

## ANALYSIS OF FACTORS ASSOCIATED WITH FATAL TRUCK CRASHES

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*Submitted to the 3<sup>rd</sup> International Conference on Road Safety and Simulation,  
September 14-16, 2011, Indianapolis, USA*

### ABSTRACT

One-ninth of all traffic fatalities in the United States have involved large trucks in the past five years, although large trucks contributed to only 3% of registered vehicles and 7% of vehicle miles traveled. This contrasting proportion indicates that truck crashes in general tend to be more severe than other crashes, though they constitute a smaller sector of vehicles on the road. To study this issue, fatal crash data procured from the Fatality Analysis Reporting System (FARS) was used to analyze characteristics and factors contributing to truck-involved crashes. Driver, vehicle, and crash-related contributory factors were identified, and as an extension, the likelihood of occurrence of these factors in fatal truck-involved crashes with respect to non-truck crashes was evaluated using the Bayesian Statistical approach. Likelihood ratios for factors like stopped or unattended vehicles, or improper following have greater probability of occurrence in truck crashes than in non-truck crashes. Other factors such as cellular usage, failure to yield right of way, inattentiveness and failure to obey traffic rules also have a greater probability in truck crashes. Inadequate warning signs and poor shoulder conditions were also found to have greater predominance in contributing to truck crashes than non-truck crashes.

**Keywords:** Transportation safety, truck crashes, fatal crashes

### INTRODUCTION

Large trucks have led to high-risk crashes resulting in severe injuries and fatalities in the United States. Of the 41,059 fatalities in motor vehicle crashes in 2007, 12% (4,808) died in crashes that involved a large truck. Only 17% of those fatalities in large truck crashes were occupants of large trucks. Hence, large truck crashes in particular are more devastating for occupants of other vehicles. Though contributing to only 8% of vehicles involved in fatal crashes for the last five years, their impact in terms of severity proves to be a major concern.

Large trucks have different performance characteristics than other smaller vehicles. The physical dimension of the vehicle makes it difficult for drivers to maneuver large trucks smoothly on roadways. They can be 40 or more times heavier than the other vehicles in the traffic stream, and have a slower initial pickup and longer deceleration time. Truck drivers face many challenges while traversing interstate or state highways at high speeds, or at intersections

while taking turns, to have control over the vehicle. Also, the element of blind spots makes it even more challenging for the truck driver and the surrounding vehicle drivers to avoid the heavy crash risk.

Crash statistics observed from the previous years, as seen in Table 1, show significant consistency in the frequencies of the different categories of large truck involved crashes. These trends reflect the need for a more effective analysis, which would provide characteristic facts pertaining to these crashes and help generate productive remedial measures. Achieving effective safety goals to downsize the intensity of the issue will require approaching truck safety aspects from a variety of parameters.

**Table 1 Large Truck Involved Crash Statistics**

Year	Injury Crashes	Property Damage Only(PDO) Crashes	Fatal Crashes	Single Vehicle Fatalities	Multi Vehicle Crash Fatalities	Total Fatalities
2002	90,000	322,000	4,224	449	4,490	4,939
2003	85,000	347,000	4,335	457	4,579	5,036
2004	83,000	312,000	4,478	469	4,766	5,235
2005	78,000	341,000	4,551	478	4,762	5,240
2006	77,000	287,000	4,321	500	4,496	5,027
2007	76,000	333,000	4,584	502	4,306	4,808

Source: Large Truck Safety Facts 2007

Previous research had shown that many driver-related factors significantly contributed to fatalities in truck crashes ((1), (3), (4), and (5)). Long and strenuous work hours for truck drivers make them fatigued and reduce their attention levels, which will dramatically increase the crash risk factor. As the amount of truck travel is dramatically increasing with the growing rate of freight transport, which in turn requires continued attention in order to find ways of reducing truck crash risk, the Federal Motor Carrier Safety Administration (FMCSA) has set as a goal of “50 by 2010,” a 50% reduction in commercial truck-related fatalities by the year 2010. Accordingly, it is important for the safety community to identify the characteristics and contributory factors related to large truck involved fatal crashes.

To attenuate the fatal truck crash frequency in the country and achieve the sustainability of this trend seems difficult with the growing rate of movement of people and goods throughout the country. Hence, it is essential to analyze the situations under which fatal truck crashes are occurring. These factors, which prevail at the time of a fatal truck crash, and their frequencies/rates, can give a picture of the conditions under which a larger proportion of such crashes occur.

This study deals with identification of these characteristics for all fatal crashes in the country for the period of 2003-2007. Also, from these observed characteristics reasonable suggestions could be made for the mitigation of the fatal truck crash risk.

## LITERATURE REVIEW

Extensive research was conducted for nearly a decade in establishing a unique truck crash characteristic data base, and several parameters related to truck crashes were analyzed (1). Data was acquired from a number of sources including FARS, TIFA (Trucks Involved in Fatal Accidents), and GES (General Estimates System). The study looked at causes of heavy truck driver aggressiveness and their impact on two-vehicle truck/light vehicle crashes, and also developed detailed models which helped propose countermeasures to mitigate collision severity.

Another analysis, conducted using the same data sources on rear-end fatal truck crashes, showed that though trucks initiate a collision by striking the other vehicle, in fatal crashes, trucks are struck by other vehicles more often (2). Also, the overlapping effects of light conditions and alcohol-involvement level of the drivers were observed, and it was seen that other vehicle drivers were more often involved in alcohol consumption under all light conditions.

In a study about motor vehicle crash rate comparisons made with respect to truck or non-truck drivers, the at-fault status was observed as the main criteria (3). Data from FARS was used for the period of 1996-2000. Drivers in fatal single-vehicle crashes were assumed to have responsibility for the crash. In fatal two-vehicle crashes, driver operator errors reported by police were used to assign crash responsibility. Deaths in crashes involving one or more passenger vehicles, for which drivers of various ages were likely to be responsible, per 100,000 licensed drivers by occupant type and many other categories were calculated (3).

Many other projects, based on the analysis of driver parameters like age and gender, were used to generate models using driver behavior factors to have a precise understanding of driver issues in crashes. One study investigated the influence of carrier scheduling practices on truck driver fatigue by developing and empirically testing a truck driver fatigue model (4). Earlier than this, a research team had developed another model with the four predictor variables of driver age, gender, time of the day, and average annual mileage (5). The effect of these four variables on crash involvement rate was studied and their level of significance was obtained. Additionally, the U.S. Department of Transportation report noted three separate studies and found driver fatigue and loss of alertness to be primary or probable causes for crashes with high severity (6).

In order to identify unsafe driver actions that lead to fatal car-truck crashes, a study analyzed two-vehicle crashes in the 1995–98 Fatality Analysis Reporting System (FARS) database to compare car-car crashes with car-truck crashes (7). In this, the 94 at-fault cases categorized as per FARS were used to see the predominant faults in both types of crash situations. A key finding of this study was that most of the 94 unsafe driver acts were about as likely in fatal car-truck crashes as in fatal car-car crashes. Therefore, general safe driving practices are also relevant around large trucks.

The United States General Accounting Office issued a report on the “Share the Road Safely” program whose goal is to educate the public about driving safely around large trucks (8). This report analyzed crash risk factors that predominantly arise while driving around large trucks. The program elaborated the necessity of having specific roadway educative measures for the public to mitigate this issue and lower the truck crash rate in general.

## METHODOLOGY

### Crash Data

Data for the study was procured from the National Highway Traffic Safety Administration’s Fatality Analysis Reporting System (FARS) for the period 2003-2007. The database documents

descriptive data on vehicles, drivers, roadways, and environmental conditions collected from police reports, emergency medical service reports, hospital records, and coroner's reports of all fatal crashes in the country.

From this database, truck and non-truck crashes were the two categories examined in the comparative study. In this study, a truck crash was a crash which involved at least one truck whose gross body weight was greater than 10,000 pounds. A non-truck crash was defined as a crash which did not involve a truck. Trucks considered for this study were vehicles with body type codes 61 to 64, 66, 67, 71, 72, 78, and 79 in the FARS database. These specific body types were considered as they included trucks which had a gross body weight greater than 10,000 pounds. All other motor vehicles, other than those body types and ones which had a body weight less than 10,000 pounds, were considered as non-truck vehicles.

Files from the database were merged using unique crash, person, and vehicle identification codes employing SAS computing software. The merged files were checked so as to obtain a unique, unduplicated crashes, people, and vehicles list to retrieve frequencies or counts of different characteristics. Various crash characteristics were recorded using filtering techniques in Microsoft Excel and Access. After suitably merging and filtering accident, person, and vehicle files, fatal truck crash data for the five year time period of 2003-2007 was combined and truck and non-truck crash cases were separated to obtain more consolidated results with respect to several parameters and their frequencies.

Further, the values obtained were compared at various levels to analyze trends and patterns of specific crash parameters with respect to time or type of crash, or the extent of fault of the drivers involved. Also, certain pairs of parameters were overlapped to observe contrasts in the combination of conditions prevailing during higher crash occurrence levels. These trends were used to make critical inferences by interpreting them in the most pragmatic conventions. Eventually the driver, crash, and vehicle-related factors were extracted to compare the predominance of these factors in both truck and non-truck crashes.

### **Bayesian Statistical Approach**

The statistical Bayesian approach is an effective tool in recognizing the predominance of crash-related factors while comparing truck and non-truck crashes in the given data set. The computation of likelihood ratios, using Bayesian posterior probabilities, is valid and useful. It makes good logical sense, while producing significant results from projected analysis of crash factors.

Equation (1) describes the conditional probability of the occurrence of a driver, vehicle, or crash-related contributory cause (CC), given that it is a truck crash.

$$P(CC / Truck) = \frac{P(Truck / CC) * P(CC)}{P(Truck)} \quad (1)$$

where,

$P(Truck/CC)$  = Probability that the crash was a truck crash, given that a specific contributory cause was also reported. As shown in Equation (2), this value is estimated from the data by considering total number of crashes and those in which a truck crash and its contributory factor were coded together.

$P(CC)$  = Overall probability of the specific driver, vehicle, or crash-related cause being reported as a contributing factor, and as shown in Equation (4),

is estimated from the numbers of cases in which the CC was reported in the dataset.

$P(\text{Truck})$  = Overall probability that a crash was a truck crash and was estimated from the data as shown in Equation (3).

$$P(\text{Truck} / \text{CC}) = \frac{\text{Number of Truck Crashes with that Contributory Factor}}{\text{Number of All (Truck and Non - Truck) Crashes with that Factor}} \quad (2)$$

$$P(\text{Truck}) = \frac{\text{Number of Truck Crashes}}{\text{Number of All (Truck and Non - Truck) Crashes}} \quad (3)$$

$$P(\text{CC}) = \frac{\text{Number of Crashes with that Contributory Factor}}{\text{Number of All (Truck and Non - Truck) Crashes}} \quad (4)$$

Similarly, the conditional probability of a contributory cause for a given non-truck crash is estimated, and the ratio of these probabilities generates the likelihood ratio of that contributory factor.

$$\text{Likelihood Ratio} = \frac{P(\text{CC} / \text{Truck Crash})}{P(\text{CC} / \text{Non - Truck Crash})} \quad (5)$$

The likelihood ratio of a given contributory factor being recorded in a truck crash as compared with a non-truck crash was assessed from crash records. This likelihood ratio is the probability of a crash being a truck crash when the contributory factor was recorded, as compared with the probability of a crash being a non-truck crash when the same contributory factor was identified. The larger the likelihood ratio, the greater the association between the contributory factor and truck crashes relative to non-truck crashes.

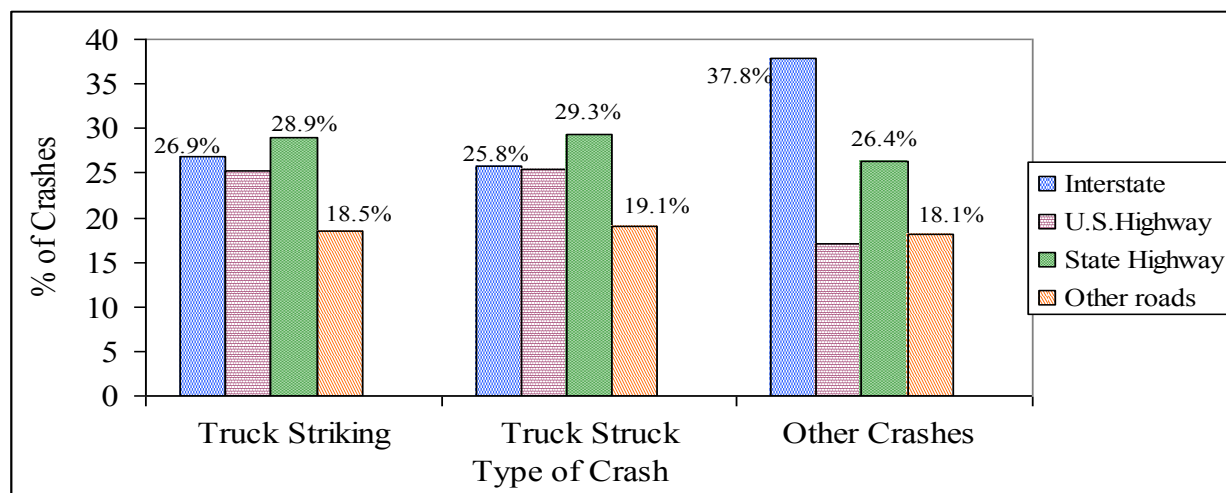
## RESULTS

### Characteristics of Truck and Non-Truck Crashes

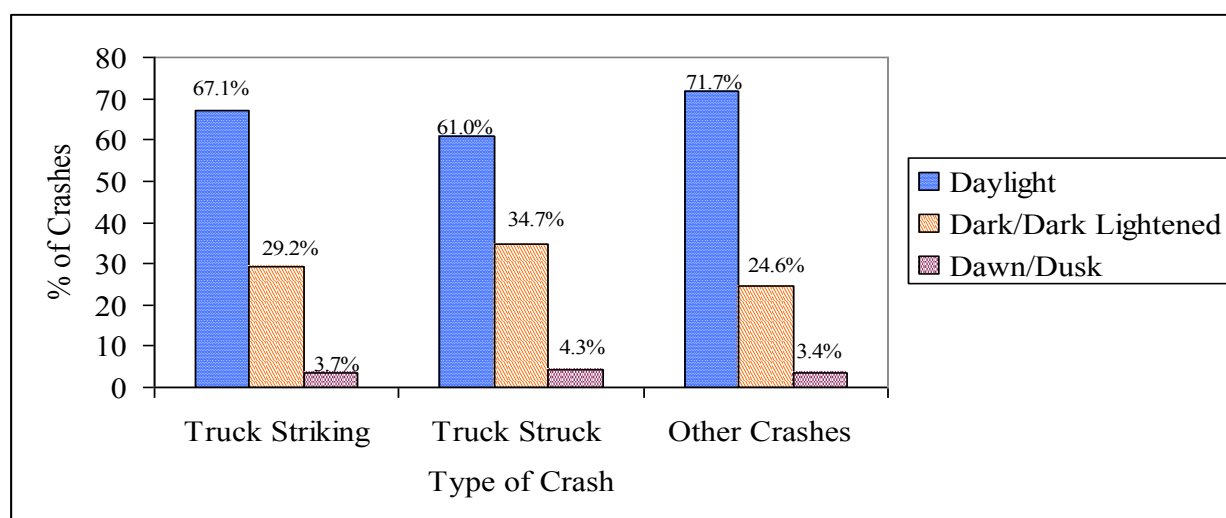
Analysis has shown that 85% of fatalities occurring in truck crashes were those of non-truck vehicle occupants. This shows that truck crashes cause more threat to other vehicle occupants than truck occupants themselves. From the combined data for the period of 2003-2007, several characteristics and contributory causes were observed.

Initially, the truck crashes were divided into two categories: the first where the truck initiates the crash as the striking vehicle and the second where the truck is struck by another vehicle resulting in a collision. Categories like “unknown” or “collision with objects” were included in “other crashes.” Percentages in each of these sub-categories were calculated by taking all crashes which occurred in that category as the base value. This categorization does not imply that the striking vehicle was the one at fault. The comparison was merely to observe the characteristic features within this dichotomy. From Figure 1(a), it is seen that roadways such as interstates and highways, where there were more lanes and higher speeds, tended to have more fatal truck crashes in both truck-struck and truck-striking scenarios, when compared to other

local roadways. Interstates had a larger percentage of crashes with trucks as the striking vehicle, whereas state highways had crashes where trucks were struck more often, leading to fatal crashes.



(a) Truck crashes on different types of roadways.



(b) Truck crashes in different types of light conditions.

**Figure 1 Truck-striking and struck crash characteristics for the period 2003-2007.**

The “other crashes” category had the largest proportion of interstate crashes and least proportion of U.S. highway crashes when compared to truck-striking/struck categories, which could imply that single-vehicle fatal truck crashes are more predominant on interstates.

When the factor of light conditions was observed in the truck-striking/struck scenario as shown in Figure 1(b), it is seen that trucks were more often the striking vehicles under daylight conditions causing fatal crashes, whereas in dark or poorly-lighted conditions, trucks were more often struck by other vehicles. This proportion remained similar in all the categories.

### Comparison of Truck and Non-Truck Crashes

The entire fatal crash data for the period of 2003-2007 was divided into crashes which involved trucks and those which did not involve trucks, or non-truck crashes. Different characteristic

factors such as initial point of impact, driver age ranges, posted speed limits, manner of collision, level of deformation, rural/urban split and types of traffic flow ways, and roadway categories were compared between truck and non-truck crashes. Percentages in each sub-category were calculated by taking the total number of truck or non-truck crashes as the base value.

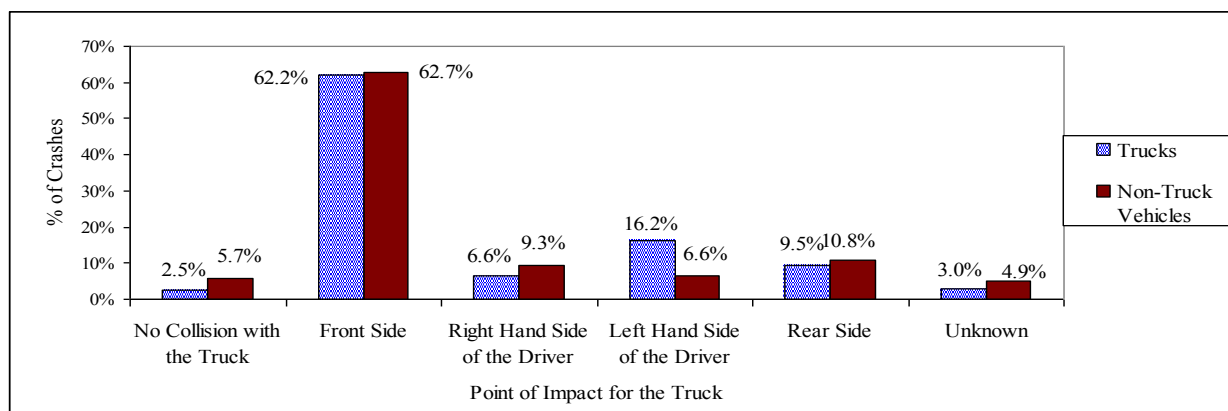
From Figure 2(a), it is seen that initial impact point for vehicles in truck and non-truck crashes was mostly on the front side. Although all other categories had lower proportions in both truck and non-truck crashes, left-hand side of the driver as the impact point had a comparatively larger proportion of fatal crashes in trucks than in non-trucks. Also, a larger proportion of truck drivers involved in fatal crashes seemed to be of the age group 41-50 yrs, whereas the non-truck drivers were mostly in the 21-30 yrs age group. Figure 2(b) shows that starting from the age group of 31-40 yrs, truck drivers had larger involvement than non-truck drivers in fatal crashes.

Figure 2(c) shows that in the speed-limit range of 21-50 mph, non-trucks had more fatal crashes than trucks, whereas between 51-70 mph, trucks seemed to have more fatal crashes than non-trucks. High speed being one of the prevailing factors in cases of most fatal crashes is also observed from Figure 2(d) where more than half of the fatal non-truck crashes were single-vehicle crashes but most of the fatal truck crashes were angle crashes.

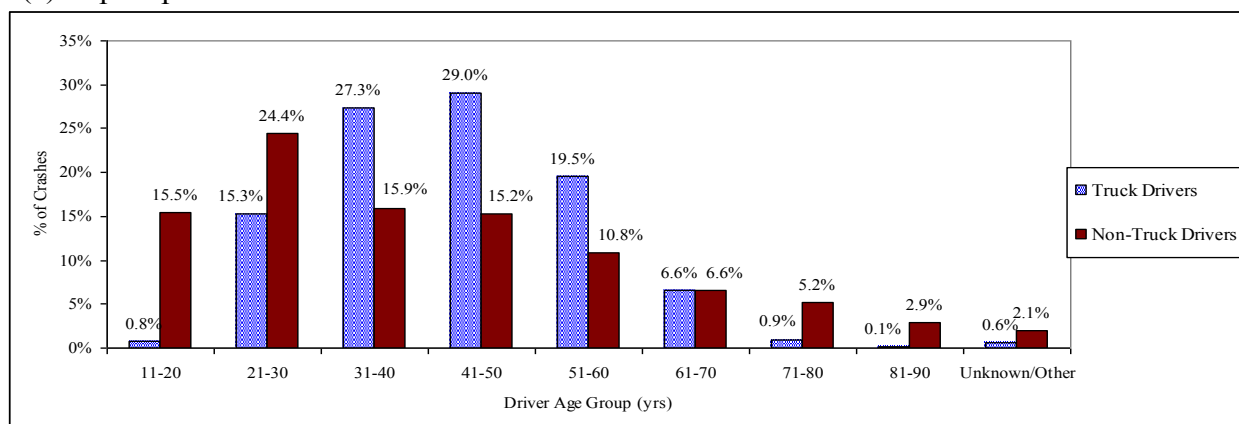
Truck and non-truck fatal crashes most commonly resulted in disabling vehicle deformation as shown in Figure 3(a,) but it is observed from Figure 3(c) that more than half of the crashes in trucks and non-trucks occurred on two-way traffic ways with no physical division. Other types of traffic flow ways, such as divided highways with or without traffic barriers, are observed to have a larger proportion of truck crashes than non-truck crashes.

From Figure 3(b), it is observed that arterial roadways in both urban and rural sectors had a higher predominance of fatal truck crashes, whereas collector and local roads had a higher predominance of non-truck crashes. Also, Figure 3(d) shows that when different types of roadways were analyzed, truck crashes had a larger proportion of crashes on interstates and highways, whereas other county and municipality roads had a higher proportion of non-truck crashes. A larger exposure rate of trucks on these major arterials and roadways might be the cause for this high proportion of fatal truck crashes.

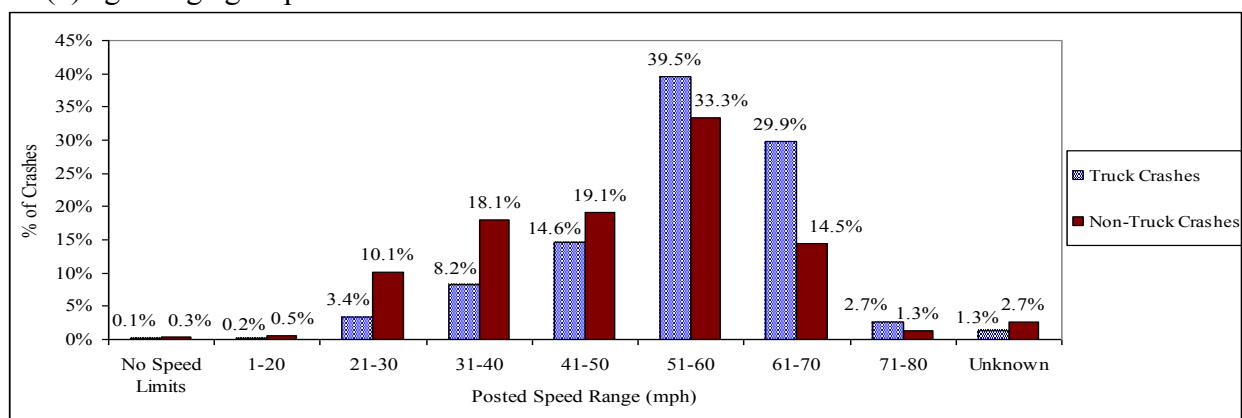
Apart from these, factors such as alcohol involvement and cellular usage were also analyzed, and all fatal truck crashes which had alcohol involvement were observed. Of these crashes, it is seen that in 87% of cases, non-truck drivers were involved in alcohol consumption and in only 12% of cases did truck drivers have that involvement.



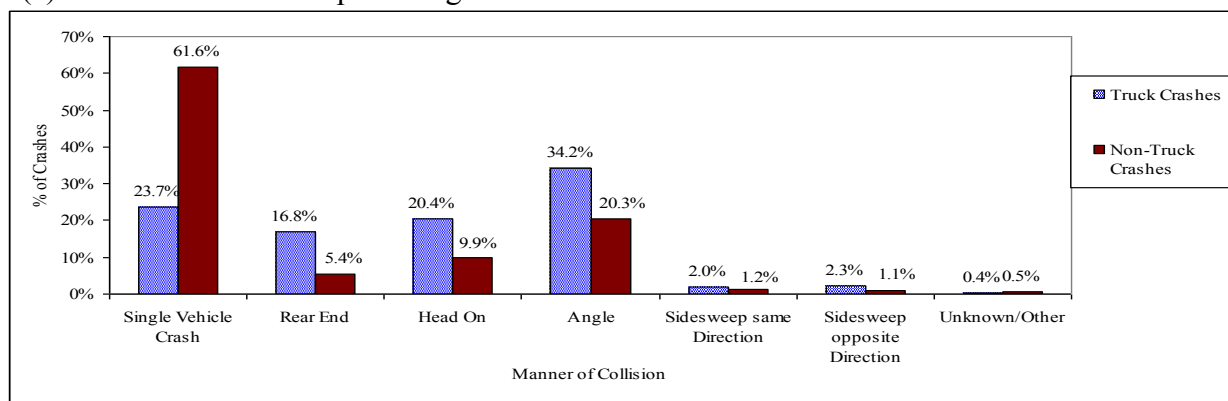
(a) Impact point on the vehicle in fatal crashes.



(b) Age-range groups of drivers.



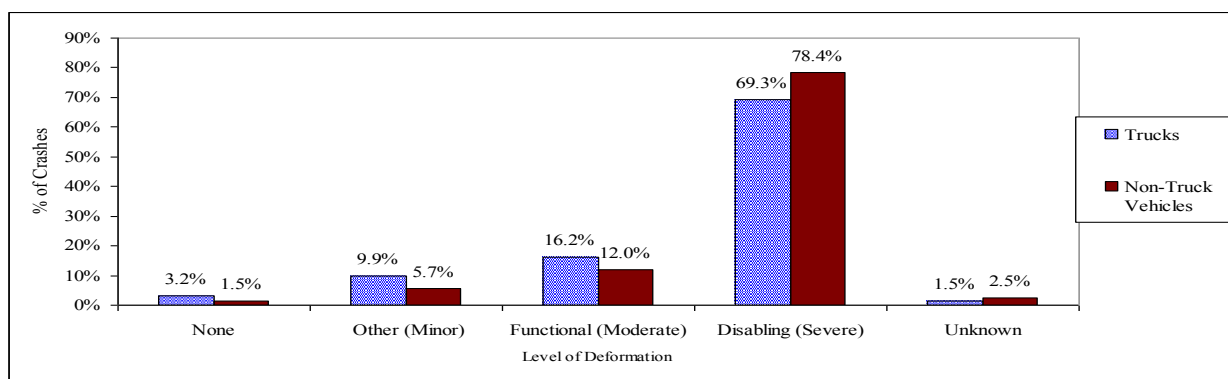
(c) Crashes in different speed ranges.



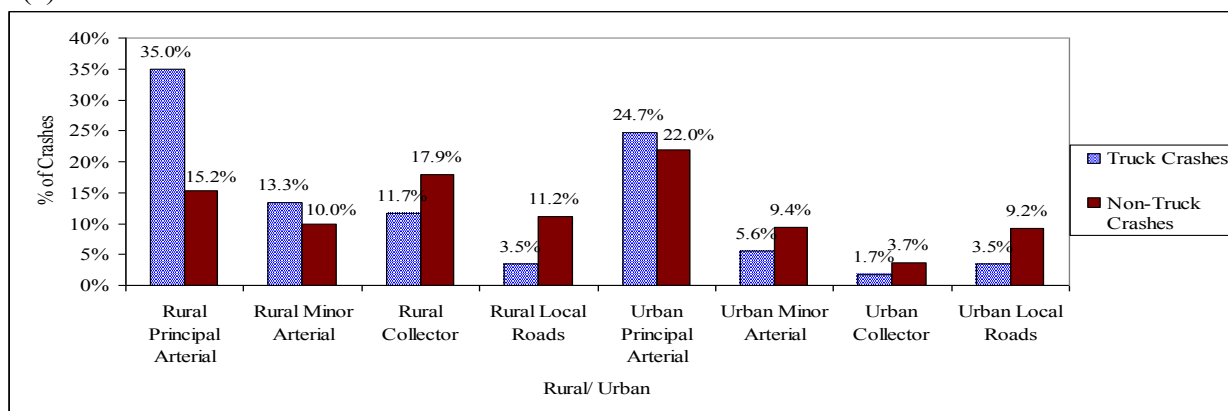
(d) Manner of collision for vehicles.

**FIGURE 2 Distribution of crashes in truck and non-truck collisions.**

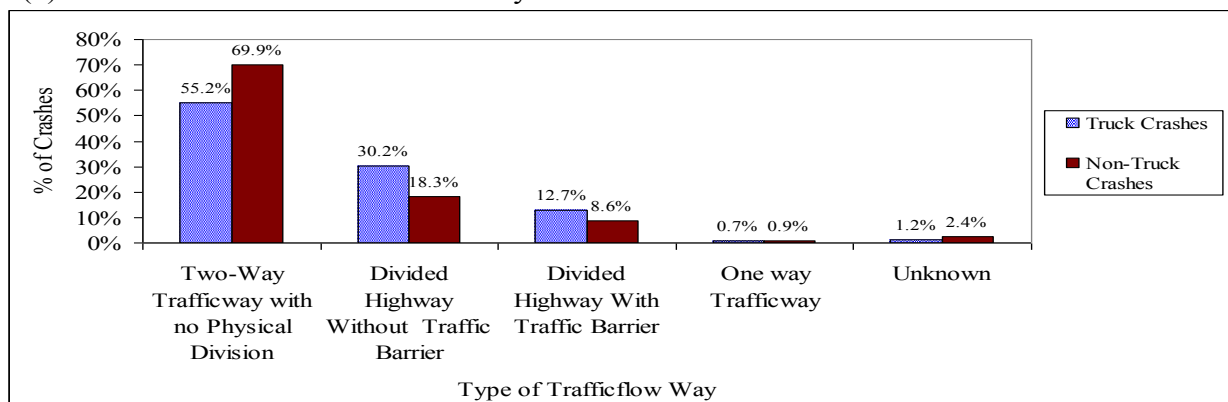




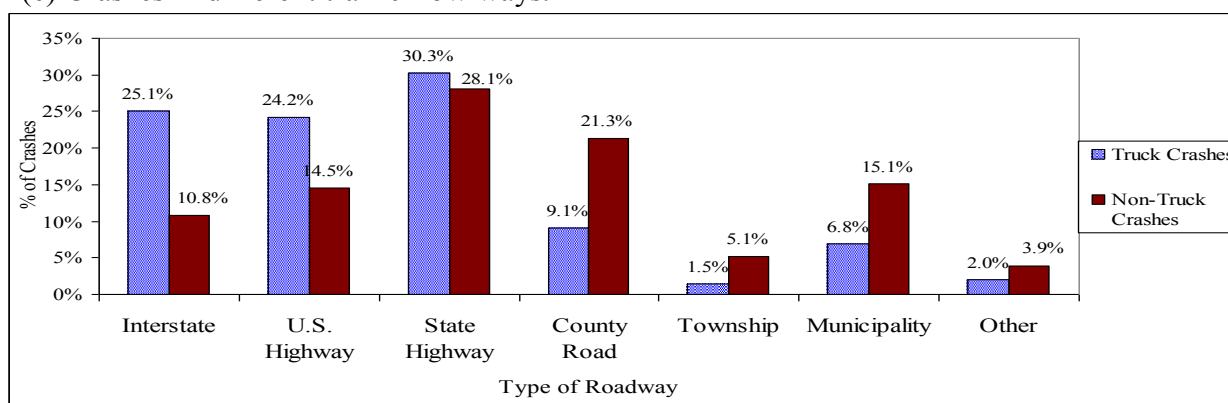
(a) Level of deformation in different crashes.



(b) Crashes on rural and urban roadways.



(c) Crashes in different traffic flow ways.



(d) Crashes on different types of roadways.

**Figure 3 Comparison of truck and non-truck collisions using different factors.**

### Contributory Causes for Truck and Non-Truck Crashes

The following tables show the likelihood of occurrence of contributory factors in truck crashes when compared to non-truck crashes. If probability of the factor is greater than one, it indicates that the factor was more predominant in truck crashes than in the non-truck crashes. The factors in the tables belong to the categories of driver-related, vehicle-related, or crash-related issues. The likelihood ratios are recorded in the descending order of predominance in each category. Crashes might have more than one contributory factor leading to the crash, as FARS records up to four driver-related, three crash-related, and two vehicle-related factors per crash. Hence, the sum of the number of crashes in truck and non-truck categories will not be equal to the number of crashes that occurred in that period.

Table 2 shows contributing crash-related factors in 11 different categories as defined by the database. Recent previous crash nearby/ vehicle set in motion by a non-driver, work area conditions, poor shoulder conditions, and inadequate warning signs are the topmost factors which have more likelihood in truck crashes than non-truck crashes. Providing sufficient signs at all places, including work areas and improving shoulder conditions, might help reduce fatal truck crashes.

**Table 2 Conditional Probabilities and Likelihood Ratio for Crash-Related Factors**

Crash-Related Factor(CF)	Number of Truck Crashes	Number of Non-Truck Crashes	Conditional Probability of This CF Given a Fatal Truck Crash	Conditional Probability of This CF Given a Fatal Non-Truck Crash	Likelihood Ratio
Recent Previous Crash Nearby/ Vehicle Set in Motion by a Non-Driver	416	1025	0.01901	0.00602	3.15
Motor Vehicle Struck by Falling Cargo	558	1496	0.02550	0.00879	2.90
Other Construction/ Work Area Condition	122	342	0.00557	0.00201	2.77
Inadequate Warning of Exits, etc.	15	57	0.00069	0.00033	2.04
Aggressive Driving or Road Rage of Non-Contact Vehicle Driver	102	391	0.00466	0.00230	2.02
Poor Shoulder Condition	22	158	0.00101	0.00093	1.08
Within Designated School Zone	6	51	0.00027	0.00030	0.91
Poor Roadway Condition	33	443	0.00151	0.00260	0.57
Speed Limit Is a Statutory Limit but Is not Posted	61	1004	0.00279	0.00590	0.47
Police Pursuit Involved	57	1557	0.00260	0.00915	0.28

Vehicle-related factors for trucks responsible for contributing to a fatal truck crash are listed in Table 3. As most of the utility vehicles are trucks rather than other motor vehicles, this cannot be considered as a contributory cause, but defective brake systems having the second highest likelihood ratio seems to be more predominant in truck crashes rather than other vehicles

crashes. Defective lights, mirrors, and engines also appear to have more likelihood because of the severe wear and tear trucks undergo as a result of long miles traveled.

These factors recorded as vehicle-related factors are subjective with respect to police officers present at crash sites. As officers are not professional vehicle inspectors these records might not be precise to the maximum extent.

**Table 3 Conditional Probabilities and Likelihood Ratio for Vehicle-Related Factors**

Vehicle-Related Factor (VF)	Number of Truck Crashes	Number of Non-Truck Crashes	Conditional Probability of This VF Given a Fatal Truck Crash	Conditional Probability of This VF Given a Fatal Non-Truck Crash	Likelihood Ratio
Vehicle Identified as Utility/Emergency/Other Working Vehicle	188	80	0.00859	0.00047	18.27
Defect in Brake System	445	421	0.02033	0.00247	8.22
Defects in Lights/Horn/Mirror/Wiper	89	260	0.00407	0.00153	2.66
Defects in Steering/Suspension/Engine/Exhaust System	77	263	0.00352	0.00155	2.27
Other Vehicle Defects(Wheels/Doors/Safety Belts/Air Bags)	124	499	0.00567	0.00293	1.93
Defective Tires	358	2501	0.01636	0.01470	1.11
Identified Vehicle Registration as Handicapped	65	581	0.00297	0.00341	0.87
Identified as a Hit-and-Run Vehicle	306	7727	0.01398	0.04540	0.30
Vehicle Went Airborne During Crash	57	1489	0.00260	0.00875	0.29
Vehicle Set in Motion by Another Vehicle/Non-Motorist	9	316	0.00041	0.00186	0.22

FARS records driver-related factors into 94 different categories which include mental, psychological, vision obscured, environmental, and other miscellaneous factors. Of these 94 cases, only those which reasonably reflect the truck driver contributing to the occurrence of the crash were included. As shown in Table 4, the conditional probability of each driver factor in truck and non-truck crashes and their likelihood ratios were estimated. When factors having considerable number of frequencies were selected, they were listed in descending order of their likelihood ratios, with the most predominant factors in truck crashes at the top of the list. Stopped or unattended vehicles, improper following, and starting and backing the vehicle improperly are the factors with the highest likelihood ratios, which shows they may contribute to fatal truck crashes more often than fatal non-truck crashes. Erratic lane change, cellular usage, and signal inattention are also factors significantly contributing to fatal crashes. Truck drivers appear to be more fatigued, drowsy, and inattentive when compared to other vehicle drivers, having a likelihood ratio of greater than one.

**Table 4 Conditional Probabilities and Likelihood Ratio for Driver-Related Factors**

Driver-Related Factor(DF)	Truck Crashes	Non-Truck Crashes	Conditional Probability of This DF Given a Fatal Truck Crash	Conditional Probability of This DF Given a Fatal Non-Truck Crash	Likelihood Ratio
Stopped or Unattended Vehicle	501	1019	0.02289	0.00599	3.82
Following Improperly	903	1902	0.04126	0.01118	3.69
Starting or Backing Improperly	147	349	0.00672	0.00205	3.27
Overloading or Improper Loading of the Vehicle	111	309	0.00507	0.00182	2.79
Making Improper Exit or Entry	76	287	0.00347	0.00169	2.05
Erratic Lane Change	525	2129	0.02399	0.01251	1.91
Cellular Telephone in Use in Driving	765	3488	0.03496	0.02049	1.70
Signal Inattention/Unfamiliar Roadway	128	643	0.00585	0.00378	1.54
Passing with Insufficient Distance or Inadequate Visibility or Failing to Yield to Overtaking Vehicle	283	1700	0.01293	0.00999	1.29
Driving on Wrong Side of the Road	557	3379	0.02545	0.01985	1.28
Failure to Yield Right of Way	2968	18801	0.13562	0.11047	1.22
Failure to Obey Traffic Rules	1688	10899	0.07713	0.06404	1.20
Drowsy ,Sleepy, Fatigued	683	4499	0.03121	0.02644	1.18
Tire Blow Out or Flat Tire	134	887	0.00612	0.00521	1.17
Inattentive(Talking, Eating)	2569	17407	0.11739	0.10228	1.14
Driving/Passing in Prohibited or Wrong Direction	83	701	0.00379	0.00412	0.92
Passing Where Prohibited by Posted Signs	104	900	0.00475	0.00529	0.89
Failing to Dim Lights or Have Lights When Required	39	338	0.00178	0.00199	0.89
Other Non-Moving Traffic Violation	745	6690	0.03404	0.03931	0.86
Operating without Required Equipment	285	2648	0.01302	0.01556	0.83
Failure to Keep in Proper Lane	5921	61914	0.27056	0.36379	0.74
Making Improper Turns	664	7085	0.03034	0.04163	0.72
Non-Traffic Violation Charged- Manslaughter or Homicide, etc.	286	3540	0.01307	0.02080	0.62
Reckless Driving	1040	13141	0.04752	0.07721	0.61
Driving Over the Posted Speed Limit	4070	54837	0.18598	0.32221	0.57
Driver Inexperienced or Impaired Health or Physical Condition	328	4683	0.01499	0.02752	0.54
Illegal Driving on Road Shoulder	54	912	0.00247	0.00536	0.46
Over Correcting	657	11656	0.03002	0.06849	0.43
Running Off the Road	587	11815	0.02682	0.06942	0.38
Other Drugs (Cocaine etc.)	1520	33954	0.06946	0.19951	0.34
Hit-and-Run Vehicle Driver	264	6807	0.01206	0.04000	0.30

## CONCLUSIONS

Characteristics of fatal truck crashes were identified in this analysis and compared with those of non-truck crashes. Fatal crash frequency was observed to be greater with the initial impact point for the vehicle in the front side of the truck rather than anywhere else. It was also seen that in 87% of fatal truck crashes where there was an alcohol involvement, non-truck drivers were the ones that were under influence and in only 12% of cases truck drivers were under the influence. Trucks seemed to have a majority of fatal crashes at higher posted speed levels like 51-60 mph, which might also be due to a larger exposure rate for these vehicles at that speed range. Fatigue, drowsiness, and inattention were observed to be more predominant in truck drivers than in other motor vehicle drivers. Two-way two-lane traffic flow ways with no physical divisions are a leading characteristic to higher crash risk and fatalities. Such roadways could be altered by providing the necessary changes in the roadway design. Improper driving and non-compliance to traffic regulations were observed to be the main driver-related contributory factors in cases of fatal truck crashes. In comparing the simultaneous effect of two-truck fatal crash characteristics, truck striking and truck being struck seemed to have similar proportions on all roadway types. Also, this proportion remained consistent even under different light conditions.

From the likelihood ratios, stopped or unattended vehicles or improper following had greater probabilities of occurrence in fatal truck crashes than in non-truck crashes. Other factors like cellular usage, failure to yield right of way, inattentiveness, and failure to obey traffic rules also had greater probabilities in truck crashes.

## ACKNOWLEDGEMENTS

This study was conducted as a part of a research project funded by the Mid-America Transportation Center (MATC). The authors wish to thank MATC officials for providing support in conducting this study. Support and assistance provided by KDOT Highway Safety Engineer Steven Buckley is also greatly appreciated.

## REFERENCES

1. Krishnaswami, V., D. Blower, L. Schneider, and D. Putcha. *Heavy Truck Aggressiveness Reduction Statistics, Analysis, and Countermeasures*. Publication University of Michigan Transportation Research Institute (UMTRI) -2005-38, 2005, UMTRI, U.S.
2. Craft, R. MC-RIA. Contact no. (202) 366-0324. Rear-End Large Truck Crashes. 2002, Federal Motor Carrier Safety Administration (FMCSA).
3. Allan, F. W., and I.V. Shabanova. Responsibility of Drivers, by Age and Gender, for Motor Vehicle Crash Deaths. *Journal of Safety Research*, Vol. 34, 2003.
4. Michael, R. C., P. C. Morrow, and R. Paula. The Influence of Carrier Scheduling Practices on Truck Fatigue. *Transportation Journal*, 2005, pg.20-41.
5. Massie, D. L., D. Blower, and K. L. Campbell. *Short-Haul Trucks and Driver Fatigue*. Office of Motor Carriers, Washington, D.C., U.S. Department of Transportation, Federal Highway Administration, 1997.
6. Wylie, C.D., T. Shultz, J.C. Miller, M.M. Mitler, and R.R. Mackie. *Commercial Motor Vehicle Driver Fatigue and Alertness Study*. Publication FHWA-MC-97-002. FHWA, U.S. Department of Transportation, 1996.

7. Kostyniuk, P. L., F. M. Streff, and J. Zakrajsek. Identifying Unsafe Driver Actions that Lead to Fatal Car-Truck Crashes. *AAA Foundation for Traffic Safety*, 2002.
8. United States General Accounting Office. *Truck Safety: Share the Report Safely Program Needs Better Evaluation of Its Initiatives*. Publication GAO-03-680. GAO, U. S., 2003.