reports of particular accident types were also used. Accident data from North Carolina were used to supplement Michigan data, and North Carolina police reports were analyzed during the examination of specific accident types.

The driver survey provided background information about the population of commercial driver's license holders in the state of Michigan. About 90 percent of younger CDL-holders currently drive a truck requiring a CDL. This percentage is slightly higher than for CDL-holders age 30 to 49. About 64 percent of young truck drivers drive a straight truck primarily, compared with 50 percent of older truck drivers. Young drivers drive about 30 percent fewer miles on average than older drivers. More of their miles are during the day, almost 70 percent are driven within 50 miles of their base, and 70 percent work for intrastate firms. In contrast, older drivers have somewhat more night mileage, almost 42 percent of their miles are driven on trips of more than 50 miles, and over 45 percent work for interstate companies. Sixty-three percent of younger drivers work for companies that operate 10 or fewer trucks, and only 6.4 percent work for firms operating more than 200 trucks. In contrast, over 19 percent of older truck drivers work for the largest fleets. Only ten percent of younger drivers claimed to have attended a truck driving school and less than two percent were trained in the military.

The literature on young male passenger car drivers points to excessive risk-taking and skill deficits as major factors in their high accident rates. Examination of moving violations, the accident record, and particular accident types provided evidence that young truck drivers have similar problems. Fifty-six percent of young truck drivers had a least one moving violation in the past three years, compared with 29 percent of older drivers. Young truck

drivers were about twice as likely to be cited for unsafe speed as older drivers (8.2 percent of younger driver's moving violations compared with 4.8 percent for older drivers). Unsafe speed was the second most frequent violation type after speeding itself, which accounted for about 70 percent of all moving violations. Considering violations committed in trucks only, 11.5 percent of younger drivers' were "unsafe speed," compared with about four percent for older drivers. Younger truck drivers also were more likely to be cited for a "hazardous action" than older drivers when involved in a traffic accident. Seventy percent of young accident-involved truckers were cited, compared with 55 percent of older drivers.

The major accident types for younger drivers are: loss of control combined with hit fixed object (12.7 percent); truck backed into other vehicle (11.9 percent); turning related involvements (14.9 percent); and, rear-end, truck striking (12.5 percent). Together these account for about 52 percent of younger truck driver accident involvements in the Michigan data. Loss of control, backing into another vehicle, and rear-end truck striking are all accident types where younger drivers are significantly overinvolved compared with older drivers. Almost nine percent of younger drivers' involvements are single-vehicle loss of control, compared with about five percent for older drivers. Almost 12 percent are involvements where the younger driver backs into another vehicle, compared with about eight percent of the involvements of older drivers. And rear-end truck striking accounts for about 12 percent of younger drivers accidents, compared with eight percent for older drivers.

A review of a sample of accident cases revealed that overly-aggressive driving, unsafe speed, vehicle control, and attentional deficits all played a role. Many loss of control involvements occurred on curves, when the driver entered the curve going too fast to maintain control if an unanticipated event occurred. Others were associated with distractions in the cab diverting the driver's attention and resulting in the truck wandering off the road.

A large fraction of turning related accidents involved problems with basic vehicle control. Low speed offtracking of the trailer in tight left turns resulted in collisions with cars stopped waiting for the truck to clear. Most remaining turning accidents were associated with failure to signal intentions and to anticipate the actions of other road users when they

attempted to pass the slowing truck. Rear-end truck striking accidents combine two characteristic problems of young truck drivers: excessive speed and failing to anticipate the actions of other road users. In many instances, the driver was going too fast and following too closely to avoid a collision when the lead vehicle did something unexpected, such as slowing for a turn or for a traffic control.

Analysis of traffic violations, the computerized record of traffic accidents, the accident typology, and case review of a sample of police reports all produced evidence of the following driving problems among younger truck drivers:

- excessive and unsafe speed;
- overly aggressive driving, as in following other vehicles too closely;
- failing to anticipate and provide for the unexpected actions of other road users, as in both rear-end and backing accidents;
- maintain proper vehicle control, as in low-speed turning and backing accidents;
- possible attentional overload, as in some of the loss of control accidents.

Effectively addressing the problems of young truck drivers is difficult. Evaluating the means of doing so is outside the scope of the present study. But it is likely that the problem of experience can be overcome through practical training that gives real-world experience. Motivational factors, such as risk-taking and aggressive driving, must be addressed as well. The material presented here indicates that the primary areas for attention are aggressive driving, accounting for the actions of other road users, and basic vehicle control, in the sense of having a feel for the boundaries of the truck. All of these problems were found to contribute to the accident types in which younger drivers were most overinvolved.



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## **Accident Experience of Younger Truck Drivers**

The Commercial Motor Vehicle Safety Act of 1986 provided that drivers of trucks with a gross vehicle weight rating of 26,001 pounds or more in interstate commerce be required to hold a Commercial Drivers License (CDL). The act established a minimum age of 21 for holders of CDLs. Currently, there are proposals to reduce the minimum age required for a CDL in order to increase the pool of eligible truck drivers. Previous studies have shown that younger drivers are significantly overinvolved in truck accidents in comparison with older drivers. A study of fatal truck involvements nationally found that drivers under the age of 21 were overinvolved by a factor of six, compared to all truck drivers [Campbell, 1991]. Another study, focusing on truck drivers in Michigan, similarly found that young truck drivers had accident rates per mile traveled about five times higher than all truck drivers [Blower, 1990]. While there has been much research throughout the world about young passenger car drivers, the same is not true for truck drivers. Beyond the studies mentioned above showing that younger truck drivers have high accident rates, there has been little work to identify the factors associated with the higher rates. In fact, there has been almost no work about young truck drivers as a separate group.

### **1. Background and problem statement**

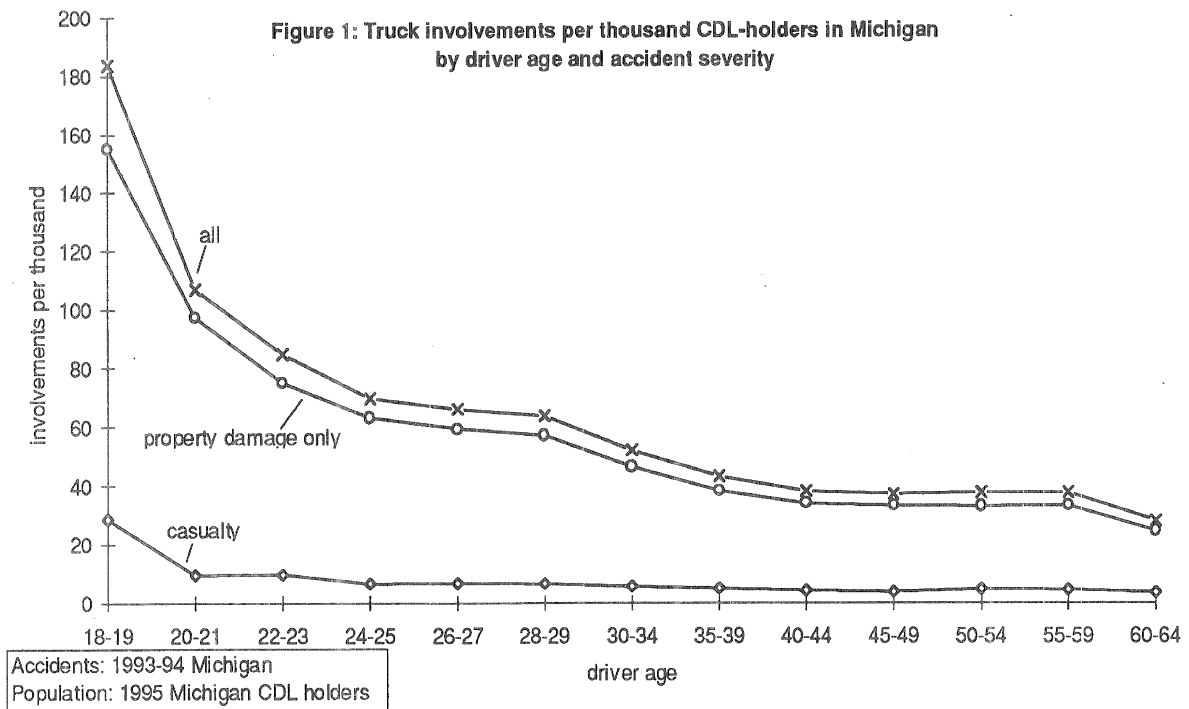
Young truck drivers are significantly overrepresented in the accident population. The primary evidence for this statement comes from two studies of national fatal truck involvements and a study of truck accidents in Michigan. Campbell [1991; 1988b] used data from surveys of fatal accidents and truck travel to calculate fatal involvement rates per mile driven by driver age. Overall, fatal involvement rates for truck drivers remained high until about age 25. The fatal accident rates of drivers 17 to 18 were 4.5 times higher than the rate for all drivers, and drivers age 19 to 20 had rates six times higher. The accident and travel surveys were matched so that rates could be calculated for exposure categories defined by area type (urban/rural), time of day (day/night), and road type (limited-access, major artery, and other). Rates were also calculated for single-unit trucks (primarily

straight trucks) and combination trucks (primarily tractor-semitrailers). Younger drivers had higher fatal accident rates in both truck types and in every operating environment. That is, the overinvolvement of young drivers was not primarily a product of differences in the operating environment of young drivers as compared with older drivers.

Fatal involvements account for only about one to four percent of all truck involvements, depending on the severity threshold of the accident population. A study of Michigan truck-tractor accident involvements considered all police-reported accidents [Blower, 1990]. Though driver age was not a primary focus of the work, accident involvement rates were calculated by driver age for property damage only (PDO) and casualty accidents. Drivers age 19 to 20 had PDO involvement rates about five times higher than all Michigan drivers. Drivers 21 to 24 had PDO rates about 2.4 times higher than the overall rate. The story was the same for casualty accidents, the rate for 19 to 20 year olds was almost six times higher and the rate for 21 to 24 year olds was over three times higher than the overall rate.

For the present work, accident involvement rates were calculated by the population of CDL-holders, using drivers with a CDL in Michigan and accidents in Michigan. Figure 1 shows involvement rates per thousand CDL-holders by driver age and accident severity. The figure shows that young truck drivers are substantially overinvolved relative to the number of CDL-holders until about age 24. Overall, Michigan CDL-holders had about five casualty involvements per thousand and about 40 property damage involvements. For the youngest group of drivers shown in the figure, the comparable numbers are 28 and almost 160, or about six and four times the overall rate, respectively. PDO and casualty accident rates for drivers age 20 to 21 were about two and 2.5 times higher than the overall rate, respectively.

Clearly, young truck drivers are involved in traffic accidents at a higher rate than older drivers. This is true for both tractors and straight trucks, for different accident severities, and whether miles traveled or license holders is used as the measure of exposure. For fatal accidents, the overinvolvement of younger drivers pervades all operating environments and appears to be a general problem.



The purpose of the present study is to seek insight into the nature of the overrepresentation of young truck drivers in traffic accidents. What is the nature of the younger truck driver experience? How does their driving experience, including moving violations, differ from older, more experienced drivers? In what types of accidents are younger drivers overrepresented? What kinds of driving or other errors are they making that contribute to accident involvement? A related goal is to identify factors associated with the overinvolvement of younger truck drivers that may be susceptible to correction through training, supervision, or assignment. In other words, by understanding why young truck drivers seem to have more problems than older ones, it may be possible to address the problems by appropriate means.

An initial difficulty in this project was that, beyond the fact that young truck drivers have higher accident rates, there has been virtually no research on them. There is no information about how many young drivers there are, much less the kinds of vehicles they drive or the types of companies for which they work. It is clear that they do not drive heavy trucks in interstate commerce, but, beyond that, little is known. Knowledge of how young truck drivers fit into the trucking industry is important. Many environmental factors are

known to be associated with increased risk. For example, bobtails have much higher accident rates than tractor-semitrailers. Compared with Interstate roads, U.S. and state routes increase accident risk per mile traveled by about a factor of two, and all other roads increase the risk by about a factor of seven [Blower, 1993]. Time of day and area type (urban or rural) are also known to be associated with differences in accident risk, with accident risk higher at night and in rural areas. In addition, characteristics of truck operations probably have an impact. For example, large fleets are more likely to have an active safety program. Construction firms that operate in urban areas have a different accident exposure than less-than-truckload freight haulers.

## 2. Methods and data

Because of the relative lack of background information about young truck drivers, this project took a broad-based approach. It included (1) a driver survey, (2) analysis of driver history files, (3) analysis of the accident record, and (4) detailed examination of individual police-reported traffic accidents. The purpose of the driver survey was to provide background about the population of CDL-holders and some indication as to how the employment of younger drivers differs from older drivers. The survey was designed to answer simple but fundamental questions, including how many CDL-holders actively use the CDL, the kind of training they have had, the type of truck they drive, and the type of firm for which they drive. Driver history files supplied information about traffic violations and accidents, and the accident files permitted a search for characteristic accident modes. Finally, examination of individual traffic accidents provided details not available from computerized accident files about the way accidents occurred. The accident scene diagram and narrative provides additional information about the sequence of events and the relative position through time of all vehicles in the accident.

Most of the data used in this project cover drivers and accidents in the state of Michigan. The Department of State kindly provided driver history files on all drivers with A, B, or C



CDLs in Michigan.<sup>1</sup> This file provided the information on traffic violations as well as the sample for the driver survey. Most of the information on traffic accidents also came from the state of Michigan. However, because of certain problems with the Michigan data, discussed in section 6, and to boost confidence in the findings, accident data from North Carolina were used also. Cases for the review of individual accidents were selected from both Michigan and North Carolina.

Note that all age groups were not included in the study. Accident rates by age describe a steep curve that flattens out at about ages 27 to 29. The purpose of the project is essentially to compare drivers on the steep part of the curve with drivers in the flat area. The most important population is the CDL-holders under 21. However, there are not enough 19-to-20 year old CDL-holders, so 21-year olds are added to establish the population of younger drivers. Accordingly, throughout this report, the term "younger drivers" refers to drivers age 18 to 21. The second group of drivers considered here, those 22 to 24, are still on the steep part of the curve and probably share many characteristics with the younger drivers. This group was included in the project in order to increase sample sizes where necessary. The final group is the reference or comparison group. Truck drivers 30-49 years old are clearly in the flat part of the accident rate curve and represent the population of mature drivers. Throughout the report, they will be referred to as "older drivers," but it must be understood that the term is relative only. These are mature drivers in the prime of their careers. Accordingly, only drivers 18 to 24 and 30 to 49 are included in the study.

It should also be noted that only male drivers are considered. Less than 10 percent of CDL-holders in Michigan are female, and many of them hold Class C CDLs as bus drivers. It is

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<sup>1</sup> A Class A license entitles the holder to drive a combination vehicle with a gross combination weight rating of 26,001 or greater, including a trailer with a gross vehicle weight rating (GVWR) over 10,000 pounds. This group of vehicles consists primarily of tractor-semitrailers, but would also include some straight trucks pulling heavy trailers. A Class B license covers straight trucks with a GVWR over 26,001, or any such vehicle pulling a trailer with a GVWR less than 10,000 pounds. The Class C CDL covers buses capable of carrying 15 passengers in addition to the driver or small vehicles not covered by Class A or B licenses used for carrying hazardous materials.

likely true that females represent a relatively untapped pool of potential truck drivers, but they are too few in the current population to study using the means employed here. Moreover, the literature about passenger car drivers shows that the problems of young female drivers are quite different from young male drivers. To avoid a potential confounding factor, females were excluded altogether.

### 3. Literature review

One researcher [Evans, 1991] has written: "The overinvolvement [in traffic accidents] of young, and male, road users is one of the largest and most consistently observed phenomena in traffic throughout the world. It is so robust and repeatable that it is almost like a law of nature." The overinvolvement of younger drivers has been shown for different parts of the world: Massie [1995] and Williams [1995] in the U.S.; Macdonald [1994] and Catchpole [1994] in Australia; Gregersen [1996b] in Sweden. Young drivers are also overinvolved in traffic accidents regardless of the measure of exposure, whether per mile traveled, per capita, or per licensed driver.

Although virtually all research on young drivers has focused on passenger car drivers, there is some work, including the present study, to show that younger truck drivers are also involved in fatal traffic accidents at a higher rate than older drivers. Campbell [1991] found that truck drivers were overinvolved until about age 25. Truck drivers age 17-18 had higher accident rates by a factor of 4.5 (meaning 4.5 times the fatal involvement rate for all truck drivers) and 19-20 year olds were overinvolved by six times. After age 20, the overinvolvement rate declined sharply. The overinvolvement rate for 21-22 year olds was 2.2, and for 23-24 year olds 1.7. Campbell was able to control for exposure, at least to the extent of comparing area type (urban or rural), time of day (night or day), and road type. He found that younger truck drivers had higher fatal accident rates in every driving environment.

Massie and Campbell [1995] found that passenger car drivers age 16-19 have a fatal accident rate per mile driven three times higher than all drivers and about five times higher than drivers with the lowest accident rate, ages 40 to 44. Young drivers were similarly overinvolved in injury accidents. Considering all accident severities, Williams

[1995] found younger drivers were overinvolved by about four times compared with older drivers. He offered evidence that younger drivers have higher accident rates by every measure of exposure available: per mile driven, per licensed driver, and per capita. Risk factors identified include driving with other teenagers in the vehicle (which presumably leads to more risk-taking and aggressive driving), speeding, and driving at night. About 20 percent of the driving of younger drivers is at night, while 40 percent of their fatal accidents occur then. Younger passenger car drivers are more likely to be in single-vehicle accidents, to go too fast, to make errors that contribute to the accident, and to be carrying passengers. Deaths as a passenger (rather than driver) account for about 40 percent of deaths of 16-19 year olds, and two thirds of those deaths occur in vehicles driven by a teenager.

The major factors associated with the high accident rates for young passenger car drivers are: (1) skill deficits associated with lack of driving experience, (2) excessive risk-taking associated with youth, and (3) exposure-related factors. Considering exposure-related factors, young passenger car drivers are overrepresented in fatigue-related accidents, drive more at night and on weekends, and more of their driving is part of recreational activities, compared with other passenger car drivers. Other than fatigue, these exposure factors are not particularly relevant to young truck drivers. The other factors illustrate the difference between the typical situations of a passenger car driver and a truck driver. Trucks are driven as part of work, young truck drivers drive less at night, and the purpose is to get a job done, rather than recreation.

Findings from research on young passenger car drivers as to skill deficits and risk-taking are relevant to the truck-driving situation. "Skill" factors include but go beyond simple vehicle control to the entire driving task, including lane-keeping, selection of following distance, efficiency at scanning the road both in front and behind the vehicle, and anticipation of the actions of other road users. Young drivers tend to focus on the immediate vicinity of the vehicle rather than further down the road, take longer to perceive a hazard, and concentrate too much on the right side of the vehicle near the curb. They also use the mirrors less frequently than more experienced drivers and more often turn their heads rather than use the mirrors when maneuvering [Evans, 1991; Catchpole, 1994]. Concentrating on the road right in front of the vehicle and paying too much attention to the

proximity to the curb are related to pure vehicle control factors. Young drivers are still learning how to steer a vehicle. While the task of steering is being learned, it is still under conscious control. The driver has to think about what he is doing, so much of his attentional capacity is occupied by simple matters such as lane-keeping. He has less attention to spare for developments down the road and for unexpected events.

Related to the "skill" factors described in the previous paragraph is experience. Much of driving is "automatic" for more experienced drivers. For example, lane-keeping does not require much conscious thought. More experienced drivers are also more efficient at scanning the roadway. They look farther down the road, so they are better prepared to respond to events likely to occur shortly. In addition, they have a more complete set of expectancies about the behavior of other road users, as well as a larger repertoire of responses. For example, an older driver will be more aware of a car approaching a stop sign on a crossing road ahead, as well as be alert when the vehicle pulls suddenly out in front of him. In contrast, young drivers are focused more in front of their vehicle and have difficulty in predicting hazards early enough to respond effectively [Evans, 1991; Catchpole, 1994].

The second factor relevant to the truck-driving situation identified in the literature on young passenger car drivers is risk-taking and other youth-related "motivational" factors. Young drivers tend to drive too fast, drive with shorter headways (tailgate), are more likely to compete with another driver, and are more likely to run a red or yellow light. They also tend to overestimate their own skills and underestimate the skills of other road users. For example, a sample of young passenger car drivers rated situations requiring fast reflexes and deft vehicle-handling lower in risk than older drivers [Catchpole, 1994; Gregersen, 1996a, 1996b]. The result is that young drivers are more likely to put themselves in a risky situation, e.g., tailgating, and less able to deal with it.

Age and experience, or to put it another way, skills and risk-taking, are two separate problems of young drivers. Each contributes to the high accident rate for younger passenger car drivers, though disentangling them is difficult since young drivers are typically inexperienced and inexperienced drivers are, in turn, primarily young [Cooper, 1995]. One study has shown that drivers with one year of experience have about a 20 percent higher

accident rate than drivers with two years [Eby, 1995]. The effect of age is such that a 25 year old with one year of experience actually has a lower risk than an 18 year old with two years of driving experience.

Virtually all the literature cited above deals only with passenger car drivers. Yet the findings on skill and risk-taking are clearly relevant to driving a truck. If anything, driving a truck is much more demanding than driving a car, so the problem of attention-overload, for example, would be greater. As to risk-taking, the greater mass and longer stopping distances of trucks clearly is a problem if young truck drivers are more likely to speed and to accept shorter headways. The findings from the analysis of driving violations and accidents presented below provides evidence that many of the problems identified for passenger car drivers exist among young truck drivers as well.

#### **4. Current population of CDL-holders in Michigan**

To provide some background about the general population of commercial driver's license holders, a survey was conducted of truck drivers in Michigan. The sample was drawn from a file of all CDL-holders in Michigan, provided by the Department of State in Michigan. The sample was limited to male holders of Class A or Class B CDLs. Females were excluded from the sampling frame because males account for more than 90 percent of Class A and B CDLs and because much of the literature on passenger car drivers shows that there are important differences in driving behavior between young male and female drivers.

Drivers were selected for the survey based on two variables, driver age and county of residence. Selection by age provided good and known coverage of the relevant age groups. County of residence was included to provide coverage of the entire state, to ensure that all aspects of the trucking industry in Michigan were included. The driver age groups selected for the survey were 18 to 21, 22 to 24, and 30 to 49.

Table 1: Sample for driver survey

Age group	N in driver file	Sample fraction	Number sampled
18-20	739	all	739
21	1,313	3 in 5	876
22-24	6,271	1 in 4	1,568
30-49	120,508	1 in 80	1,506
Total	128,831		4,689

The driver survey was carried out initially by a mailed survey, followed by a reminder postcard, and finally an attempted telephone interview. A short survey, along with an explanatory cover letter, was sent to each driver in the sample. About 20 percent of surveyed drivers responded to the initial mailing, which is within the usual range for mailed surveys. A reminder postcard was sent to drivers who had not responded to the initial survey. The postcard stimulated some additional responses, but did not bring the response rate to a satisfactory level. Ultimately, telephone interviews were attempted with about 3,500 drivers who had not responded to the initial letter or postcard. At least one phone call was made to each driver who had not responded to either mailing. In some cases, multiple calls were made, including calls to clarify ambiguous or inconsistent responses. Over 2,000 surveys were completed. The data collected were then carefully reviewed, keypunched, and analyzed.

There are about 200,000 CDL-holders in Michigan, of whom almost 70 percent have Class A licenses, 28 percent have Class B licenses, and about three percent have Class C licenses. Younger drivers, aged 18 to 21, make up only about one percent of all CDL-holders, and drivers 22 to 24 are only about three percent of CDL-holders. Drivers in the 30 to 49 age group, the comparison group in this study, make up over 61 percent of all CDL-holders and about the same percentage of A and B licenses. About 53 percent of young drivers have Class A licenses and an additional 43 percent have Class B licenses. The comparison group of experienced drivers, age 30 to 49, is heavily weighted toward Class A, with about 71 percent A licenses and 26.5 percent Class B licenses. Also, it should be noted that, while in general only a small percentage of the driving population has a CDL, it is much smaller for younger drivers than older ones. Less than half a percent of all drivers 18 to 21 have a

CDL, compared with less than two percent for 22 to 24 year olds and about five percent of drivers age 30 to 49.

**Table 2: CDL-holders in Michigan**

CDL Class	Driver age					Total
	18-21	22-24	25-29	30-49	50 & over	
Class A	1,138	3,741	13,840	87,869	32,677	139,265
Class B	914	2,533	7,473	32,759	12,211	55,890
Class C	78	248	615	2,894	1,441	5,276
Total	2,130	6,522	21,928	123,522*	46,329	200,431
	(column percentages)					
Class A	53.43	57.36	63.12	71.14	70.53	69.48
Class B	42.91	38.84	34.08	26.52	26.36	27.88
Class C	3.66	3.80	2.80	2.34	3.11	2.63
Total	100.00	100.00	100.00	100.00	100.00	100.00

Note: there are six drivers with unknown CDL type not included.

One of the purposes of the driver survey was to determine how many CDL-holders were actually using their licenses and how they were employed. It was expected that a lower proportion of younger CDL-holder would actually be employed as truck drivers than older drivers. It was also expected that younger drivers generally work in different parts of the trucking industry from older drivers. The expectation was that young drivers are more likely to drive straight trucks, with mostly local trips during the day, and to be employed in a relatively small fleet that was private. They would also drive fewer miles over the course of the year. Going into the survey, the general picture for younger drivers was of employment by a private, non-freight-hauling firm that operates intrastate, driving a straight truck. On the other hand, the typical picture for older drivers was driving for an interstate for-hire trucking company, driving a tractor-semitrailer on long haul trips, with more hours at night and a higher average annual mileage.

Table 3 shows the percentage of drivers with CDLs who currently drive a truck, as determined by the CDL-holders survey. Interestingly, a slightly higher percentage of younger drivers use their CDL than older drivers, by 91 percent to 88 percent. However, this difference is not statistically significant, given the number of responses. And the difference is not practically significant. It appears that about 90 percent of CDL-holders currently use their CDL and that there are no significant differences by age group.

Table 3: CDL usage by age group

Currently driving?	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
Yes	632	90.67	490	86.57	675	87.89
No	65	9.33	76	13.43	93	12.11
Total	697	100.00	566	100.00	768	100.00

In many other respects, however, the younger driver population is different from older drivers. Table 4 shows the types of trucks CDL-holders primarily drive, for each of the three age groups. Higher proportions of younger drivers reported driving straight trucks and straight trucks with trailers, while older drivers more often drive tractor-semitrailers. In each case this difference is statistically significant. If all straight trucks are combined and all tractor combinations are combined, about 64 percent of young drivers drive straight trucks compared with 52 percent of older drivers. About 48 percent of the experienced drivers primarily drive tractors, compared with 36 percent of younger truck drivers.

Table 4: Primary truck configuration by age group

Truck type	Age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
Straight	293	46.51 *	211	43.33	273	40.81
Straight w/trailer	108	17.14 *	61	12.53	72	10.76
Tractor/single	207	32.86 *	201	41.27	290	43.35
Tractor/double	22	3.49	14	2.87	34	5.08
Total	630	100.00	487	100.00	669	100.00

\* Statistically different from proportion of older drivers at 0.05 level

Note: Missing data on truck type excluded

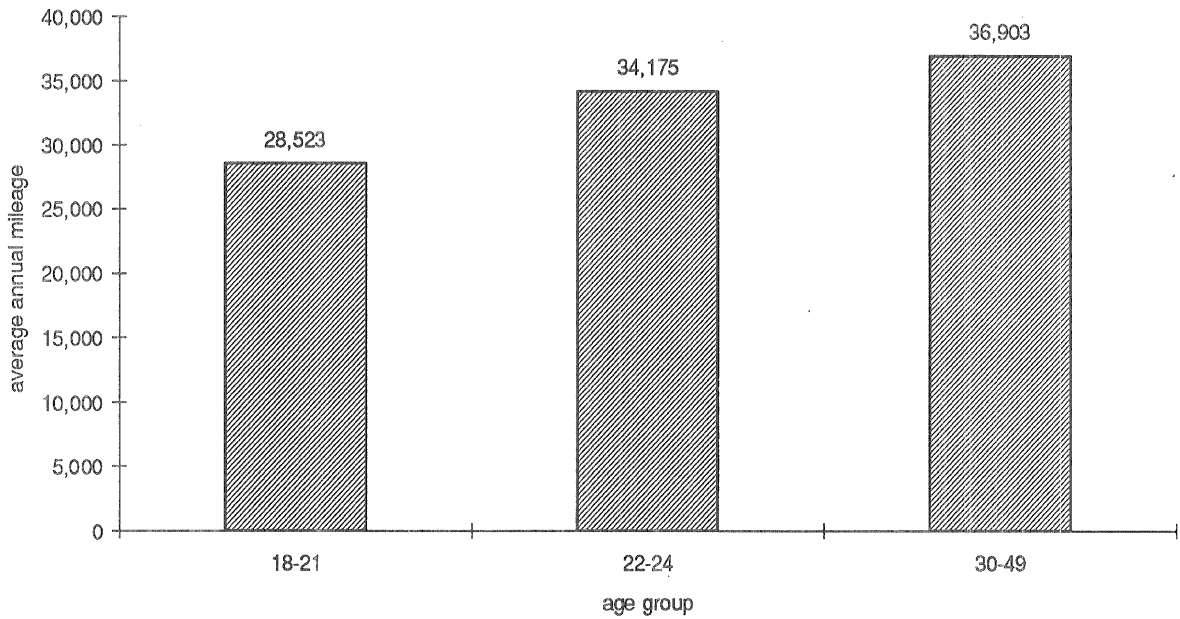
Young drivers also drive fewer miles per year than older drivers. Figure 2 shows the average annual mileage for the three age groups.<sup>2</sup> Drivers 18 to 21 estimated their average travel at about 29,000 miles per year, 22 to 24 at 34,000, and driver 30 to 49 at 37,000 per

<sup>2</sup> Each driver was asked to estimate the average number of miles driven in a year. Several drivers estimated totals greater than 200,000, including one with an estimated total annual mileage of 700,000. These estimates are unrealistically high, so in calculating average annual travel, driver estimates greater than 200,000 were reduced to 200,000.



year. Note that the averages are calculated across all truck types and all types of operations. Older drivers drive about 29 percent more miles per year, and the difference is statistically significant. The difference between younger drivers and the 22 to 24 age group is also statistically significant.

Figure 2: Average annual mileage of CDL holders by age group



Figures 3 and 4 show the distribution of travel operating a heavy truck by time of day and trip length for each age group. In the time of day question, drivers were asked to estimate the proportion of travel in each of four time blocks: 6 A.M. to noon, noon to 6 P.M., 6 P.M. to midnight and midnight to 6 A.M. As expected, younger drivers drive more during the day and more of their travel is local than older drivers. The differences are not overwhelming, but they are substantial and significant. For all groups, most of the travel is during the day. Over 87 percent of the mileage of younger drivers is during the day, compared with about 78 percent for older drivers. Note that in both the “night” time blocks, 6 P.M. to midnight and midnight to 6 A.M., drivers in the 18 to 21 age group drive about half as much as drivers in the 30 to 49 age group.

Figure 3: Time of day driving by age group

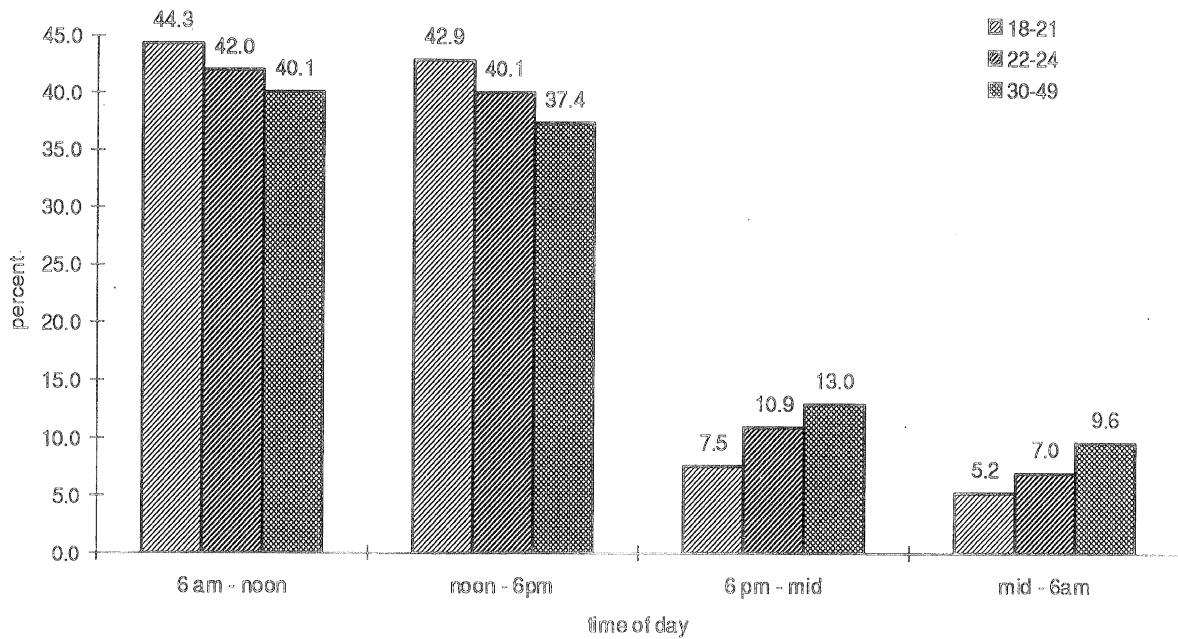


Figure 4 shows the distribution of travel for each age group by trip length. Drivers were asked to estimate the percentage of their travel that occurred within 50 miles of base (local trips), trips of 51 to 100 miles (one way), 101 to 200 miles, 201 to 500 miles, and more than 500 miles. Drivers in the 18 to 21 age group accumulate almost 70 percent of their mileage in local trips. Local trips account for about 58 percent of the travel of the other age groups. This difference is statistically significant. At the other end of the scale, differences by age group are also marked. The proportion of travel on trips of more than 500 miles is over twice as great for the older drivers as for the youngest age group, and the same is true for trips in the 201 to 500 mile range. These differences speak to both type of operations and operating environment. Local trips are typically (though not always—farm trucks are an exception) in urban areas with a relatively high traffic density. Construction, retail, and delivery are typical operations. Longer trips are primarily on Interstate-quality roads, which have relatively lower accident risk, and are operated typically by long-haul freight companies, both truckload and less-than-truckload.

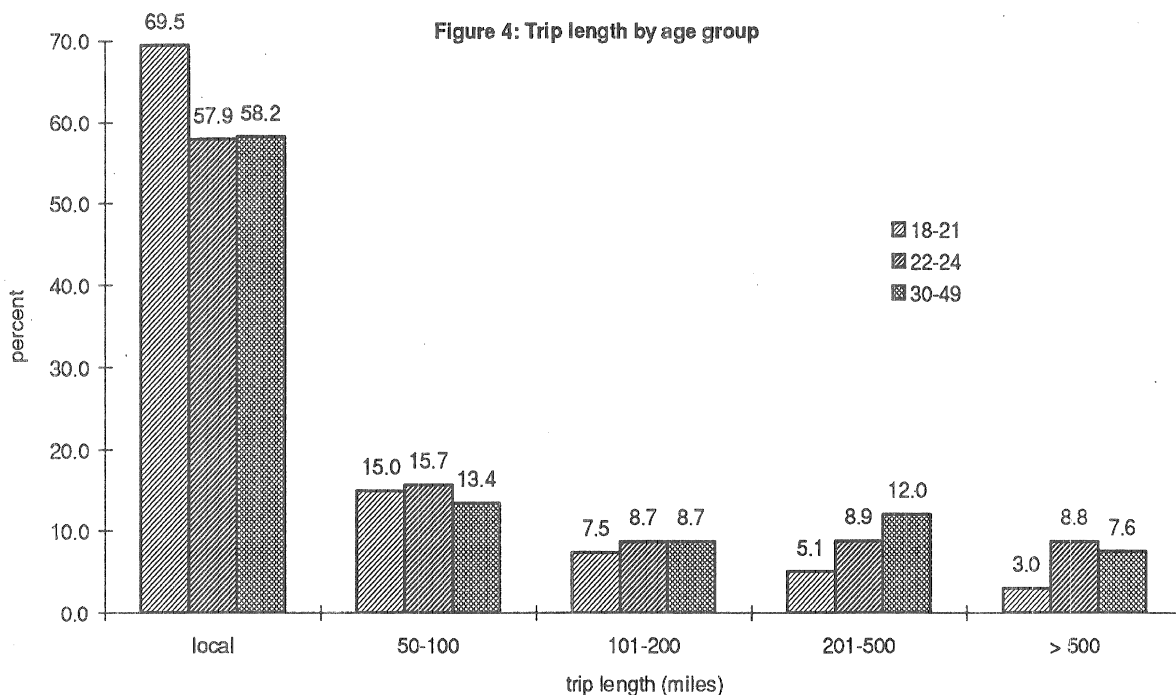


Table 5 offers additional evidence of differences in employment between younger and older drivers. The table shows the type of company for which the driver works in each age group. (Note that 57 drivers for whom company type could not be ascertained are excluded from the table.) Companies that operate trucks across state lines are considered “interstate.” The table categorizes the company by which the driver is employed. Even if a driver himself never crossed state lines, if his company operated interstate, he would be classified as interstate in this table. Companies are also classified as either “for-hire” or “private.” In this classification, a for-hire company is simply a freight-hauler, a company that transports the goods of others for hire. “Private” includes all other company types, including construction, retail, and, in some cases, municipal government.

Table 5: Company type by age group

company type	18-21		age group 22-24		30-49	
	N	%	N	%	N	%
interstate for-hire	68	11.17 *	92	19.21	137	21.01
interstate private	111	18.23 *	128	26.72	157	24.08
intrastate for-hire	43	7.06 *	21	4.38	28	4.29
intrastate private	387	63.55 *	238	49.69	330	50.61
total	609	100.00	479	100.00	652	100.00

Note: 57 cases with missing data excluded

\* Statistically different from proportion of older drivers at 0.05 level

The table illustrates that company type varies significantly by age group. Only about 11 percent of 18 to 21 year old drivers work for an interstate for-hire company. Virtually all of the drivers in the age group who do are 21, since the national CDL is limited to drivers 21 and older. Almost 64 percent of younger drivers work for an intrastate private firm, and over 70 percent work for an intrastate firm. In contrast, the distributions across company type for the other two age groups have higher proportions of interstate for-hire companies. About 20 percent drive for interstate for-hire companies and about 45 percent drive in interstate commerce, whether private or for-hire. The reader should bear in mind that the survey attempted to cover all types of truck drivers, a large fraction of whom are farmers, work in construction, or some other similar activity. Yet the table clearly shows older drivers are about twice as likely to work for an interstate freight hauler as the younger drivers, who more typically work for smaller, local firms.

Table 6 shows the size of companies that drivers reported they worked for, in terms of the number of trucks operated by the company. The intent of the question was to determine the number of trucks operated by the company at all locations, not just the base where the individual driver worked. The results here are consistent with the other results presented in this section. Drivers in the younger age group are much more likely to work for small companies than more mature drivers. Almost 43 percent of younger drivers work in companies with one to five trucks, and over 62 percent in companies with ten or fewer. Fewer than seven percent work for companies with more than 200 trucks. In contrast, over

18 percent of older drivers work for the largest trucking companies, and over 31 percent work in fleets larger than 50 trucks. Again, this is consistent with the picture of younger drivers working more locally, driving primarily straight trucks for small private firms. Older drivers work more often in interstate commerce and much more frequently for large, interstate trucking firms. Distributions for drivers 22 to 24 are mostly intermediate between the other two age groups.

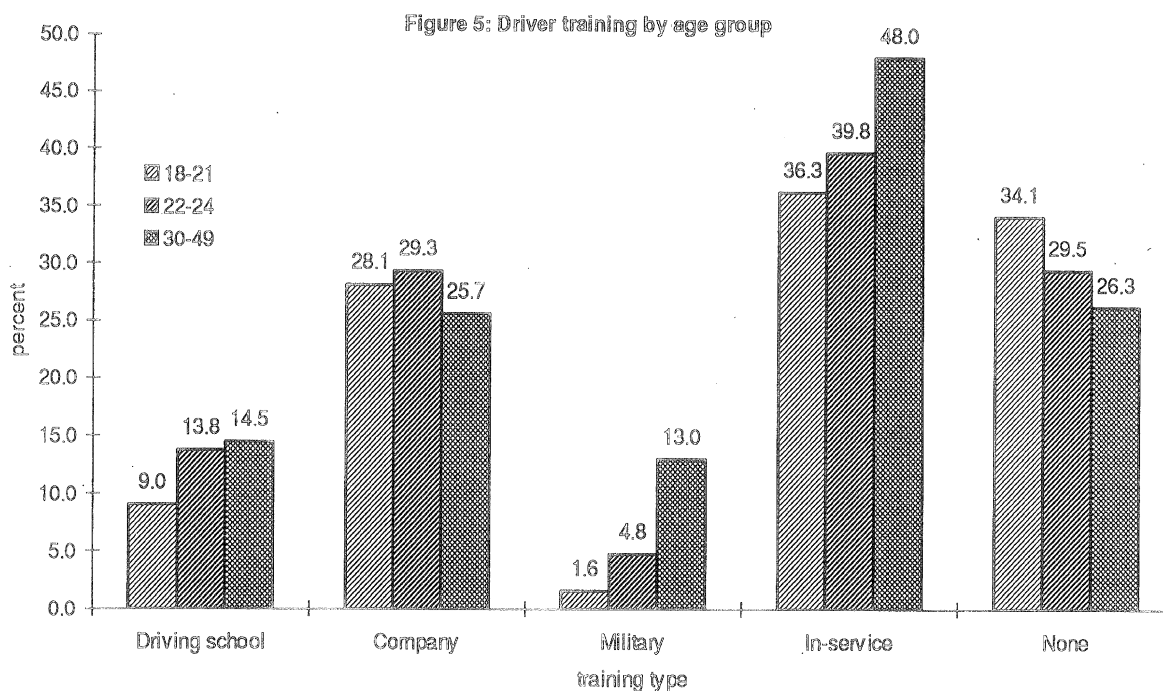
**Table 6: Fleet size by driver age group**

fleet size	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
1-5 trucks	262	42.74 *	165	34.38	196	29.70
6-10 trucks	119	19.41 *	90	18.75	87	13.18
11-50 trucks	156	25.45	135	28.13	168	25.45
51-200 trucks	37	6.04 *	36	7.50	89	13.48
> 200 trucks	39	6.36 *	54	11.25	120	18.18
Total	613	100.00	480	100.00	660	100.00

Note: 44 cases with missing data excluded

\* Statistically different from proportion of older drivers at 0.05 level

The last area to be considered here is driver training. Respondents were asked if they had received training by any of four modes: a truck driving school, company course, in the military, or through in-service training. Figure 5 presents the results of this question. Note that the age group percentages can sum to more than 100, since drivers could answer affirmatively to more than one of the choices, and about 20 percent did so.



The “driving school” category refers to a formal, professional truck driving school. About nine percent of younger drivers claimed to have attended a driving school, while about 15 percent of older drivers said they had. This difference is significant at the 0.05 level. About 28 percent of younger drivers had been exposed to some sort of company course, a non-significant two percent more than older drivers. A much higher proportion of older drivers had had training in the military. Thirteen percent of drivers age 30 to 49 had received military training compared with less than two percent of the younger drivers. Only about 5 percent of drivers 22 to 24 had military driver training. These differences are large, statistically significant, and reflect the experiences of the various generations. The final training category is “in-service” training. This can be anything that the driver considered to be on-the-job training, including riding with a more senior driver. While there are certainly exceptions, the most rigorous training among these types is likely to have been provided by driving schools and the military, both of which younger drivers had little experience with. Even given the range of training alternatives, 34 percent of younger truck drivers had no training at all, compared with 26 percent for the 30 to 49 age group. This difference is statistically significant at the 0.05 level.

Finally, there is the question of truck driving experience. While age and experience generally go hand in hand, given the emphasis in the literature on passenger car drivers, it is worth pointing out explicitly that the older driver group has had much more experience in truck driving than the younger driver group. The question was worded broadly to include any truck driving experience a respondent may have had. Drivers in the 18 to 21 age group claimed on average about 2.4 years of experience driving a truck. Drivers 22 to 24 had about 3.8 years of experience, while drivers in the 30 to 49 age group average over 15 years of driving experience. The literature on passenger car drivers indicates that, along with age, the lack of experience is strongly associated with accident risk.

In sum, the survey validated some of the prior expectations and overturned others. About 90 percent of young CDL-holders currently drive a truck. As to the accident risk of the environment in which young truck drivers operate, the results do not consistently point to a high-risk or low-risk environment. Most drive straight trucks on local trips for small, intrastate private firms. Straight trucks have somewhat lower accident rates than tractor-semitrailers. Local trips, at least for non-farm operations, are probably mostly on urban, non-Interstate quality roads. While urban accident rates are generally lower than rural, Interstate and similar limited-access roads are the safest roads in the highway system [Campbell, 1988; Blower, 1990, 1993]. Similarly, while there is some evidence that large trucking firms have lower accident rates than small ones, private companies as a whole may have lower rates than for-hire trucking companies [Moses, 1994]. On the other hand, young drivers have relatively little night travel, while more experienced drivers travel significantly more at night, when the accident risk is much higher. Most consistent with the high accident rates of younger drivers are the findings on driver training. While overall few drivers have much formal truck driver education, younger drivers have less than others, particularly from driver training schools or the military. Possibly most important of all, older drivers have much more experience in driving a truck.

## **5. Traffic violations**

The Michigan Department of State provided driver history files for all holders of Commercial Driver's Licenses from the state of Michigan. Included in the records were

name, address, sex and age, CDL type and endorsements, as well as information about all traffic offenses committed by the driver. This latter information includes the particular offense, arrest and conviction date, and type of vehicle in which the offense was committed. Information on all types of violations of the traffic code is included in the driver history files, including a variety of criminal offenses, transgressions of licensing requirements, and other non-moving violations. Moving violations are of primary concern here, however. Non-moving violations, which range from felony committed using an automobile to no proof of insurance, are omitted from the analysis. The traffic violations to be considered here relate to the safe control and operation of a motor vehicle in traffic. The general question is, what type of moving violations do younger drivers characteristically commit? Do those violations differ from the violations of older drivers in ways that identify problems associated with youth?

Moving violations committed in cars as well as trucks are considered here. Such violations are counted in law against the CDL. Using all moving violations increases sample sizes and seems warranted since the distribution of violations in cars and trucks are similar. Moreover, some research has shown that drivers with a large number of violations committed in cars have a higher probability of accident-involvement while driving a truck [Geissinger, 1986]. Also, note that in most instances, violations considered are restricted to those occurring in the three years prior to the close of the file provided by the state. This restriction was enforced to provide comparability between the three age groups. Since the driver history file is the complete driving record for an individual, older drivers obviously have more time to accumulate violations. Moreover, the point of the analysis is to compare the driving records of mature truck drivers with young ones, so the primary concern is the recent driving record of each age group.

Alcohol offenses are not treated as moving violations in this analysis. While operating a vehicle under the influence of alcohol is an extraordinarily serious offense and one associated with a high proportion of serious passenger car accident involvements, it is not in any useful way an error in vehicle control. The purpose of the present study is to identify driving problems of the young that may be susceptible to training and instruction. Alcohol use certainly leads to errors in vehicle control, but it is not here considered itself as an error



in vehicle control or operation. Moreover, the incidence of alcohol violations while driving trucks is low. There was only one conviction in the past three years for a driver in the 18 to 21 age group, where the vehicle in which the offense occurred was identified as a truck. There were no alcohol offenses for drivers in the 22 to 24 age group while driving a truck. The low incidence of alcohol offenses while driving a truck is confirmed also in the analysis of accidents below.

Table 7 below shows the number of moving violations committed in all vehicle types for each of the three age groups of truck drivers. For example, 928 of the 2,130 drivers with CDLs in the 18 to 21 age group committed no moving violations in the previous three years, 645 committed one moving violation, 334 committed two moving violations, etc. The table illustrates the frequency with which younger drivers are cited for moving violations, compared with older drivers. Almost 71 percent of the older drivers had committed no moving violations in the previous three years, compared with only about 44 percent of the younger driver group. This difference is both large and statistically significant. About 30 percent of younger drivers had one violation and 26 percent had more than one violation. Twenty percent of older drivers had one moving violation and nine percent had more than one. The 22 to 24 age group falls between the two extremes, though the distribution is more like the younger group than the older group. Violations in all vehicle types are included in this count, but clearly younger drivers commit moving violations at a much higher rate than older drivers, and the proportion of the population that avoids moving violations altogether is much smaller.

**Table 7: Number of moving violations by age group  
all vehicle types, past three years  
Michigan Department of State driver history file**

number of violations	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
0	928	43.57	3,140	48.14	87,580	70.90
1	645	30.28	1,826	28.00	24,712	20.01
2	334	15.68	930	14.26	7,487	6.06
3	145	6.81	391	6.00	2,419	1.96
4	43	2.02	147	2.25	871	0.71
5+	35	1.64	88	1.35	459	0.37
Total	2,130	100.00	6,522	100.00	123,528	100.00

Averaged over the whole population of drivers, drivers in the 18 to 21 age group committed about one violation in the prior three years, drivers 22 to 24 committed 0.9 violations, and truck drivers 30 to 49 committed about 0.42 violations.

Table 8 shows the number of moving violations in trucks only over three years by age group. In this table, the age groups appear to have quite similar distributions of violations, at least considering just the number of such violations. Over 94 percent of younger drivers have no violations over the previous three years while driving a truck, compared with almost 92 percent for older drivers. This difference is statistically significant, though not important. When large numbers of cases are involved, even small differences can be "real," statistically. But the difference between 92 and 94 percent is of no practical consequence. Moreover, it is likely that the reason for the slightly higher number of moving violations in trucks issued against the older driver population is a matter of exposure. Younger drivers drive trucks about 30 percent fewer miles than older drivers.

**Table 8: Number of moving violations by age group  
in trucks only, past three years  
Michigan Department of State driver history file**

number of violations	18-21		age group 22-24		30-49	
	N	%	N	%	N	%
0	2,012	94.46	6,005	92.07	113,196	91.64
1	108	5.07	424	6.50	8,269	6.69
2	8	0.38	69	1.06	1,477	1.20
3	1	0.05	16	0.25	431	0.35
4	1	0.05	6	0.09	110	0.09
5+	0	0.00	2	0.03	45	0.04
Total	2,130	100.00	6,522	100.00	123,528	100.00

It is also certain that many in the younger driver group did not drive a truck in each of the three prior years. Those age 18 have had a CDL for less than a year, age 19 for one year, and so on. Even so, when the issue date of the CDL is taken into account, older drivers have a higher annual average number of moving violations committed while driving a truck than younger drivers. This runs contrary to expectations and all other evidence presented in this study, which consistently shows younger drivers with higher rates of violations and accident-involvement. However, it is likely that not all recent violations have been recorded

in the driver history file. Since the truck driving history of younger drivers is weighted toward the most recent year of the file (since they have more novice drivers), incomplete reporting for that year would understate moving violations.

**Table 9: Moving violations by age group  
trucks only, past three years  
Michigan Department of State driver history file**

violation type	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
reckless/careless	2	1.53	7	1.09	117	0.89
speeding	84	64.12 *	407	63.20	9,819	74.38
unsafe speed	15	11.45 *	42	6.52	533	4.04
too slow	1	0.76	4	0.62	61	0.46
assured distance	0	0.00 *	7	1.09	117	0.89
stop sign	5	3.82	9	1.40	212	1.61
school crossing	0	0.00 *	0	0.00	19	0.14
RR crossing	0	0.00	1	0.16	1	0.01
other traffic device	4	3.05	23	3.57	368	2.79
traffic officer	0	0.00	0	0.00	2	0.02
traffic signal	5	3.82	38	5.90	516	3.91
failure to yield	7	5.34	25	3.88	232	1.76
improper lights	0	0.00 *	0	0.00	15	0.11
fail to signal/observe	3	2.29	3	0.47	106	0.80
improper passing	1	0.76	4	0.62	87	0.66
improper turn	1	0.76	10	1.55	113	0.86
wrong lane	1	0.76 *	49	7.61	703	5.33
left of center	1	0.76	4	0.62	29	0.22
illegal turn	1	0.76	8	1.24	102	0.77
cross divided highway	0	0.00 *	1	0.16	18	0.14
wrong way	0	0.00 *	2	0.31	30	0.23
illegal exit/entrance	0	0.00	0	0.00	1	0.01
total	131	100.00	644	100.00	13,201	100.00

\* Statistically different from the proportion for older drivers at 0.05 level.

Table 9 shows three years of moving violations by driver age group. Only violations committed while driving a truck are included in the table. In each age group, speeding violations are by far the most common. Among younger drivers, over 64 percent of moving violations in a truck are for violating the speed limit. Note that speed-related violations have been divided into two categories, speeding and unsafe speed. The first category is simply for exceeding the speed limit. The second category is for violating the “basic speed

law," which is essentially driving too fast for conditions, driving at a speed greater than reasonable, or excessive speed less than reckless driving. Many of the citations for violations of the basic speed law are associated with accident involvement. In other words, the driver was involved in an accident and the reporting officer made a judgment that excessive speed was a factor. Violations of the basic speed law are the second most-common citation for younger drivers, followed by failure to yield (5.3 percent), disobeying a stop sign and disobeying a traffic signal (3.8 percent each), and disobeying some other traffic sign (3.1 percent). Since younger drivers are overinvolved in rear-end accidents where the truck they are driving is the striking vehicle, it was expected that they would have an excess of citations for failure to maintain an assured distance, but that proved not to be the case. However, "assured distance" is a major "hazardous action" of younger drivers involved in accidents. See table 11.

While table 9 is useful, it should be noted that there are only 131 violations recorded for younger drivers and many of the categories have zero or only one case. Ideally, in considering the driving experience of younger truck drivers, the first choice is to consider just violations committed while driving a truck. It could be argued that driving trucks is the only relevant behavior. However, in this case data on violations committed while driving a truck are limited. It is necessary to consider alternatives, i.e., to expand the scope to all traffic violations of truck drivers, regardless of the vehicle type the driver was driving at the time. Expanding the range of vehicle types considered in order to increase sample size is valid if the distribution of violations for trucks is similar to the distribution for all vehicle types. Note that as a practical matter, all traffic violations are counted against the CDL, not just violations committed while driving a truck. Research has shown that truck drivers with a high number of violations committed in automobiles have a higher probability of accident-involvement while driving a truck [Geissinger, 1986]. Moreover, the distributions of moving violations in table 10 below, which includes all vehicle types, are fairly similar to those in table 9 above, which includes just truck violations. Speeding violations account for about 65 to 70 percent in each, unsafe speed is 8 to 11 percent in each, and the other major categories are stop sign problems, traffic signal, and failure to yield.

**Table 10: Moving violations by age group  
all vehicle types, past three years  
Michigan Department of State driver history file**

violation type	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
reckless/careless	78	3.69 *	156	2.63	942	1.78
speeding	1,440	68.18 *	4,120	69.38	37,601	70.99
unsafe speed	173	8.19 *	395	6.65	2,561	4.84
too slow	10	0.47	26	0.44	226	0.43
assured distance	9	0.43	30	0.51	273	0.52
stop sign	74	3.50 *	191	3.22	1,412	2.67
school crossing	4	0.19	10	0.17	80	0.15
RR crossing	0	0.00 *	2	0.03	11	0.02
other traffic device	25	1.18 *	94	1.58	1,073	2.03
traffic officer	1	0.05	4	0.07	22	0.04
traffic signal	94	4.45 *	332	5.59	2,967	5.60
failure to yield	80	3.79 *	166	2.80	1,431	2.70
improper lights	7	0.33	20	0.34	106	0.20
fail to signal/observe	14	0.66	29	0.49	407	0.77
improper passing	23	1.09	50	0.84	485	0.92
improper turn	21	0.99	68	1.15	581	1.10
wrong lane	18	0.85 *	90	1.52	1,334	2.52
left of center	6	0.28	22	0.37	167	0.32
illegal turn	20	0.95 *	103	1.73	1,020	1.93
cross divided highway	4	0.19	7	0.12	105	0.20
wrong way	11	0.52	23	0.39	155	0.29
illegal exit/entrance	0	0.00	0	0.00	4	0.01
total	2,112	100.00	5,938	100.00	52,963	100.00

\* Statistically different from the percentage for older drivers at 0.05 level.

The major difference is the increase in reckless citations for younger drivers from 1.5 percent in trucks to 3.7 percent in cars. This is a concern since excessive aggressiveness while driving is one of the major characteristics that distinguishes younger drivers. Those two numbers seem to indicate that young drivers are less aggressive in a truck. A statistical test of the difference between them just fails to achieve significance at the 0.05 level. However, I would argue that the two cases of reckless driving in table 9 are too few to command confidence. Moreover, the proportion of unsafe speed violations is higher for younger truck drivers driving trucks than driving cars. Reckless driving and unsafe speed violations have similar implications for behavior. Both indicate excessively aggressive

driving and overconfidence in driving ability. Accordingly, while not optimal, it is reasonable to rely on the table incorporating moving violations in all vehicles in order to benefit from the much larger sample sizes available. Larger sample sizes permit greater confidence in the findings.

As in table 9, speeding violations account for the greatest percentage of moving violations. About 70 percent of moving violations in each age group are for exceeding the speed limit. For younger truck drivers, the other major categories are unsafe speed, failure to obey a traffic signal, failure to yield, failure to obey a stop sign, and reckless or careless driving. Young truck drivers are overrepresented in unsafe speed and reckless/careless driving citations compared with older drivers. The two categories account for almost 12 percent of the moving violations of younger drivers, compared with about 6.5 percent for older drivers, so younger drivers are cited almost twice as often. This difference is statistically significant at the 0.05 level.

Unsafe speed and reckless/careless driving suggest similar driving problems: an excessively aggressive driving style and overconfidence in driving abilities and vehicle control. These two violation types account for about 40 percent of all non-speeding moving violations of younger truck drivers. Speeding itself, in terms of purely exceeding the speed limit, can be considered also as evidence of being too aggressive. While pure speeding seems endemic among all the age groups considered in this paper, younger drivers have significantly higher proportions of unsafe speed and reckless/careless violations than older drivers. In any case, both types of violation (unsafe speed and reckless/careless) indicate that the driver is operating in a high-risk manner. In considering the typical accident types of younger drivers, many examples of this problem will be noted.

The other primary violation types relate to stop signs or signals and failure to yield. Stop sign and signal violations are issued for failing to stop at a stop sign or traffic signal. Failure to yield includes a variety of violations, such as failing to yield for oncoming traffic in turning across traffic, failing to yield right of way when exiting a driveway, and failing to yield to the vehicle on the right at a stop sign. While the driving error involved in each of these violations is clear enough, the source of the problem is not so obvious. For example,

failing to stop for a stop light could be deliberate disregard, e.g., a decision to “take the chance.” Or the driver may not have noticed the light because his attention was fully occupied elsewhere. This is the concept of attentional-overload, noted in studies of young passenger car drivers. A driver looking for a cross street in a new city, maneuvering a large truck in traffic, may simply not notice a traffic light or stop sign. (Table 10 deals with violations in all vehicles, but the same violation types are also the major violations when just trucks are considered, as in table 9.)

Table 11 records the hazardous actions noted on accident reports of truck drivers involved in accidents in Michigan for accident years 1993 and 1994. A “hazardous action” differs from a citation in that a traffic ticket is not necessarily issued. Note that younger drivers have a much higher rate of hazardous actions than older drivers. Only about 30 percent of accident-involved younger drivers were not logged for an action that contributed to the accident, compared with almost 45 percent of older drivers. Among the hazardous actions, younger drivers have a higher proportion of speed-related actions than older drivers, though the difference just fails to achieve statistical significance, and speeding is the primary hazardous action in only 6.2 percent of younger drivers involvements. More importantly, about 12 percent of the hazardous actions involve backing and almost 20 percent are for failure to maintain clear distance. The section dealing with traffic accidents below shows that younger drivers are overinvolved in backing accidents compared with older drivers in Michigan.

The other point to make is that the “clear distance” action is related to rear-end accidents where the truck is the striking vehicle. “Failure to maintain clear distance” essentially indicates that the driver rear-ended a vehicle. Young drivers are overinvolved in such accidents. Review of rear-end accidents showed that typically the young driver failed to anticipate the actions of other road users and failed to choose a speed and following distance that would give him time to react safely.

**Table 11: Hazardous actions by truck drivers  
Michigan police-reported truck involvements, 1993-1994**

Action	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
none	149	29.6 *	384	34.3	4,630	44.8
speed too fast	31	6.2	52	4.6	424	4.1
speed too slow	1	0.2	1	0.1	9	0.1
failure to yield	31	6.2	58	5.2	489	4.7
traffic control	10	2.0	19	1.7	144	1.4
wrong way	1	0.2	2	0.2	1	0.0
left of center	5	1.0	8	0.7	50	0.5
improper passing	1	0.2 *	12	1.1	68	0.7
improper lane use	17	3.4	51	4.5	474	4.6
improper turn	11	2.2 *	37	3.3	436	4.2
improper signal	1	0.2	2	0.2	30	0.3
improper backing	62	12.3 *	112	10.0	785	7.6
clear distance	99	19.7 *	205	18.3	1,094	10.6
other	68	13.5	129	11.5	1,144	11.1
unknown	12	2.4	30	2.7	353	3.4
error/no code	4	0.8	19	1.7	203	2.0
Total	503	100.0	1,121	100.0	10,334	100.0

\* Statistically different from proportion of older drivers at 0.05 level

Table 12 shows a similar distribution of traffic violations of accident-involved truck drivers in North Carolina, 1990-1993. A host of violations with a few cases each have been combined into the "other" category. As in the case of Michigan truck involvements, a higher proportion of younger drivers has some sort of violation than older drivers. This difference is substantial and statistically significant. Over 76 percent of younger truck drivers were issued some sort of citation, compared with 64 percent of older drivers. The distribution of violation types is quite similar for the two groups of drivers, except for safe speed and safe movement violations. Almost all the difference in the proportion of violations between younger and older drivers is accounted for by those two violation types. Most of the difference is captured by the excess "safe speed" violations of younger drivers, where almost 21 percent of accident-involved younger truck drivers' violations were safe speed, compared with 12.2 percent of the violations of older drivers.



**Table 12: Traffic violations by truck drivers in traffic accidents  
North Carolina police-reported truck involvements, 1990-1993**

Citation	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
none	232	23.8 *	726	28.5	8,171	36.0
alcohol	4	0.4	12	0.5	135	0.6
speed limit	12	1.2	35	1.4	246	1.1
safe speed	204	20.9 *	416	16.4	2,770	12.2
safe movement	214	22.0	510	20.1	4,460	19.6
backing	49	5.0	125	4.9	964	4.2
other	259	26.6	719	28.3	5,954	26.2
Total	974	100.0	2,543	100.0	22,700	100.0

\* Statistically different from proportion of older drivers at 0.05 level

Finally, the violations and hazardous actions of the truck and other vehicle were compared in two-vehicle accidents. Citations for violations and hazardous actions do not by themselves constitute a determination of "fault" or "causation" in a traffic accident. Traffic accidents typically consist of a complex series of events associated with a wide range of factors. Instead, it is probably most accurate to consider the cited actions as indicating driver errors that contributed to the accident. Tables were prepared from files on two-vehicle accidents in both Michigan and North Carolina. In each accident, it was recorded whether the truck alone was cited for a hazardous action (traffic violation in North Carolina), the other vehicle alone, both, or neither. The results are displayed in tables 13 and 14. The distributions by age group in each table are remarkably similar. In Michigan, about 33.8 percent of young truck drivers were given the only hazardous citation in two-vehicle accidents; in North Carolina, the percentage is 33.2. Twenty-two point two percent of older Michigan truck drivers received the only citation in two-vehicle accidents, compared with 22.9 percent in North Carolina. And so on for the other categories.

However, the major point of the tables is that younger truck drivers make errors that contribute to two-vehicle accidents at a rate about 50 percent higher than older, experienced drivers. Younger truck drivers are cited for driving errors at a much higher rate than the other vehicle in two-vehicle accidents. About 33 percent of younger truck drivers are cited compared with 12 to 14 percent of the other drivers in the accidents. This is strong evidence that young drivers make driving errors at a higher rate than older

drivers, and that the overinvolvement of young truck drivers is not a matter of exposure or a different driving environment. Instead, the overinvolvement of young truck drivers in traffic accidents is because they make driving errors at a substantially higher rate than older, experienced truck drivers.

**Table 13: Hazardous action cited in two-vehicle accidents  
Michigan police-reported truck involvements, 1993-1994**

hazardous action	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
truck only	124	33.79 *	241	29.39	1,409	18.37
other only	52	14.17 *	99	12.07	1,304	17.00
both	0	0.00	4	0.49	27	0.35
neither	191	52.04 *	476	58.05	4,932	64.29
total	367	100.00	820	100.00	7,672	100.00

\* Statistically different from proportion of older drivers at 0.05 level

**Table 14: Violation charged in two-vehicle accidents  
North Carolina police-reported truck involvements, 1990-1993**

violations charged	age group					
	18-21		22-24		30-49	
	N	%	N	%	N	%
truck only	197	33.16 *	465	28.74	3,387	22.88
other only	72	12.12 *	254	15.70	2,839	19.18
both	9	1.52	38	2.35	258	1.74
neither	316	53.20	861	53.21	8,320	56.20
total	594	100.00	1,618	100.00	14,804	100.00

\* Statistically different from proportion of older drivers at 0.05 level

Unfortunately, there is not enough information on the nature and circumstances of the violations to identify the particular driver error with any specificity. However, it is clear that excessive speed is a major problem for younger truck drivers, along with overly-aggressive driving (as in the violations for clear distance, traffic signal and failure to yield), and vehicle control (evidenced by the improper backing violations). These problems have been noted by many researchers in young, male passenger car drivers. When these errors are translated to trucks, the problem is magnified. Trucks obviously have much greater mass than passenger cars. Stopping distances are typically greater. The truck itself has less performance in terms of the ability to accelerate and maneuver laterally. Roadway design

typically leaves a greater margin of safety for automobiles than trucks and in some cases does not account for the special problems of trucks. For example, ramps on limited-access roads are typically signed for passenger cars, and passing zones are specified based on the sight angle and acceleration ability of a car [U.S. Congress, 1988, p. 110-112]. As a result, the operating environment is less forgiving of driver error in trucks than cars. The envelope of acceptable driver performance is smaller. Problems with speeding and driving beyond capabilities, as shown by the moving violations of younger drivers, help explain the higher accident rate of younger truck drivers.

## **6. Characteristics of accident involvement**

Most of the data in this section are from Michigan police accident reports for 1993 and 1994. Two years of data were used to maximize the available sample size. Data from 1993 was the earliest useful file available. The state of Michigan drastically revised accident reporting in 1991-1992, and data from the year 1992 are considered "transitional." All accidents involving a truck requiring a Class A or Class B CDL were subset and built into an analysis file. Tables in this section are derived from that file. The frequencies reflect two years of data, and have not been annualized. In addition, the frequencies are counts of trucks involved in accidents, not of accidents themselves.

In addition to the Michigan data, accident data from North Carolina were also analyzed. While adequate for most purposes, sample sizes in the Michigan data are not large. In addition, because of the change in collection procedures for the Michigan accident file, missing data in some cases are quite substantial. For example, age is missing on nearly 25 percent of the cases. In order to build confidence in the findings from the Michigan file, a second data file was selected for analysis. Producing similar results in two independent data files reinforces the results. Accordingly, an analysis file was built using all available (to UMTRI) years of North Carolina accident data. This file consists of four years of accident data, 1990 through 1993.

Rather than repeat each graph and table using both the Michigan and North Carolina data, the report will focus on the Michigan data. Findings from the North Carolina will be

introduced as appropriate. In general, the North Carolina data reinforced the findings from the Michigan data.

Table 15 shows the distribution of accident severity for the three age groups. Accident severity is characterized in this table by the most severe injury in the accident. The most severe injury can occur in any vehicle and is not limited to the truck. Incapacitating injuries are classified as "A" injuries. These include major fractures and other severe injuries that render the victim unable to perform normal activities. "B" injuries are visible, but not incapacitating. "C" injuries involve a complaint of pain but are not visible (though they can sometimes prove to be serious). The K (fatal) ABC-O (no injury) classification is common for police-reported accident data.

Table 15: Distribution of accident severity by age group  
Michigan police-reported truck involvements, 1993-1994

	18-21		age group 22-24		30-49	
	N	%	N	%	N	%
fatal	6	1.2	12	1.1	103	1.0
a-injury	19	3.8	53	4.7	426	4.1
b-injury	30	6.0	57	5.1	590	5.7
c-injury	66	13.1	146	13.0	1,279	12.4
no injury	382	75.9	853	76.1	7,936	76.8
Total	503	100.0	1,121	100.0	10,334	100.0

Overall, the distributions of accident severity are very similar among the three age groups. Statistical tests show no differences between the groups, i.e., no tendency for one group to be involved in more serious accidents than the others.

Table 16 below shows the distribution of truck configuration by age group in the Michigan accident file. It can be compared with table 4 on page 12, which shows the primary truck configurations reported in the driver survey. Note the relatively high percentage of "other" and unknown truck configurations. Vehicle configuration is always a difficult area in police-reported data. Even so, the relative proportions are roughly similar to table 4. Young drivers are primarily in straight trucks, while a majority of the involvements of older drivers are in tractor-semitrailers. Though there is no detail in the file, many of the vehicles

in the “other” category are probably straight trucks pulling a trailer. This table serves primarily to confirm the findings from the travel survey.

**Table 16: Distribution of truck configuration by age group  
Michigan police-reported truck involvements, 1993-1994**

truck type	18-21		age group 22-24		30-49	
	N	%	N	%	N	%
tractor-semitrailer	129	25.6 *	414	36.9	5,318	51.5
tractor double	29	5.8	49	4.4	755	7.3
straight truck	167	33.2 *	387	34.5	2,600	25.2
other	116	23.1 *	162	14.5	675	6.5
unknown	62	12.3	109	9.7	986	9.5
Total	503	100.0	1,121	100.0	10,334	100.0

\* Statistically different from proportion of older drivers at 0.05 level

Given the different parts of the trucking industry younger drivers tend to be in, it was expected that there could be differences by day of week in accident involvements. Older drivers probably drive more often on the weekend, since they are more often involved in long-haul freight carriage. On the other hand, it was expected that younger drivers would primarily work a five-day week, with fewer miles on the weekend. The accident data do not bear out this expectation. The distribution of accident involvements by day of week is quite similar for all three age groups (figure 6). About 15 to 20 percent of involvements occur each day, Monday through Friday, with about five to eight percent on Saturday and three or four percent on Sunday. None of the differences between the three age groups are statistically significant. Distributions in the North Carolina data were very similar.

Figure 6: Day of week by age group  
Michigan police-reported truck involvements, 1993-1994

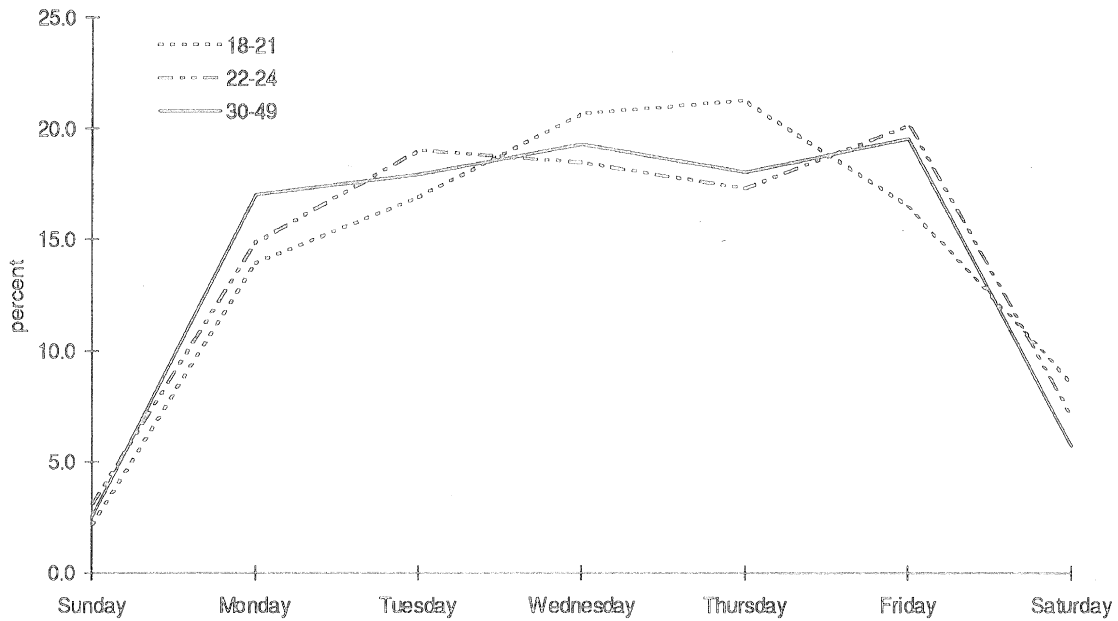
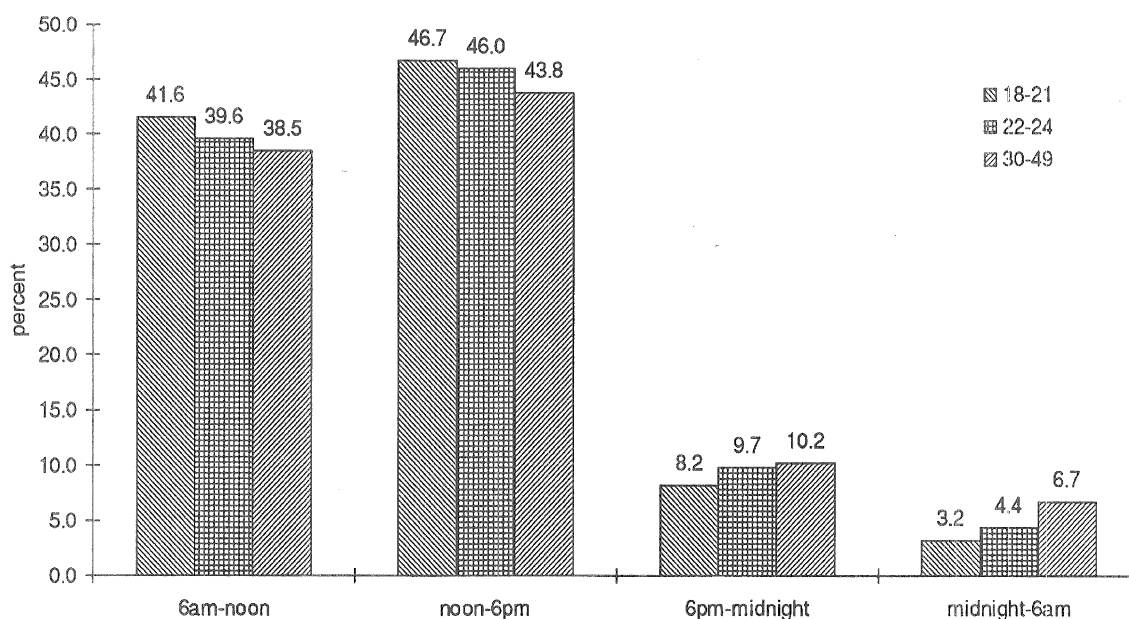


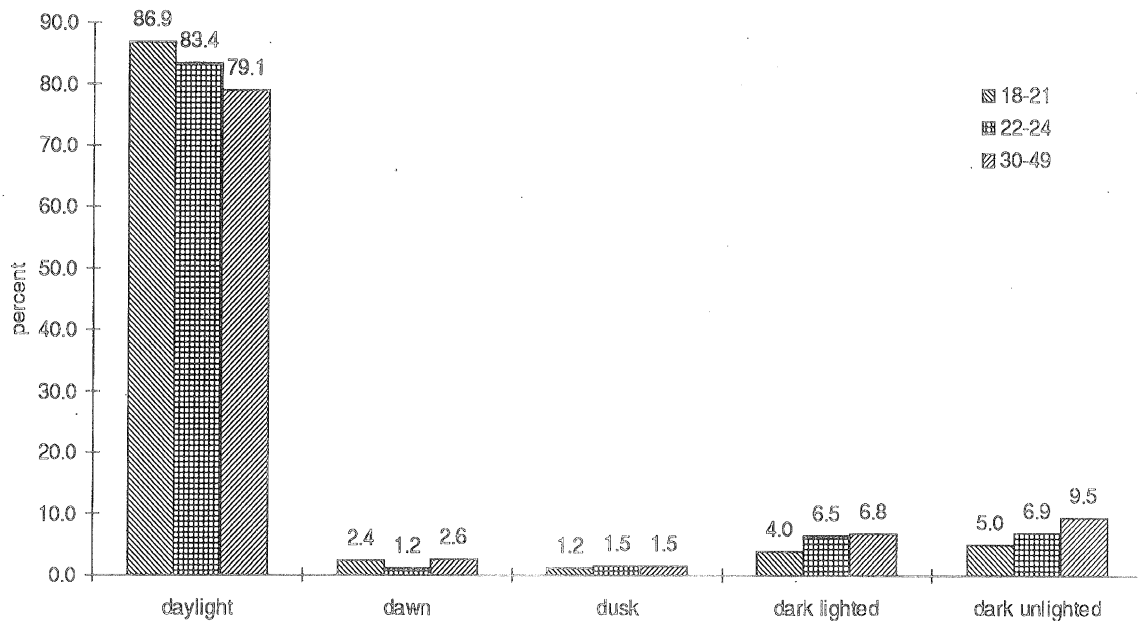
Figure 7 shows truck involvements distributed across the same time blocks as in the driver's survey. In fact, figure 7 here looks very similar to figure 3 in the material from the driver survey. About 80 to 85 percent of all truck involvements occur between 6 A.M. and 6 P.M. for each age group. Similarly, the drivers surveyed estimated that about 80 to 85 percent of their travel occurred between 6 A.M. and 6 P.M. Note also that the daytime involvements stair-step down for each age group, but that at night, the steps go up. While it is true that the only difference that is statistically significant is that between younger and older drivers in the midnight to 6 A.M. time block, the consistency of the effect leads to a strong presumption that the effect is real. The graph for the North Carolina data looks very similar. Differences between the age groups are not great, especially during the day, but note that older drivers have about twice the percentage of accident involvements after midnight. This is certainly consistent with the picture of the differences between older and younger drivers. It is also consistent with the hypothesis that nighttime travel and accidents do not play a significant role in the overinvolvement of younger truck drivers.

Figure 7: Time of day by age group  
Michigan police-reported truck involvements, 1993-1994



Light condition, i.e., whether it was daylight or not, speaks more directly to some of the differences in operating environment between young and older drivers. Once again, the great majority, between 79 and 87 percent, of involvements occur during daylight. But a higher percentage of younger drivers' involvements occur during daylight, while the proportion of older drivers' involvements are higher in both the dark/lighted (urban) and dark/unlighted (rural) condition. In figure 8, the differences between younger and older drivers are significant in every category except dawn and dusk. Studies have shown that night is associated with significantly higher accident risk [Campbell, 1988; Blower, 1993]. Night nearly doubles the risk of involvement in an accident. Causes of the higher risk at night likely include the greater incidence of fatigue and shorter sight distances due to darkness. Ideally, we would calculate accident rates for light condition, but collecting the appropriate data is not possible within the scope of the current work. Nevertheless, figure 8 strongly suggests that night travel does not play a large role in explaining the overinvolvement of younger drivers.

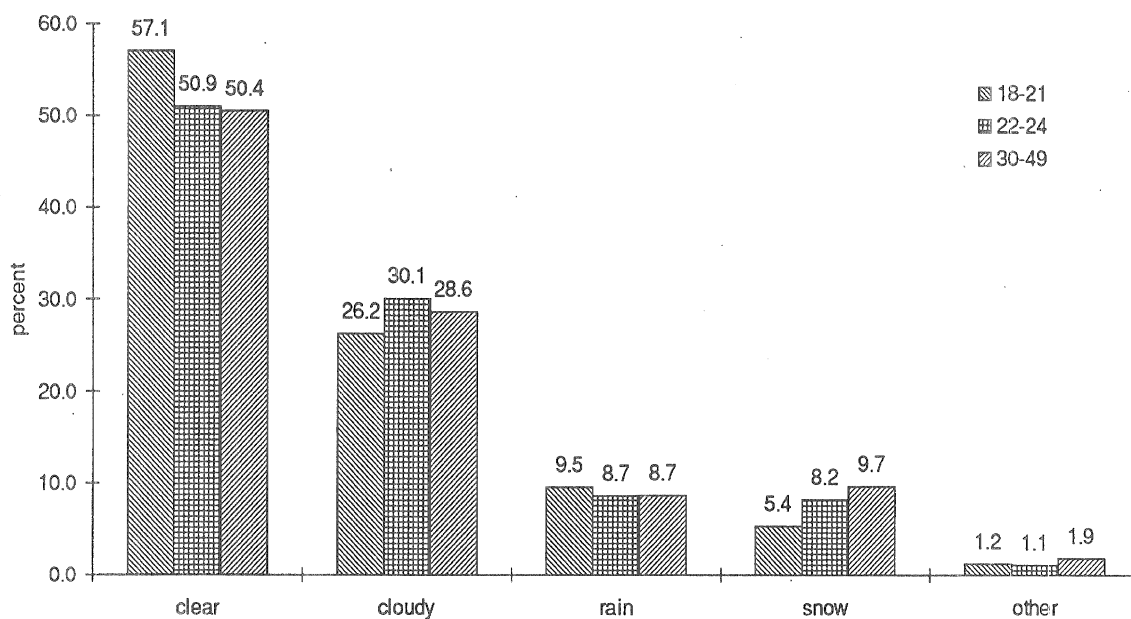
Figure 8: Light condition by age group  
Michigan police-reported truck involvements, 1993-1994



Other environmental factors that were available to explain the excessive accident rate of younger drivers include weather and road condition. Young drivers may have more difficulty driving in unfavorable weather or with slick road conditions. If that were the case, one would expect young drivers to have a higher proportion of their involvements than older drivers in bad weather or on icy, snowy roads. In fact, the reverse is more nearly the case. Figure 9 shows the distribution of weather conditions and figure 10 shows the distribution of road conditions for the three age groups. A higher proportion of the involvements of young drivers occur during favorable road and weather conditions. About 57 percent of young driver involvements occur during clear weather, compared with 50 percent of the involvements of older drivers. This difference is statistically significant. Similarly, the roadway was dry for 72 percent of young driver involvements, compared with 66 percent of the involvements of older drivers. This difference is also significant. The graphs also do not show any marked higher proportion of involvements during periods of rain or snow, or on icy, snowy roads. In fact, the proportions are higher for older drivers. There is no evidence in these graphs that difficulties in coping with weather accounts for the overinvolvement of young drivers in traffic accidents.



**Figure 9: Weather condition by age group**  
Michigan police-reported truck involvements, 1993-1994



**Figure 10: Road condition by age group**  
Michigan police-reported truck involvements, 1993-1994

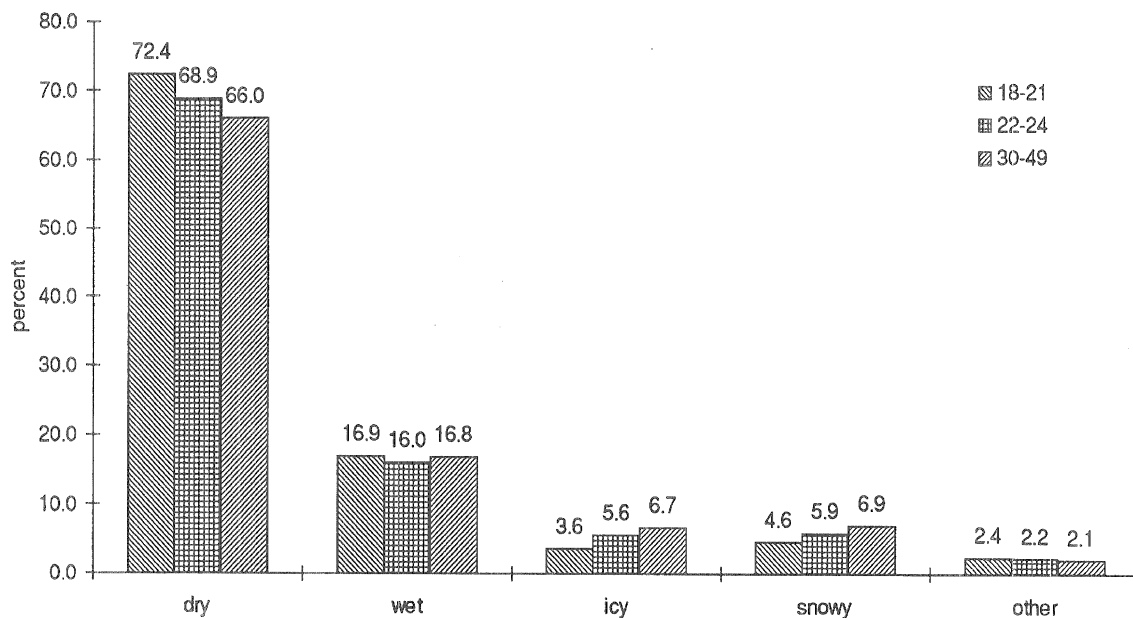
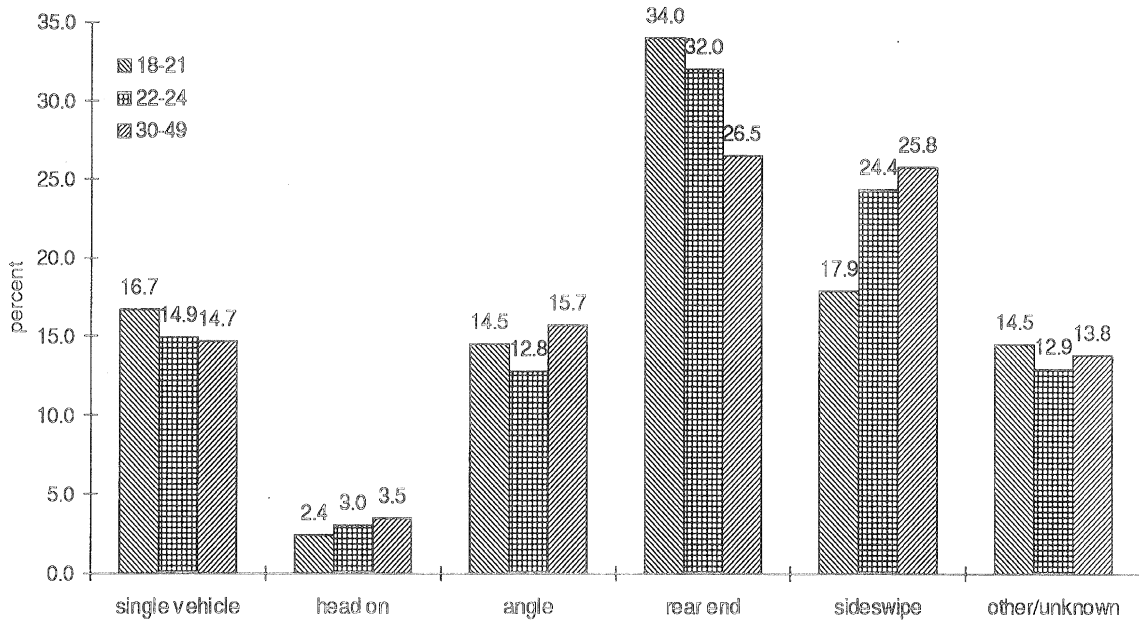


Figure 11 shows the distribution of accident type for the three age groups. In this figure, accident type is classified as single vehicle, head-on, angle collision, rear-end, sideswipes, and all other accidents. Younger drivers have a somewhat higher percentage of

involvements in single vehicle accidents, 16.7 percent to 14.7 percent, but there is not enough data for this difference to be statistically significant. Still, the difference is in the expected direction. Single vehicle accidents typically involve problems with vehicle control, since the influence of another vehicle in the accident is eliminated. It is expected that the less experienced younger drivers would have more problems handling a large vehicle than more experienced drivers.

Figure 11: Accident type by age group  
Michigan police-reported truck involvements, 1993-1994



However, the largest differences in the graph are for rear-end and sideswipe collisions. Fully 34 percent of the collisions of younger drivers involve a rear-end collision, compared with only 26.5 percent of the involvements of older drivers. This difference is both substantial and statistically significant. In this accident typology, rear-ends where the truck is the striking vehicle are not distinguished from rear-ends where the truck is struck, but still the difference is marked. The other large difference in the graph is for sideswipes. For older drivers, this collision type is the second most common, with 25.8 percent of their involvements. Sideswipes account for 17.9 percent of the involvements of younger drivers.

While useful, figure 11 provides only a simple classification of accident involvements. In order to understand in greater detail the nature of the accidents in which younger drivers

are involved, a more complex accident typology was developed. In this typology, an effort was made to characterize the relative position and motion of both vehicles involved in two-vehicle accidents. In order to produce a typology with this information, a "two-vehicle" file was constructed. The two-vehicle file includes both vehicles in all two-vehicle accidents with at least one truck. Where an accident involved two trucks, two records of the accident were created, one with each truck as the subject vehicle. With both vehicles in the accident, and some information about what they were doing, it is possible to develop a more detailed accident typology. These typologies are based on variables characterizing vehicle movements, precollision maneuvers, and contact points. Typologies were developed using both the Michigan and the North Carolina accident data. The typology for Michigan is displayed in table 17 and for North Carolina in table 18. These typologies are critical to the overall objective of the project, so considerable effort was expended to develop similar typologies. Consistency in the distributions of accident frequencies for the two states is a good indicator of reliability.

The typology is divided into five main accident types: single-vehicle, backing related, angle or sideswipe, turning related, and rear-end involvements. The single-vehicle category has several subcategories, the most important of which are "loss of control" and "hit fixed object." In both of these subcategories, the truck leaves the roadway and hits something off the road. "Loss of control" and "hit fixed object" might be regarded as virtually the same, but in the loss of control accident type, the reporting officer has made an explicit judgment about the precipitating event.

Backing accidents are divided into cases where the truck backs into another vehicle, another vehicle backs into the truck, and cases that cannot be distinguished using available information. The angle/sideswipe class is the most complex. It includes categories for both vehicles going in the same direction and both going straight, opposite direction and both going straight, crossing paths and both going straight, other vehicle moves or changes lanes into the truck, where the truck moves into the other vehicle, and unclassifiable other angle/sideswipe involvements.

Turning involvements are divided among cases where the truck is turning and the other vehicle is going straight, the reverse case, and the case where both vehicles are turning. Rear-ends are classed by whether the truck is the striking or struck vehicle and all other rear-ends. Finally there are categories for two-vehicle involvements that do not fit any of the above categories, and accidents that involve more than two vehicles.

Table 17: Accident typology by age group  
Michigan police-reported truck involvements, 1993-1994

Accident type	age group						
	18-21		22-24		30-49		
	N	%	N	%	N	%	
Single vehicle	Lost control etc.	44	8.9 *	68	6.2	535	5.3
	Rollover	2	0.4	3	0.3	41	0.4
	Other non-collision	15	3.0	23	2.1	224	2.2
	Hit animal	9	1.8 *	26	2.4	376	3.7
	Hit other non-fixed object	2	0.4	15	1.4	82	0.8
	Hit fixed object	19	3.8	33	3.0	350	3.5
	Unknown single vehicle	1	0.2 *	9	0.8	82	0.8
	Single vehicle subtotal	92	18.5	177	16.2	1,690	16.7
Backing related	Truck backed into other	59	11.9 *	101	9.2	808	8.0
	Other backed into truck	2	0.4	10	0.9	72	0.7
	Other backing	1	0.2	2	0.2	20	0.2
	Backing subtotal	62	12.5 *	113	10.3	900	8.9
Angle or sideswipe	Same direction, both straight	17	3.4 *	44	4.0	552	5.5
	Opposite direction, both straight	9	1.8	14	1.3	150	1.5
	Crossing, both straight	33	6.7	54	4.9	572	5.7
	Truck moved into other	13	2.6	35	3.2	271	2.7
	Other moved into truck	9	1.8	21	1.9	278	2.7
	Other angle/sideswipe	22	4.4	48	4.4	533	5.3
	Angle/sideswipe subtotal	103	20.8	216	19.7	2,356	23.3
Head-on	4	0.8	11	1.0	137	1.4	
Turning related	Truck turning, other straight	45	9.1	118	10.8	1,150	11.4
	Other turning, truck straight	23	4.6	59	5.4	491	4.9
	Both turning	6	1.2 *	21	1.9	303	3.0
	Turning subtotal	74	14.9 *	198	18.1	1,944	19.2
Rear-end	Truck striking	62	12.5 *	141	12.9	846	8.4
	Truck struck	29	5.8	61	5.6	676	6.7
	Other rear end	9	1.8	27	2.5	214	2.1
	Rear end subtotal	100	20.2	229	20.9	1,736	17.2
Other 2-vehicle	24	4.8	53	4.8	599	5.9	
More than 2 vehicles	37	7.5	98	8.9	750	7.4	
Total	496	100.0	1,095	100.0	10,112	100.0	

\* Statistically different from proportion of older drivers at 0.05 level

The major accident types for younger drivers are: Loss of control combined with hit fixed object (12.7 percent); Truck backed into other vehicle (11.9 percent); Turning related involvements (14.9 percent); Rear-end, truck striking (12.5 percent). Together these account for about 52 percent of younger truck driver accident involvements in the Michigan data. Loss of control, backing into another vehicle, and rear-end truck striking are all accident types where younger drivers are significantly overinvolved compared with older drivers. Almost nine percent of younger drivers' involvements are single-vehicle loss of control, compared with about five percent for older drivers. Almost 12 percent are involvements where the younger driver backs into another vehicle, compared with about eight percent of the involvements of older drivers. And rear-end truck striking accounts for about 12 percent of younger drivers accidents, compared with eight percent for older drivers.

A similar typology was developed using the North Carolina data. The results are displayed in table 18. Despite the differences in the types and detail of accident information recorded in the two files, the typologies are reasonably similar. The distributions of accident types are about the same in both typologies, and there is even some commonality in the types of accidents where younger drivers show up as overinvolved compared with older drivers.

In the North Carolina data, younger drivers have higher proportions of single-vehicle loss of control involvements, turning related involvements, rear-end truck striking involvements and backing involvements where the truck backs into another vehicle. The most notable difference is in the proportion of angle/sideswipe involvements. Overall, however, the two typologies reinforce each other.

Table 18: Accident typology by age group  
North Carolina police-reported truck involvements, 1993-1994

	Accident type	age group					
		18-21		22-24		30-49	
		N	%	N	%	N	%
Single vehicle	Lost control etc.	105	12.62 *	211	9.45	1,824	9.07
	Rollover	7	0.84	34	1.52	252	1.25
	Other non-collision	7	0.84	23	1.03	177	0.88
	Hit animal	0	0.00 *	6	0.27	146	0.73
	Hit other non-fixed object	8	0.96	14	0.63	270	1.34
	Hit fixed object	33	3.97	107	4.79	788	3.92
	Unknown single vehicle	0	0.00	0	0.00	0	0.00
	Single vehicle subtotal	160	19.23	395	17.69	3,457	17.19
Backing related	Truck backed into other	83	9.98 *	186	8.33	1,499	7.45
	Other backed into other	8	0.96	21	0.94	210	1.04
	Other backing	3	0.36	3	0.13	57	0.28
	Backing subtotal	94	11.30 *	210	9.40	1,766	8.78
Angle or sideswipe	Same direction, both straight	21	2.52 *	100	4.48	963	4.79
	Opposite direction, both straight	29	3.49	78	3.49	786	3.91
	Crossing, both straight	41	4.93	133	5.96	1,190	5.92
	Truck moved into other	23	2.76 *	96	4.30	1,125	5.59
	Other moved into truck	8	0.96 *	63	2.82	710	3.53
	Other angle/sideswipe	8	0.96	22	0.99	304	1.51
	Angle/sideswipe subtotal	130	15.63 *	492	22.03	5,078	25.25
Head-on	Head-on	3	0.36 *	12	0.54	160	0.80
Turning related	Truck turning, other straight	85	10.22 *	183	8.20	1,612	8.02
	Other turning, truck straight	52	6.25	124	5.55	924	4.59
	Both turning	12	1.44	34	1.52	401	1.99
	Turning subtotal	149	17.91 *	341	15.27	2,937	14.61
Rear-end	Truck striking	114	13.70 *	259	11.60	1,650	8.21
	Truck struck	42	5.05	106	4.75	1,123	5.58
	Other rear end	13	1.56	32	1.43	422	2.10
	Rear end subtotal	169	20.31 *	397	17.78	3,195	15.89
	Other 2-vehicle	53	6.37 *	170	7.61	1,722	8.56
	More than 2 vehicles	74	8.89	216	9.67	1,794	8.92
	Total	832	100.00	2,233	100.00	20,109	100.00

\* Statistically different from proportion of older drivers at 0.05 level

Loss of control accidents show some association with curved roads and bad weather conditions. This is not to say that they are in some sense caused by these conditions, but that they are more likely to occur in such conditions than other involvements. Michigan does not have a useful description of the roadway geometry of the accident scene in the

available public files, but in North Carolina about 28 percent of loss of control (LOC) involvements of younger drivers occurred on a curved roadway, compared with about 13 percent of all involvements. The proportions were similar, though slightly higher, for older drivers. Review of police reports on LOC accidents showed that the problem in LOC involvements on curves is typically excessive speed for the degree of curvature and grade. In many instances, the truck did not exceed the posted speed limit. However, the greater mass, higher center of gravity, and less responsive handling characteristics of a heavy truck require a lower speed for trucks than for passenger cars, for which roads are typically signed.

Weather is also associated with LOC involvements. The proportions of icy or snowy roads in LOC involvements are higher than for all involvements in the Michigan data. Results are similar for wet roads in the North Carolina data. This association is true for both older and younger drivers, though sample sizes are not large enough to determine if younger drivers have more problems with slick roads than older drivers.

However, younger drivers have a higher incidence of loss of control involvements in both the Michigan and North Carolina accident files. It is likely that the higher rate of LOC accidents is explained by the combination of two factors: excessive speed and lack of experience in driving heavy trucks. It is clear from the material about traffic violations that younger drivers tend to drive more aggressively and to speed than older drivers. Moreover, younger drivers have much less experience in handling a heavy truck and much less experience from which to select a safe speed for existing conditions. The "unsafe speed" violation, which is typically issued in policing accidents as opposed to a traffic stop, is virtually a judgment by the officer that the driver was operating the vehicle beyond his ability to control it.

Problems with vehicle control and excessive speed are also suggested by the location of accidents on expressways in Michigan. Although the variables describing the roadway in the Michigan data are limited, it is possible to distinguish accidents on exit and entrance ramps from other locations on an expressway. Over 30 percent of the involvements of younger drivers on expressways occur on entrance/exit ramps, compared with about 21

percent for older drivers. This difference just fails to be significant at the 0.05 level. Even so, the difference is consistent with other findings in this report and is likely to be real. Given the greater mass and higher center of gravity of heavy trucks, the safe speed for trucks is often considerably below that for passenger cars. Older drivers are more likely to have a practical grasp of the relevant physics.

Rear-end collisions are largely associated with intersections, where a lead vehicle is slowing or stopping and the following vehicle fails to respond appropriately. There did not seem to be any association with night time in either the Michigan or North Carolina files, though that is likely because traffic densities are much lighter at night and a rear-end collision requires at least two vehicles. Associations with wet roads and bad weather were too slight to be significant in either file.

#### 7. Review of individual accident types

To better understand the collision types in the accident typologies, the original police reports were examined for several accident types. Police reports usually include a scene diagram showing vehicle movements, along with the reporting officer's narrative of what he considered to be the most important factors in the accident. Reading the police reports provides a better idea of what type of accidents fall into the various categories. For example, the "truck turning, other straight" category can include several different situations, such as the truck turning across an oncoming vehicle's line of travel, the other vehicle passing a turning truck, or the truck turning into a stopped vehicle. In addition, the police narrative and scene diagram can more specifically identify driver errors, if any, that contributed to the accident.

Accordingly, a total of 400 police reports were selected from the Michigan and North Carolina accident files, 200 from each state. Half of the police reports involved younger drivers and the other half older drivers. The police reports were selected from the major accident types identified in the accident typologies above. Police reports were selected for single-vehicle loss of control, backing, turning related, angle/sideswipe, and rear-end truck striking groups. Below, the findings from the "hard-copy review" of the reports are discussed.



Angle/sideswipe: opposite direction, both going straight: Many of these occur on curves to left. The truck drives left of center, either because of excessive speed or the trailer goes left of center due to low-speed offtracking, and collides with an oncoming vehicle. There were some instances, on straight roads, where a vehicle simply drifted left of center without any information to indicate why. There did not appear to be any distinction between the age groups.

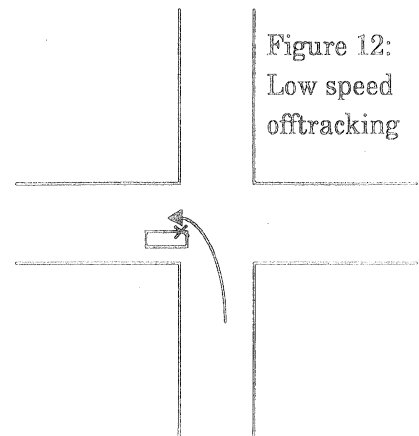
Angle/sideswipe: same direction, both going straight: Many of these collisions could easily be moved to other categories. A typical example is the lead vehicle slowing for a turn. The following truck is not able to stop in time and attempts to pass the lead vehicle on either the left or right. These collisions could be moved to the rear-end category. In some cases, vehicles traveling side by side drift into one another: these belong in the "moved into" categories. Accident types of older and younger drivers were similar.

Angle/sideswipe: crossing paths, both straight: This accident typically occurs at driveways or intersections. Characteristically, either the truck or the other vehicle failed to observe a stop sign or signal. For younger drivers, in about half of the cases the other vehicle failed to yield and pulled into the truck's path. In the circumstances, there was little the driver could have done. In the other half of the cases, the younger driver failed to yield, either by stopping and then pulling into traffic inappropriately or by failing to stop at all. In the accidents of older drivers, the results were similar. However, analyses of moving violations showed that younger drivers are cited more often for failure to yield.

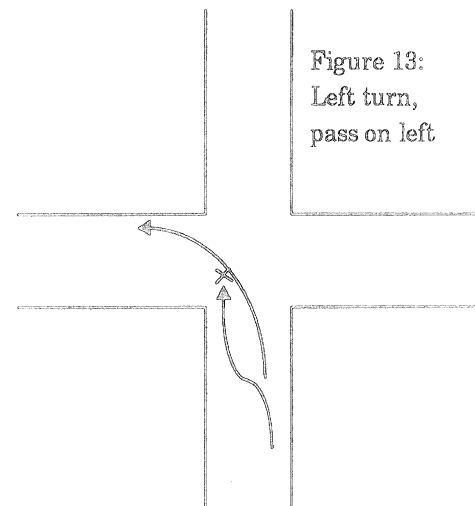
Angle/sideswipe: truck move into other: Most cases involve a truck merging into traffic or changing lanes and failing to see a vehicle in the "blind spot." Interestingly, older drivers have higher proportions of this type of accident than younger drivers, and the difference is significant, though it is a minor accident type for both.

Truck turning, other straight: This accident type encompasses four primary modes: (1) truck turning left and hits vehicle stopped on the cross street (figure 12), (2) left turn with no signal and following vehicle attempts to pass on left (figure 13), (3) truck attempts right turn by swinging wide to the left and following vehicle attempts to pass on the right (figure 14), and (4) truck attempts left turn across path of on-coming vehicle.

In the first scenario, the truck is maneuvering in city traffic and is turning at a signal-controlled intersection. Tractor-semitrailers are subject to low-speed offtracking, in which the trailer axles track to the inside of the tractor's path in a low speed turn. Both older and younger drivers experienced accidents of this type, but in the accident reports examined for this project, the problem was much more frequent for younger drivers. This is a problem of vehicle control and understanding how articulated vehicles move in low speed turns, as well as having a feel for where the vehicle is. Older drivers with much more experience in driving long combinations have more success in avoiding this type of accident.



In the second type of truck-turning accident, the problem is primarily one of failing to signal and observe, as well as to anticipate the actions of other road users. Typically in this accident the lead truck is slowing to turn left into a driveway or sometimes a cross street. The following vehicle tries to pass the slowing truck, which then starts to complete the left turn, colliding with the passing car. In many of these cases the truck driver is cited for failing to signal. Again, younger drivers are involved in this type of



accident about twice as often as older drivers, in the sample of police reports examined. The number of cases examined is not large enough to support statistical tests.

The third type of truck turning accident is the opposite of the above, i.e., in this accident the truck is turning right. In the process of making the right turn, the driver has swung left in order to get his vehicle around the corner. A following car attempts to pass on the right and is struck by the truck as it completes its right turn. Again, the problem here is primarily a failure to signal the turn properly and to anticipate the moves of the following traffic.

However, this accident type does not seem to be especially associated with younger drivers. Both older and younger drivers were involved equally in this type of accident.

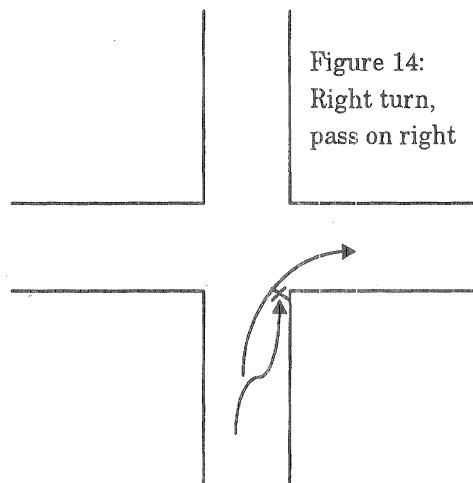


Figure 14:  
Right turn,  
pass on right

The fourth type of truck-turning accident found in the accident report review consisted of the truck making a left turn across on-coming traffic. Prior to reviewing individual cases, it had been expected that this type of accident would be relatively common. In fact, the three accident types above were much more frequent. Turning across a traffic stream involves making a judgment on the gap available in the on-coming traffic stream and the ability of the vehicle to make it through that gap. It was thought that younger drivers might have more difficulty making this judgment, but in fact they did about as well as the older drivers. And in most cases, the truck driver making the turn said that he simply had not seen the on-coming vehicle. In other cases, the driver said he thought the gap was large enough to complete the turn safely.

Other turning, truck straight: About half of the accidents in this category fall into the configuration represented by figure 12 on page 46, with the truck in the following vehicle position. In these accidents, however, the truck is typically "following too closely," according to the reporting officer, or driving too fast, so that it is unable to stop in time and the driver attempts to steer around to the left to avoid rear-ending the lead vehicle. These accidents have the same characteristics as rear-end, truck striking collisions. This particular accident scenario occurred more often for younger drivers and reflects a failure to anticipate the actions of other vehicles and to choose a speed that allows them to react safely. There were

instances of this type of collision for older drivers, of course, but the accident type fits better with the characteristics of younger drivers that have been established here.

The other half of the accidents that fall into this category involve a vehicle turning left across the path of the on-coming truck. In almost all of these, there was nothing obvious the truck driver could have done to avoid the accident, and he was not found at fault in any of the cases.

Backing: About half of these cases involve hitting a parked car while maneuvering toward a loading dock or other unloading position. In all such cases, the driver said that he had not seen the parked vehicle. That should be obvious, but the true error is that the driver did not check for a parked vehicle. The other half involve backing in traffic and striking a vehicle that was not anticipated. A typical example is a driver stopping in traffic and then backing toward a driveway, but striking a vehicle in traffic. In one case the driver had even waved around traffic in order to clear a path, but did not see a car that had stopped too close to the back of his trailer to be visible to the driver. Both backing accident types occurred about equally to older and younger drivers, though overall younger drivers have a somewhat higher proportion of backing involvements.

Rear-end, truck striking: Most of these cases are intersection-related. The lead vehicle is slowing for a traffic control signal at an intersection and the following truck failed to stop in time and rear-ended the lead vehicle. The truck was cited for following too closely and failure to reduce speed. There were two cases in which the lead vehicle changed lanes in front of the truck just before braking. There was also one case where a truck, traveling at 70 mph on an Interstate in fog collided with another truck going 50 mph. But the primary problem in most cases was a failure to anticipate the actions of other road users and to drive at a speed that permits safe stopping. Older drivers also were involved in this accident type, but at about half the rate of younger drivers.

Loss of control: Accidents of this type fell primarily into three scenarios: (1) truck ran or drifted off a straight stretch of road for no obvious reason, (2) truck came upon traffic while rounding a curve and lost control attempting to stop, (3) driver reached for something in the cab and lost control of his vehicle. The accidents in the first scenario may be fatigue related,

though in several cases there was no explicit confirmation in the narrative and the accident did not occur in the early morning hours. The unexplained ran-off-the-road accident can also occur simply through lack of attention, allowing the vehicle to go off the road, and then overcorrecting. The second scenario is clearly a problem of excess speed and failure to anticipate. The driver essentially is driving beyond his range of vision, similar to driving beyond the headlights at night. When an unanticipated problem occurred, the driver has not left himself enough time and space in which to react safely. The third scenario reflects both a lack of attention and an inability to maintain vehicle control. These accidents occurred on straight stretches of road. In one instance a driver was reaching for his sunglasses and in another the driver was looking for some papers in the cab. While not desirable, it is conceivable that an older, more experienced driver could have more easily maintained control of the vehicle with divided attention. Experience, in the sense of a nearly-automatic ability to perform low-level driving functions such as maintaining steering control, may also enter into the explanation.

Older drivers also experienced loss of control accidents, including likely fatigue-related events that led to drifting off the road. But a much larger fraction of the loss of control accidents of older drivers were due to events beyond the driver's immediate control. One resulted from avoiding a hit-and-run accident, and several others were due to equipment problems. The overall point, however, is that younger drivers have a higher incidence of loss of control accidents and they appear to be related to inattention, failure to anticipate, and excessive speed.

## **8. Summary and conclusions**

While there has been much work on young drivers of passenger cars, particularly males, there has been very little research published on younger truck drivers. Because of this, the current work took a fairly broad approach. Drivers were surveyed to establish basic background information about younger truck drivers. Driver history files provided information about traffic violations and thus the range and proportions of certain errors in driving behavior. Computerized accident files were searched, to the extent possible, for associations with environmental factors. An accident typology was developed to show the

particular types of accidents in which young truck drivers are involved. The kinds of accidents young drivers are involved in provided further information about common errors and reinforced the picture from the analysis of traffic violations. Finally, the scene diagrams and narratives of a sample of individual accidents were analyzed to more specifically identify and characterize driver errors.

The driver survey provided background information about the population of commercial driver's license holders in the state of Michigan. About 90 percent of younger CDL-holders currently drive a truck requiring a CDL. This percentage is slightly higher than for CDL-holders age 30 to 49. About 64 percent of young truck drivers drive a straight truck primarily, compared with 50 percent of older truck drivers. Young drivers drive about 30 percent fewer miles on average than older drivers. More of their miles are during the day, almost 70 percent are driven within 50 miles of their base, and 70 percent work for intrastate firms. In contrast, older drivers have somewhat more night mileage, almost 42 percent of their miles are driven on trips of more than 50 miles, and over 45 percent work for interstate companies. Sixty-three percent of younger drivers work for companies that operate 10 or fewer trucks, and only 6.4 percent work for firms operating more than 200 trucks. In contrast, over 19 percent of older truck drivers work for the largest fleets. Only ten percent of younger drivers claimed to have attended a truck driving school and less than two percent were trained in the military.

The literature on young male passenger car drivers points to excessive risk-taking and skill deficits as major factors in their high accident rates. Examination of moving violations, the accident record, and particular accident types provided evidence that young truck drivers have similar problems. Fifty-six percent of young truck drivers had a least one moving violation in the past three years, compared with 29 percent of older drivers. Young truck drivers were about twice as likely to be cited for unsafe speed as older drivers (8.2 percent of younger driver's moving violations compared with 4.8 percent for older drivers). Unsafe speed was the second most frequent violation type after speeding itself, which accounted for about 70 percent of all moving violations. Considering violations committed in trucks only, 11.5 percent of younger drivers' were "unsafe speed," compared with about four percent for older drivers. Younger truck drivers also were more likely to be cited for a "hazardous

action” than older drivers when involved in a traffic accident. Seventy percent of young accident-involved truckers were cited, compared with 55 percent of older drivers. Incidentally, the high proportion of actions contributing to the accident indicates that exposure factors are not a primary source of young drivers’ overinvolvement.

In two-vehicle accidents, younger truck drivers were about 50 percent more likely than older drivers to have the only hazardous action or traffic violation charged in the accident. Also in two-vehicle accidents, when the truck driver is young, he is over twice as likely as the other driver to be cited for a hazardous action or traffic violation. Older drivers are cited at about the same rate as the other driver in two-vehicle accidents. This is further evidence that young drivers commit errors that contribute to traffic accidents at a higher rate than older, more experienced drivers.

Loss of control, turning-related, backing, and rear-end truck striking accidents account for about half of younger driver’s accident involvements. A review of a sample of accident cases revealed that overly-aggressive driving, unsafe speed, vehicle control, and attentional deficits all played a role. Many loss of control involvements occurred on curves, when the driver entered the curve going too fast to maintain control if an unanticipated event occurred. Others were associated with distractions in the cab diverting the driver’s attention and resulting in the truck wandering off the road.

A large fraction of turning related accidents involved problems with basic vehicle control. Low speed offtracking of the trailer in tight left turns resulted in collisions with cars stopped waiting for the truck to clear. Most remaining turning accidents were associated with failure to signal intentions and to anticipate the actions of other road users when they attempted to pass the slowing truck. Rear-end truck striking accidents combine two characteristic problems of young truck drivers: excessive speed and failing to anticipate the actions of other road users. In many instances, the driver was going too fast and following too closely to avoid a collision when the lead vehicle did something unexpected, such as slowing for a turn or for a traffic control.

In sum, analysis of traffic violations, the computerized record of traffic accidents, the accident typology, and case review of a sample of police reports all produced evidence of the following driving problems among younger truck drivers:

- excessive and unsafe speed;
- overly aggressive driving, as in following other vehicles too closely;
- failing to anticipate and provide for the unexpected actions of other road users, as in both rear-end and backing accidents;
- maintain proper vehicle control, as in low-speed turning and backing accidents;
- possible attentional overload, as in some of the loss of control accidents.

Much of the literature on young car drivers points to the propensity of young males to speed, to drive too aggressively, and to fail to anticipate the actions of other road users. These problems are only aggravated in a truck. Because trucks have greater mass and less nimble handling characteristics, they take longer to stop and are much less maneuverable in traffic. The quick reactions on which young drivers rely are less useful in a truck than anticipating and providing for a problem in the first place.

In a sense, the answer to many of these problems is experience. The two main differences between young and older drivers are age and experience. Experience includes knowledge of the wide variety of behaviors of other road users, strategies for coping with other road users, a knowledge of how your own vehicle is going to perform, as well as the low-level skills of driving, such as lane-keeping and maintaining headway that are learned so well as to be automatic and unconscious. Older drivers tend to anticipate the actions of vehicles around them better simply because they have "been there" so many times. They have seen how other drivers behave around trucks. They also have to pay less attention to the basics of driving and so have more attentional capacity to spare for reacting to other road users.

The problems of youth, excessive risk-taking and overestimation of ones own driving abilities, are more difficult to address. Interestingly, the evidence in the literature about



young passenger car drivers as to the efficacy of driver's training is mixed. Some studies have shown a slight reduction in accident frequency, but in others there was an increase over untrained drivers. In fact, one study concluded that the main effect of driver's training in the study group was to provide licenses at an earlier age and thus allowing more time to be involved in an accident [see the review in Gregersen, 1996a]. However, driver's training traditionally focuses on skill factors. But if traffic accidents are a product of attitude and risk-taking in addition to pure vehicle control skills, these factors must be addressed as well. A recent study in Sweden of novice passenger car drivers showed training that focused on the limits of driving skill led to less overestimation of driving abilities [Gregersen, 1996b].

Effectively addressing the two problems of age and experience of young truck drivers is difficult. Evaluating the means of doing so is outside the scope of the present study. But it is likely that the problem of experience can be overcome through practical training that gives real-world experience. Motivational factors, such as risk-taking and aggressive driving, must be addressed as well, and the study in Sweden mentioned above may suggest a useful approach. The material presented here indicates that the primary areas for attention are aggressive driving, accounting for the actions of other road users, and basic vehicle control, in the sense of having a feel for the boundaries of the truck. All of these problems were found to contribute to the accident types in which younger drivers were most overinvolved.

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