Legislative Budget and Finance Committee

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A Review of Large Truck Crashes Involving Fires on Pennsylvania Highways

(Conducted Pursuant to Act 2002-229)

June 2003

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Report Summary and Recommendations

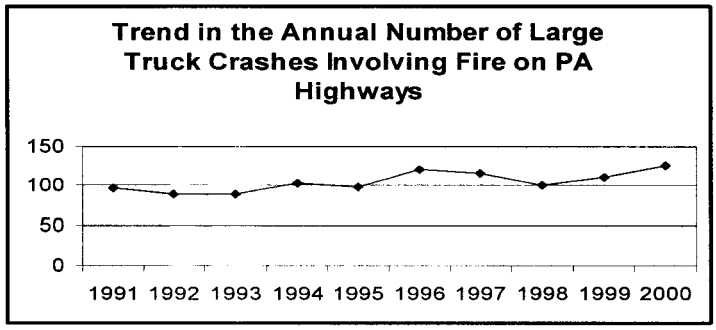
Summary

Pennsylvania's highways serve as a major Northeast corridor for commercial truck traffic and carry a heavy volume of the nation's large truck traffic. During 2000, large trucks[1] traveled more than 10.65 billion miles in Pennsylvania. Improving truck safety and reducing the number and severity of crashes involving these large trucks is an important public safety objective.

During 2000, highway crashes involving at least one large truck claimed the lives of 183 persons and injured 6,070 others in large truck crashes on Pennsylvania highways. Act 2002-229 directed the Legislative Budget and Finance Committee to review a specific subcategory of these large truck crashes. The subject of this review is large truck crashes occurring on Commonwealth highways in which a fire was involved either before or as a result of the crash. The act further required that we review such crashes for a ten-year period based on the most recent available data.

Vehicle fires can occur when the following elements are present: (1) an ignition source, (2) a fuel source, and (3) oxygen. Under normal circumstances, these elements are kept separate except in the controlled environment of the engine itself. However, a major vehicle crash can produce conditions where these elements come together and ignite. Further, in a major crash, the two systems most responsible for commercial motor vehicle fires--the fuel system and the electrical system--can be seriously damaged.

Using data from the Pennsylvania Department of Transportation's Pennsylvania Accident Record System (PARS), we determined that a total of 1,045 large truck crashes involving fire, or an average of about 100 a year, occurred on Commonwealth highways during the ten-year period ending in Calendar Year 2000.[2]



[1]As used in this report, the term "large trucks" refers to trucks over 10,000 pounds gross vehicle weight rating (GVWR), including single unit trucks and truck tractors. The terms heavy trucks, motor carrier vehicles, and commercial vehicles are often used synonymously with the term large trucks.

[2]This is the most recent year for which complete crash report data is available. See pages 9-10.

A low of 88 such crashes occurred in both 1992 and 1993 while the high was in 2000 when PENNDOT records indicate 126 crashes of this type were recorded. A statistical profile of the 126 large truck crashes involving fire that occurred during CY 2000, including crashes, fatalities, and injuries by county, is presented on page 18 of this report.

Motor vehicle crashes are classified by severity and include fatal crashes, injury crashes, and property-damage only crashes in which no one is killed or injured but damage to involved vehicles required towing. The annual numbers of large truck crashes involving fire that occurred from 1991 through 2000 are listed below, by crash severity.

PA Large Truck Crashes Involving Fire, by Crash Severity

	Number of Large Truck Crashes Involving Fire			
CY	Total	Fatal	Injury	Property Damage Only
1991	96	12	18	66
1992	88	13	17	58
1993	88	12	17	59
1994	103	18	17	68
1995	98	15	17	66
1996	121	10	22	89
1997	115	17	18	80
1998	100	13	18	69
1999	110	20	13	77
2000	126	15	18	93
Total	1,045	145	175	725

We found that:

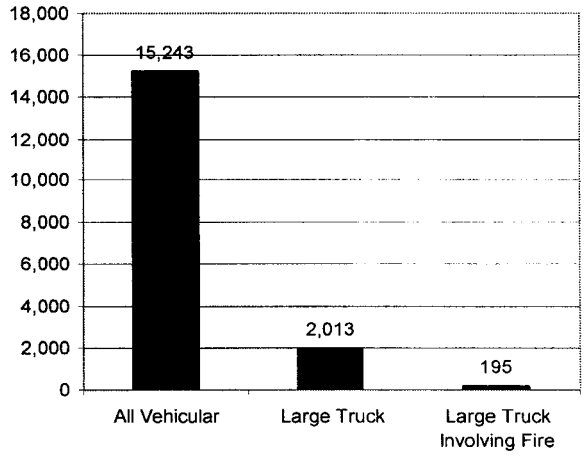
- The 1,045 crashes of this type that occurred represent 1.4 percent of all large truck crashes during the ten-year period.
- Of the 1,045 total crashes, 909 or 87.0 percent occurred on state and local roads (i.e., on interstates, other state highways, and local streets and township roads). The remaining 13.0 percent (136 crashes) occurred on the Pennsylvania Turnpike. Each of these crashes included "fire" as one of the reported data elements in the crash. However, it is not possible to determine from available records the causes of these fires or their severity.
- A total of 145, or 13.9 percent, of the 1,045 crashes were fatal crashes that resulted in 195 deaths. In these cases, it is not possible from available records to determine the relationship fire had to these fatalities since a death resulting from a large truck crash involving fire might be attributable to causes other than the associated fire.

- A total of 175, or 16.7 percent of the 1,045 crashes, resulted in injuries to the vehicle occupants. These injury crashes contributed to a total of 424 injuries.
- Nearly 70 percent of the reported ten-year total of 1,045 large truck crashes with fire were property-damage only crashes, and a large number of these were non-collision events. Such a "crash" may occur, for example, if while in transit, a large truck's brakes overheat and result in an on-board fire. While not necessarily resulting in a collision, this is a reportable accident and, if the vehicle is towed, is recorded as a crash involving fire.

The 126 large truck crashes involving fire that occurred in 2000 was about one-third greater than the number of such crashes that occurred in 1991. It is, however, necessary to examine this statistic in the context of the 26 percent increase that occurred in vehicle miles traveled by large trucks during the same period. Pennsylvania's overall large truck crash/fire involvement rate (i.e., the number of large trucks involved in crashes with fires per 100 million vehicle miles traveled) was essentially unchanged between 1991 and 2000 (1.23 in 2000 and 1.20 in 1991). We also found that Pennsylvania's large truck crash/fire involvement rate, although slightly higher in recent years, was about the same as the U.S. average in 2000 (1.23 for PA and 1.30 for the U.S. as a whole).

We also examined the number of large truck crashes involving fire in the context of the total number of motor vehicle crashes and the total number of large truck crashes that occurred between 1991 and 2000. During this period, a total of 1,392,300 motor vehicle crashes of all types occurred on Pennsylvania highways. Of that number, 72,512, or 5.2 percent, were crashes involving large trucks and 1,045, or 0.08 percent were large truck crashes that also involved fire. The number of fatalities associated with these crashes is shown below.

Number of Fatalities on Pennsylvania Highways
(1991 Through 2000)



While from the standpoint of statistical significance, large truck crashes involving fire are not a frequent occurrence, they can be tragic events that, in some cases, have tremendous significance in terms of loss of life and human suffering. Understanding the causation of such crashes is, therefore, critical to identifying ways to reduce their incidence.

We found, however, that as is the case for all motor vehicle crashes, no reliable Pennsylvania-specific or nationwide information exists on the exact causes of large truck crashes involving fires. Vehicle fires involving trucks do not appear to have been a major focus for researchers and database deficiencies complicate the situation. The examination of the "primary contributing factors" appears then to be the best approach, although imperfect, to understanding why and how such crashes take place.

Using PENNDOT crash records for large truck crashes involving fire, we identified the "primary contributing factors" cited for the 1,045 fire crashes that occurred in the ten-year period examined. For these crashes, the most frequently cited contributing factor, accounting for nearly 50 percent of the crashes, was "engine failure." This appears to be the case since about 70 percent of the crashes are non-injury or property-damage-only crashes, and "engine failure" is predominately associated with crashes of this type.

Primary Contributing Factors Reported for Large Truck Crashes Involving Fires
(1991-2001)

Contributing Factors	Number of Crashes
Engine Failure	485
Mechanical Problems Other Than Engine Failure	113
Improper/Illegal Driver-Related Actions	99
Improper/Careless Driver-Related Behavior	85
Speed Related	51
Driver Health/Drowsiness/Fatigue Problems	19
Unknown Contributing Factor (Sole Cause)	18
Driver Drinking (Charged or Indicated)	15
Failure to Heed or Obey a Traffic Control Device	13
Other Contributing and Miscellaneous Factors	147
Total	1,045

The need for improved data collection on and understanding of truck crash causation has been recognized at the federal level. The Motor Carrier Safety Improvement Act of 1999 requires the U.S. Department of Transportation to conduct and periodically update a comprehensive study of the causes of commercial motor vehicle crashes. The act additionally requires that the National Highway Safety

Traffic Administration administer a program in cooperation with FMCSA to improve data collection and analysis on commercial vehicle crashes.

To meet this mandate, the U.S. Department of Transportation and the National Highway Traffic Administration are conducting the "Large Truck Crash Causation Project." As stated at its initiation, the goal of this project is to determine the causes of serious large truck crashes so that the most effective countermeasures to reduce the occurrence and severity of large truck crashes will be implemented. "Fire occurrence" is one of the data collection elements in this study. It is, therefore, conceivable that improved understanding of large truck crashes involving fires may result from this project.

In assigning the Committee this study, Act 2002-229 sought recommendations for reducing the incidence of such crashes, including initiatives and approaches that may be underway at the federal level. We found that while many broader truck safety programs and strategies are ongoing at both the state and federal levels, little, if any, research or programming is currently in place to deal uniquely with the issue of large truck crashes involving fires.

Nevertheless, ongoing truck safety programs, including Pennsylvania's 2002 "Unified Truck Safety Strategy" and the Federal Motor Carrier Safety Administration's "Motor Carrier Safety Action Plan" include many objectives which, if successfully implemented, could contribute to the goal of reducing all large truck crashes, including those which involve fire.

Also, recent research suggests that additional federal regulatory changes, especially to regulations relating to fuel systems, may provide significant potential safety benefits. This research contrasts U.S. fuel system regulations and technology to more stringent regulations which are in effect in the European Community. However, changes to industry regulatory requirements are, of course, not within the purview of state government.

Certain technology advancements that could be modified for use by the commercial trucking industry have also been cited as possible means of reducing large truck crash fires. These innovations come primarily from the auto racing and the heavy equipment industries, although the airline industry is also identified as a possible source of additional fire prevention techniques. These include specialized fuel cell technology and on-board suppression systems. We did not, as part of this study, determine the extent to which pertinent federal agencies have considered the applicability and cost feasibility of these technologies and their potential for inclusion in future regulatory requirements.

Recommendations

We recommend that PENNDOT:

1. **Provide a report by September 30, 2003, and periodically thereafter, to the House and Senate Transportation Committees on the implementation status of the 38 separate objectives that comprise Pennsylvania's "Unified Truck Safety Strategy."[3]**

2. **Consider adding a section to its annual crash report (entitled *Pennsylvania Crash Facts and Statistics*[4]) to provide both the General Assembly and the general public statistical information on and an analysis of data relating to large truck crashes involving fire.**

3. **Consider adding a web page to the PENNDOT website for drivers to learn more about safe driving techniques, especially those recommended for use in the vicinity of large trucks.[5]**

4. **Review the results and recommendations of the federal "Large Truck Crash Causation Project" for applicability to Pennsylvania.**

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[3]Fifteen of the Strategy's 38 objectives had target dates between June 2002 and July 2003. A total of 12 of the objectives are "ongoing" and do not have a specific target date. See Appendix D for a listing of the Strategy's 38 objectives and the target implementation date for each.

[4]*Pennsylvania Crash Facts and Statistics* is a report published annually by PENNDOT's Bureau of Highway and Traffic Engineering.

[5]This action could be taken in conjunction with implementation of the strategic focus area identified in the Unified Truck Safety Strategy as "Improve Behavior of All Drivers," which provides for an update of the "Pennsylvania Drivers Manual" and test to include more information on safe truck-car interaction.

I. Introduction

The Legislative Budget and Finance Committee has had a long-standing interest in truck safety. Since 1986, the Committee has conducted four separate studies of state government programs and activities designed to improve truck safety and reduce the number and severity of accidents involving large trucks (i.e., trucks over 10,000 pounds gross vehicle weight rating).

This report complies with the mandate in Act 2002-229 that the LB&FC conduct a ten-year review of large truck crashes involving fire on Pennsylvania highways. The General Assembly developed Act 229 in cooperation with PENNDOT, the Pennsylvania State Police, and the trucking industry, to improve highway safety, especially in highway construction work zones and designated "highway safety corridors." (See Appendix G for a summary of the key provisions of Act 229.)

Scope and Objectives

1. To examine and analyze statistics and data on large truck crashes involving fires over the past ten years. To the extent information is available, this will include an analysis of the major factors contributing to such crashes, the types of vehicles involved, the road types and conditions on which they occur, the number occurring in work zones, and other related factors and data.
2. To determine the nature and extent of state and federal programs and initiatives designed to reduce the number and severity of such crashes.
3. To develop findings and recommendations, as appropriate.

Methodology

This study focused on an examination of crashes involving large trucks that resulted in fires on Pennsylvania highways. For purposes of this study, we defined a "large truck" as one that has a gross vehicle weight rating over 10,000 pounds, including single unit trucks and truck tractors. Both the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA) use this definition and federal truck crash statistics are reported on this basis. The use of this definition enables comparisons of Pennsylvania data to be made to national crash statistics.

As directed in Act 2002-229, the review covered a ten-year time period. The ten-year timeframe used was from 1991 through 2000 since CY 2000 was the latest year for which complete crash data was available from the Pennsylvania Department of Transportation (PENNDOT). Study activities centered mainly on the data

available from PENNDOT, however, LB&FC staff also interviewed and gathered information from personnel responsible for motor carrier safety and accident reconstruction in the Pennsylvania State Police and for roadway safety and the Operations and Incident Management System at the Pennsylvania Turnpike Commission. The majority of work on this project was carried out between April 2003 and June 2003.

We worked with both state and federal officials to determine the number and severity of large truck crashes involving fire in Pennsylvania and to document the trend in such accidents from 1991 through 2000. We also collected information on the number of vehicle miles large trucks traveled each year for that time period both in Pennsylvania and nationally. LB&FC staff worked closely with staff of PENNDOT's Bureau of Highway Safety and Traffic Engineering, especially its Crash Information Systems and Analysis Division and its Safety Management Division. This Crash Information Systems and Analysis Division manages the Pennsylvania Accident Record System (PARS). Using PARS data, LB&FC staff developed a Pennsylvania "large truck crash profile" based on 2000 data and compiled crash data needed to calculate large truck crashes with fire involvement rates.

LB&FC staff also accessed pertinent federal databases containing large truck crash data including the Fatality Analysis Reporting System (FARS), the General Estimates System (GES), and the Motor Carrier Management Information System (MCMIS). To this end, we were in contact with officials of the Federal Motor Carrier Safety Administration (FMCSA), the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the Bureau of Transportation Statistics, the National Transportation Safety Board, and the Transportation Research Board. We also contacted transportation safety researchers at the University of Michigan's Transportation Research Institute and the University of Maryland's Department of Fire Protection Engineering.

In analyzing statistics pertaining to large truck crashes involving fire, we also attempted to identify the primary factors that contribute to large truck crashes. This involved examination of PARS data as well as internal and consultant studies available from PENNDOT. We also reviewed federal database information and special reports and analyses on the topic of crash causation as well as industry materials and academic research available on this subject.

Acknowledgements

The LB&FC staff acknowledges the excellent cooperation and assistance provided by the staff of the Department of Transportation, including Craig Reed, Director, Bureau of Highway Safety and Traffic Engineering; William Hunter, Chief, Crash Information Systems and Analysis Division; Girish Modi, Chief, Safety Management Division; Daniel Smyser, Chief, Motor Carrier Division; Gaye Forrest

Liddick, from the Highway Statistics and Performance Reporting Section, Transportation Planning Division, and Kory Shope, an employee of Ciber, Inc., who is currently working under contract with PENNDOT; and staff of the Pennsylvania State Police including Lieutenant Thomas McDaniel, Assistant Director, Safety Program Division, Bureau of Patrol; Sergeant Vincent Babich, Motor Carrier Safety Coordinator; and Trooper Martin Long, Cars Unit Coordinator. The LB&FC staff additionally recognizes the input and assistance provided by staff of the Pennsylvania Turnpike Commission including Allen W. Baldwin, Director of Operations and Incident Management and Joseph Rispoli, Manager of Customer Safety; and by James W. Runk, President and CEO of the Pennsylvania Motor Truck Association and Donald S. Siekerman, Safety Director for the Pennsylvania Motor Truck Association; as well as by officials and staff of all the federal agencies listed in the methodology section of this report.

Important Note

This report was developed by Legislative Budget and Finance Committee staff. The release of this report should not be construed as an indication that the Committee or its individual members necessarily concur with the report's findings and recommendations.

Any questions or comments regarding the contents of this report should be directed to Philip R. Durgin, Executive Director, Legislative Budget and Finance Committee, P.O. Box 8737, Harrisburg, Pennsylvania 17105-8737.

II. Background Information on Commercial Vehicle Fires[1]

Vehicle fires can occur when the following elements are present: (1) ignition source, (2) fuel source, and (3) oxygen. Normally, these elements are kept separate except in the controlled environment of the engine itself. However, a major vehicle crash can produce conditions where these elements come together and ignite.

In a major crash, the two systems most responsible for vehicle fires in commercial motor vehicles can be seriously damaged: the fuel system and the electrical system. The collision itself may result in serious leaks and even ruptures to the fuel system, spilling fuel in and around the vehicle. Steel tanks for example may be punctured or break along a seam. Plastic or elastomer tanks, while seamless, can still be punctured and can ignite if the temperature of the material reaches its fire-point. If that happens, it is only a short time before the remaining fuel is spilled. (See Exhibit 1.) The electrical system is also prone to immediate damage on impact as well as further damage due to heat sources in the crash.

Exhibit 1

Typical Commercial Vehicle Fuel Systems

A commercial motor vehicle fuel system typically consists of these components:

- fuel tank,
- fuel filters,
- engine-driven pump or pressure device,
- injector system, and
- optional fuel system heaters.

The pump (or pressure device) moves the fuel from the tank through the filter to the injector. The injector regulates the quantity of fuel injected into the cylinders. Because the pump tends to move more fuel to the injector than is needed at any one moment, there is a pipe to return the excess fuel from the injector to the tank. The filter cleanses the fuel before it enters the cylinders.

Many larger trucks are outfitted with two fuel tanks mounted on each side of the frame. The fuel tanks are vented so that equal pressure is maintained both inside and outside the tanks. Fuel tanks were traditionally manufactured from steel substrate coated with terne or zinc-nickel. Increasingly, today's tanks are constructed using plastic or elastomers, which refer to a variety of polymers having the elasticity of rubber. Plastic fuel tanks, because they are seamless, are not prone to failures along the seam, as are steel tanks. Also, plastic is not a source of sparks the way that steel is. Plastic, however, when it becomes hot, is more likely to burn than is steel.

Commercial vehicles operated in cold weather frequently have fuel system heaters to keep the fuel warm. The units may variously heat the fuel in the tank, heat the fuel in-line (i.e., while the fuel is traveling from the tank to the injector), or heat the filters that, in turn, heat the fuel as they clean it. Most heavy vehicles operating today use diesel fuel. Diesel fuel has a low vaporizing rate and is, therefore, less likely to ignite than is gasoline.

Source: *Traffic Safety Related Research – Truck Safety*, Parsons Brinckerhoff Quade & Douglas, Inc., Wilbur Smith Associates, Inc., The Scientex Corporation; and Mizerak Bowers and Associates, Inc., April 2002.

[1]This material is derived from an April 2002 report on traffic safety related research prepared for PENNDOT by the firms of Parsons Brinckerhoff Quade & Douglas, Inc., Wilbur Smith Associates, Inc; The Scientex Corporation; and Mizerak Bowers and Associates, Inc.

During and in the immediate aftermath of a crash, exceptional heat can come from a variety of sources to ignite a vehicle fire. One of the most common ignition sources in large truck fires is the electrical system itself, such as a short circuit or electrical arching (luminous discharges of current). Unusually hot surfaces, such as the exhaust system, can also ignite a fire if they are in direct contact with combustible material and raise the temperature of that material beyond its flash point. Other potential ignition sources include friction sparks produced by metal-to-metal or metal-to-road surface contact. The latter are particularly significant when flammable vapors are present. Fuel sources that would keep a fire going include oil, gasoline, diesel fuel, and other combustible materials on or in the vehicle.

Overall, roadway crashes produce conditions ripe for vehicle fires, especially when one of the vehicles is a heavy truck. Under these circumstances, the exposure of fuel and heat sources is comparatively massive and the sheer size of the vehicle tends to push the incident towards the high end of the "severity" spectrum.

There are a few important differences between typical passenger vehicles and large trucks. First, large trucks tend to burn diesel fuel, which is difficult to ignite (with a flash point[2] of 140 degrees F) while passenger cars typically burn gasoline, which will ignite much more easily (flash point of –35 degrees F). However, large trucks also carry much more fuel than passenger cars. Significant energy is required to start a diesel fire (not just a few sparks or a hot exhaust pipe). Therefore, the risk of fire in a truck collision is mainly from the electrical system (especially the battery box) or from a fire that starts in another vehicle and is perhaps fueled by the comparatively large amount of fuel typically carried by a truck. If the batteries on a truck are crushed or short out, they may start a fire that could ignite the diesel fuel.

[2]Flash Point: The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air immediately above the liquid surface.

III. Large Truck Crashes Involving Fires on Pennsylvania Highways

A. Definitions and Crash Reporting Systems

Definitions

Large Trucks. When referring to truck traffic on the state's highways, members of the motoring public frequently use the term "big trucks." What is not so clear, however, is what constitutes a "big truck" as both state and federal statutes, guidelines, and related literature include various descriptions and definitions. The terms used to describe such vehicles include, for example, large trucks, heavy trucks, motor carrier vehicles, and commercial vehicles.

While the terminology used to refer to trucks varies, many definitions are based upon or relate to a vehicle's weight or weight rating. The term most commonly used in this context is the *Gross Vehicle Weight Rating*, or GVWR. This is the maximum loaded weight of a single vehicle, as specified by the manufacturer on the federal weight certification label.

Although not specifically defined in statute, the term "large truck" has become standard in reports of the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA), both agencies of the U.S. Department of Transportation, when publishing information about trucks, especially regarding crash statistics and fatalities. As used by these two agencies, large trucks are defined as trucks over 10,000 pounds gross vehicle weight rating, including single unit trucks and truck tractors. For purposes of this report, we use this definition when referring to large commercial motor vehicles.

Crashes. The federal government defines a motor vehicle *crash* as an event that produces injury and/or property damage, involves a motor vehicle in transport, and occurs on a trafficway or while the vehicle is still in motion after running off the trafficway. Crashes are classified by severity by the federal government as follows:

- *Fatal Crash.* A police-reported crash involving a motor vehicle in transport on a highway or trafficway in which at least one person dies within 30 days from injuries sustained in the crash.
- *Injury Crash.* A police-reported crash that involves a motor vehicle in transport on a trafficway in which no one died but at least one person was reported to have: (1) an incapacitating injury; (2) a visible but not incapacitating injury; (3) a possible, not visible injury; or (4) an injury of unknown severity.

- *Property-Damage-Only (PDO) Crash.* A police-reported crash involving a motor vehicle in transport on a trafficway in which no one involved in the crash suffered any injuries.

The Pennsylvania Department of Transportation defines a *reportable crash* as "a crash resulting in death within 30 days of the crash; or injury in any degree to any person involved; or crashes resulting in damage to any vehicle serious enough to require towing" and classifies crash severity as follows:

- *Fatal Crash.* A crash in which one or more of the involved persons dies within 30 days of the crash and the death(s) are attributable to the crash.
- *Injury Crash.* A crash in which none of the involved persons were killed, but at least one was injured.
- *Property-Damage-Only (PDO) Crash.* A reportable crash where no one was killed or injured, but damage to the vehicle required towing.

While the federal and the Commonwealth's definitions for crashes (reportable crashes) and crash severity are similar, the Pennsylvania Department of Transportation has added a degree of specificity as to what is a "reportable" crash and that a requirement exists for a vehicle to be towed in order to be classified as a Property-Damage-Only crash if no one was killed or injured in the crash.

Large Truck Crash Involvement Rate. Crash rates are usually expressed as the number of crash-involved vehicles per 100 million vehicle miles traveled (VMT).

Crash Databases. LB&FC staff examined a combination of databases to compile and analyze large truck crashes involving fire statistics. The data sources we used for this analysis include the federal Fatality Analysis Reporting System (FARS), the federal General Estimates System (GES), the federal Motor Carrier Management Information System (MCMIS) Crash File, and the Pennsylvania Accident Record System (PARS).

The Pennsylvania Accident Record System (PARS). PARS is maintained at the state level by the Pennsylvania Department of Transportation (PENNDOT); it includes an extensive database of motor vehicle accident records, including detailed information on "heavy truck" crashes. Much of the data maintained by PENNDOT feeds into the national databases referred to above. PENNDOT also issues an annual statistical review of reportable motor vehicle traffic crashes on Commonwealth roads entitled *Pennsylvania Crash Facts and Statistics.*

The PENNDOT database also allows the compilation of data on large trucks (i.e., those weighing 10,001 pounds or more). LB&FC staff used this database to achieve consistency with federal statistics and rates which report on "large trucks"

using the 10,001 pounds and greater weight designation. We used this PENNDOT database to compile and analyze statistics that characterize the state's large truck crash profile and safety record for large trucks in Pennsylvania. PENNDOT maintains the Pennsylvania Accident Record System (PARS) database which consists of various data fields designed to capture critical information pertaining to all reportable crashes. Within PENNDOT, the Bureau of Highway Safety and Traffic Engineering is responsible for maintaining the PARS database. The input for the database comes from local and state police reportable-crash reports.

The Fatality Analysis Reporting System (FARS). The Fatality Analysis Reporting System is maintained by the National Highway Traffic Safety Administration (NHTSA). The FARS is a census of crashes involving any motor vehicle traveling on a public trafficway, but only fatal crashes. FARS is considered a very reliable national crash database. A large truck is defined in the FARS as a truck with a gross vehicle weight rating (GVWR) of more than 10,000 pounds.

The General Estimates System (GES). The General Estimates System is also maintained by the NHTSA. The GES is a probability-based, nationally-represented sample of all police-reported fatal, injury, and property-damage-only crashes. The data presented from the GES file are national estimates, calculated using an appropriate weighting variable. The GES data cannot be broken down by states, since the crash cases drawn are aimed only at obtaining a valid national sample. The GES definition of a large truck is the same as the FARS definition.

The Motor Carrier Management Information System (MCMIS). The Motor Carrier Management Information System Crash File is maintained by the Federal Motor Carrier Safety Administration. The MCMIS Crash File includes the National Governors' Association (NGA) recommended data elements collected on trucks and buses involved in crashes that meet the NGA recommended crash threshold. An NGA reportable crash must involve a truck (a vehicle designed, used, or maintained primarily for carrying property that has at least two axles and six tires) or a bus (a vehicle with seats for at least 16 people, including the driver). The crash must result in at least one fatality; one injury where the person injured is taken to a medical facility for immediate medical attention; or one vehicle having been towed from the scene as a result of disabling damage suffered in the crash. The states report these crashes to the OMCHS through the SAFETYNET computer reporting system.

Crash Reporting Systems

Crash data in this report is derived from the Pennsylvania Accident Reporting System (PARS). The starting point for the collection of PARS data is the accident report that is completed by the investigating law enforcement officer at the scene of a crash. During the period reviewed (Calendar Year 1991 through Calendar Year 2000), the Commonwealth used a standardized two-page police accident

reporting form (AA-45) to record the crash report. A key section on this report form was the crash event narrative that was designed to present the most important elements of the crash in a logical, readable format. Before being submitted to the PENNDOT Bureau of Highway Safety and Traffic Engineering (BHSTE), the document underwent a review by the investigating officer's superior and was revised as necessary.

Once submitted to PENNDOT, the crash report was subject to scrutiny and analysis by staff of the Crash Information Systems and Analysis Division before being recorded in PARS. PENNDOT analysts interpreted and coded information from the individual crash reports. Some degree of subjective judgment was required in this analysis, as great reliance was placed on the narrative section of the report completed by the police officer. As a result, some elements of any particular crash found in the PARS database for the period 1991 through 2000 may be interpretative determinations made by a PENNDOT analyst based on the investigating officer's narrative.

In 2000, PENNDOT initiated substantial changes to its crash reporting system, including major automated software system modifications. This change coincided with a major revision and expansion of the forms and procedures used by the investigating officers to prepare reports at the scene of a crash. The state's new standardized reporting form, now known as the "Police Crash Reporting Form," was first issued in an eight-page format. Because of difficulties and concerns from the field, the form was modified to six pages (Form #AA-500).

One very significant change associated with the implementation of the new reporting system is that PENNDOT analysts now have a greatly reduced role in identifying key crash elements based on the crash report narratives. Under the current system, the investigating officer will be required to identify specific key elements of a reportable crash, such as "the first harmful event," "most harmful event," and "primary contributing factor," etc., on a crash reporting form that has reduced the importance of the narrative section. The transition process for these and other changes was ongoing as of June 2003.

According to PENNDOT officials, start-up difficulties related to the crash reporting form and the design and implementation of a new crash reporting system have delayed data availability for both calendar years 2001 and 2002, which would have been available at the time of this report's release under the prior crash reporting system.

The difficulties PENNDOT is experiencing in relation to the collection and reporting of motor vehicle crash data is also being felt at the federal level. An official with the Federal Motor Carrier Safety Administration (FMCSA) told LB&FC staff that there has recently been a problem with Pennsylvania in reporting crash

data to federal crash information databases in terms of timeliness and quality of data. This FMCSA official also stated that until this current problem developed, Pennsylvania was regarded as one of the top reporters of crash data into the FARS and MCMIS systems.

Pennsylvania's recent crash reporting problems impact on the Motor Carrier Management Information System, which is a system of databases managed by the FMCSA. Without Pennsylvania's data, this database now has a yearly system deficit of about 6,000 large truck crash records. Of these 6,000 missing large truck crashes, about 5,000 involve interstate motor carriers who are then not being tracked properly and being given a correct safety record rating. Nationally, there are about 105,000 large truck crashes annually, and Pennsylvania numbers represent 5-6 percent of the crashes recorded in the system.

This FMCSA official also indicated that unless there is accurate data in MCMIS from all states, the system might well generate an inaccurate SafeStat score for a motor carrier. SafeStat is designed to incorporate current on-road safety performance, enforcement history, and on-site compliance review information in an automated, data-driven analysis system for measuring the relative safety fitness of motor carriers. The objective of this system is to enable the FMCSA to target inspection resources more effectively by improving identification of those carriers with high-risk profiles. Since SafeStat ranks the relative performance of motor carriers in four areas: (1) accident history, (2) driver performance, (3) vehicle safety, and (4) safety management, inaccurate or missing crash information could materially impact a motor carrier's score, thereby causing the FMCSA not to target a high risk carrier for inspection.

Supplemental crash data is also contained in accident reconstruction reports that are prepared by the Pennsylvania State Police for some crashes. In certain cases, a Pennsylvania State Police (PSP) Collision Analysis and Reconstruction Specialist (CARS) is also required to reconstruct the accident. PSP "Field Regulations" specify which accidents require reconstruction:

> Criteria: It is the policy of the Department that the following accidents shall be reconstructed:
>
> a. Any vehicle accident resulting in one or more fatalities, serious bodily injury or extensive property damage where the possibility of prosecution for an indictable offense exists.
> b. A Department vehicle accident or legal intervention incident resulting in one or more fatalities, serious bodily injury, or extensive property damage.
> c. A serious vehicle accident involving a school bus or a hazardous material spill resulting in an evacuation.

Note: Nothing in this section shall preclude the reconstruction of other accidents upon the request of the investigating member in concurrence with a supervisor, e.g., circumstances likely to generate more than routine media interest, a complex vehicle accident, etc.

Records of accident reconstructions are maintained by the PSP.

B. Statistical Profile of Crashes in CY 2000

CY 2000 is the most recent year for which complete information on large truck crashes involving fire is available from PENNDOT crash files. From a review of these files, we developed a statistical profile of large truck crashes involving fires that occurred on Pennsylvania roadways during CY 2000. The data elements in this profile include the following:

1. Number of Large Truck Crashes Involving Fires on Pennsylvania Highways
2. Number of Injuries and Fatalities Resulting From Large Truck Crashes
3. Number of Fatalities and Injuries, by County
4. Number of Large Trucks Involved in Crashes on the Pennsylvania Turnpike
5. Weights of Large Trucks Involved in Crashes
6. Vehicle Configurations of Large Trucks in Crashes Involving Fire
7. Cargo Body Types of Large Trucks in Crashes Involving Fire
8. Crashes Involving Large Trucks Carrying Hazardous Materials
9. Registration of Large Trucks Involved in Fire-Related Crashes
10. Road Types on Which Large Truck Fire-Related Crashes Occurred
11. Large Truck Crashes in Construction Zones
12. Road Surface Conditions at the Time of Large Truck Crashes
13. Large Truck Crashes by Month and Time of Day

Before reviewing the individual elements, it is important to consider the following general statements regarding the data:

- For purposes of this study, a large truck (defined as a vehicle with a gross vehicle weight rating of greater than 10,000 pounds) necessarily includes a variety of vehicles such as truck tractors with cabs, truck tractors in combination with single or double trailers, single unit trucks, dump trucks, garbage or refuse trucks, and mobile homes.
- Every large truck crash enumerated in this report had "fire" as one of the data elements of the crash. However, it is difficult, without in-depth examination of each crash, to determine the specific role fire played in causing the crash to occur and its severity.

- Some of the crashes resulted in fatalities and/or injuries. Determining what relationship fire had in producing these casualties would require an in-depth review. For example, a death associated with a large truck crash involving a fire might have been attributable to causes other than the ensuing fire.
- A large proportion of the crashes included in the report involved no injuries or deaths. Information about these crashes may be sketchier and less informative than information about more serious crashes. The only certain conclusion that can be made about these "no-injury" crashes (which are also called property-damage-only crashes) is that they resulted in damage to a vehicle serious enough to require towing.
- A large proportion of the crashes included in the report are described as "non-collision crashes." Since all reportable crashes in PARS are characterized by the *first harmful event* of the crash, a crash characterized as "non-collision" only means that the first harmful event did not involve a collision with a fixed or non-fixed object. Even though a collision may have occurred subsequent to the first harmful event, the crash would still be classified as "non-collision."

1. Number of Large Truck Crashes Involving Fires on Pennsylvania Highways

In Calendar Year 2000, a total of 126 large truck crashes that involved fire occurred in Pennsylvania. In the context of all large truck crashes (8,164) in Pennsylvania during 2000, crashes involving fire represented a relatively small percentage (1.54 percent).

No. of Large Truck Crashes	Large Truck Crashes Involving Fire	% Large Truck Crashes
8,164	126	1.54%

Crash Severity. In terms of crash severity, a motor vehicle crash is classified as either a fatal crash, an injury crash, or a property-damage-only crash. The number of large truck crashes involving fire in 2000 (including crashes on the Pennsylvania Turnpike) is shown below by crash severity:

Crash Severity	No. of Crashes Involving Fire	% of Total
Fatal	15	11.9%
Injury	18	14.3
Property Damage Only	93	73.8
Total	126	100.0%

Crash Classification. As shown, nearly three-quarters of the crashes involved no injuries or fatalities (i.e., property damage only). It must also be pointed out that a large number, 94 of the 126 crashes, were classified as "non-collision crashes." In descending order, the large truck crashes involving fire were classified as follows:

Non-collision	94
Rear-End	12
Hit Fixed Object	11
Head-On	4
Angle	3
Sideswipe	2
Total	126

First Harmful Event. Crashes can also be categorized by the first harmful event and most harmful event. The first harmful event indicates the first action or event in the crash, as cited by the investigating officer in the crash report. The first harmful event description is useful in understanding the initial actions or problems that occurred in the crash. As indicated, fire was cited as the first harmful event in the vast number (94) of the crashes. However, in the remaining 32 crashes, another event initially took place, generally involving a collision with either a fixed or moving object.

Fire	94
Struck Unit #2	18
Struck Unit #1	3
Hit Median Barrier	3
Hit Guiderail	2
Hit Temporary Construction Barrier	1
Struck Curb	1
Struck Ditch	1
Struck Embankment	1
Struck Rocks	1
Struck Tree	1
Total	126

Most Harmful Event. The first event is not always the most harmful event to occur during a crash, which often involves several events in sequence. The following indicates the particular descriptions of the most harmful event in the crashes, based on the crash reports.

Fire	102
Struck Heavy Truck	13
Struck Automobile	3
Struck Tree	2
Struck Median Barrier	2
Overturned	2
Struck Light Truck	1
Struck Other/Unknown Vehicle	1
Total	126

2. Number of Injuries and Fatalities Resulting From Large Truck Crashes Involving Fires

Fatal Crashes and Fatalities. In CY 2000, 22 persons were killed in 15 separate crashes in which both a fire/explosion occurred and at least one large truck was involved. Two of the fatal crashes involved two large trucks each.

The 15 fatal crashes were all collision crashes. Three of the crashes were angle crashes, four were rear-end collisions, four were head-on collisions, and four involved hitting a fixed object. Also, each of the 15 crashes involved at least one truck with a gross vehicle weight rating (GVWR) of 50,000 pounds or greater; twelve of the trucks involved had a GVWR of 80,000 pounds.

Two of the most serious crashes in terms of casualties involved rear-end collisions. Although fire was a factor in the crash, it was neither the first harmful event nor the most harmful event in either of the crashes.

In the first rear-end collision that involved at least two vehicles (a tractor-trailer truck and a light truck vehicle), four persons were killed and three persons were injured. The primary contributing factor was "tailgating" and the most harmful event that occurred in the crash was the large truck hitting the light truck. This crash occurred on an interstate highway in Centre County.

The other tragic rear-end collision was a multiple-vehicle crash that included two large trucks and several other vehicles. This crash took place on an interstate highway in Montgomery County, killing 3 persons and injuring 14. The primary contributing factor was "seizure, epilepsy, etc." and the most harmful event was the striking of an other/unknown vehicle (i.e., other than a large truck).

The crash report data indicated that "fire" was the most harmful event in four of the 15 crashes. One person died in each of the four crashes, two of which occurred on the Pennsylvania Turnpike, another on an interstate highway, and the fourth on a street or township roadway. In each crash the first harmful event was some type of collision. In the two Turnpike crashes, the first harmful events were "struck embankment" and "struck curb," respectively. In the interstate crash, the large truck hit a guiderail as the first harmful event and, in the local road crash, another vehicle apparently hit the large truck from an angle. In all four of these crashes, the sequence of the fire event was either 3, 4, or 5 among a series of events occurring after the initial collision event.

See Table 1 for a summary description of the fatal large truck fire-related crashes that took place in 2000.

Table 1

Descriptive Information on Fatal Large Truck Crashes Involving Fire

(Calendar Year 2000)

Description	# of Fatalities	# of Injuries	Prime Contributing Factor	Most Harmful Event	Road Type	Body Type/ Vehicle Config.	Wt.
Head-On	1	0	Driving Wrong Side	Struck Heavy Truck	State Hwy.	Truck/Semi-Trailer	80,000
Hit Fixed Obj.	1	0	Unsecured/Shift Load	Fire	PTK-Main.	Truck/Semi-Trailer	50,000
Hit Fixed Obj.	1	3	Driver Lost Control	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Hit Fixed Obj.	1	0	Driver Lost Control	Fire	Interstate	Truck/Semi-Trailer	80,000
Head-On	1	0	Driving Wrong Side	Struck Heavy Truck	State Hwy.	Truck/Semi-Trailer	80,000
Rear-End	4	3	Tailgating	Struck Light Truck	Interstate	Truck/Semi-Trailer	80,000
Angle	1	0	Speed Related-Other	Fire	Street/Twp. Road	Truck/Semi-Trailer	80,000
Rear-End	1	5	Delayed Braking Response/Pumping Required	Struck Auto	State Hwy.	Single Unit Truck With 3 or More Axles	73,280
Head-On	1	0	Driving Wrong Side	Struck Heavy Truck	State Hwy.	Truck/Semi-Trailer	80,000
Rear-End	3	14	Seizure, Epilepsy, etc.	Struck Other Unknown Vehicle	Interstate	Truck/Semi-Trailer Truck Trac. Bobtail	80,000 80,000
Head-On	2	0	Driving Wrong Side	Struck Heavy Truck	State Hwy.	Single Unit Truck With 3 or More Axles	73,280
Angle	2	2	Too Fast for Conditions, Inclement Weather	Struck Heavy Truck	State Hwy.	Truck/Semi-Trailer	80,000
Angle	1	2	Didn't Stop for Unknown Reason	Overturned	State Hwy.	Two Single Unit Trucks With 3 or More Axles	58,400 74,000
Hit fixed Obj.	1	0	Drowsiness, Sleep, Fatigue	Overturned	Interstate	Truck/Semi-Trailer	80,000
Rear-End	1	0	Driving Wrong Side	Struck Heavy Truck	State Hwy.	Truck/Trailer	80,000

Source: Developed by LB&FC staff from data obtained from the Pennsylvania Accident Reporting System (PARS), PA Department of Transportation.

Injury Crashes and Number of Injured. Injury crashes are further classified by whether the injury was a minor injury, moderate injury, or major injury. During CY 2000, three of the 18 injury crashes were classified as involving major injury, whereas 5 were moderate injury crashes, 9 were minor injury crashes, and 1 additional crash was classified as "unknown injury." A total of 26 persons were injured in these crashes.

See Table 2 for description of the injury large truck fire-related crashes that took place in 2000.

3. Number of Fatalities and Injuries, by County

Forty-eight of the 67 counties experienced at least one fire-related large truck crash in 2000. Lehigh County had the most crashes, seven, followed by the counties of Blair, Clearfield, Lancaster, and Montgomery, with six crashes each. Table 3 shows the county-by-county distribution of large truck crashes involving fire, and the associated number of injuries and fatalities. As shown, the most fatalities (4) from these crashes occurred in Centre County; the most injuries (15) occurred in Montgomery County.

4. Number of Large Truck Crashes Involving Fire on the Pennsylvania Turnpike

During CY 2000, 16 large truck crashes involving fire occurred on the Pennsylvania Turnpike. Most of the crashes (13) occurred on the main section of the Turnpike, while the remaining three crashes took place on the Northeast Extension. Also, most of the crashes (12) involved no injuries, but 2 crashes involved fatalities, and the 2 remaining injury crashes were further classified as moderate injury and minor injury. In total, two persons died and seven persons were injured.

Crash Severity	No. of Crashes	No. of Fatalities	No. of Injuries
Fatal	2	2	3
Injury	2	0	4
Property Damage Only	12	0	0
Total	16	2	7

See Table 4 for a summary of the CY 2000 large truck fire-related crashes on the Pennsylvania Turnpike and Appendix E for further related information.

5. Weights of Large Trucks Involved in Crashes

PENNDOT crash data regarding fire-related large truck crashes indicates that very heavy trucks (gross vehicle weight rating of 80,000 lbs. or greater) represented the majority of trucks involved in fire-related crashes. A total of 131 large trucks were involved in 126 crashes. Twelve trucks weighing 80,000 lbs. or greater

Table 2

Descriptive Information on Injury Large Truck Crashes Involving Fire

(Calendar Year 2000)

Description	# of injuries	Prime Contributing Factor	Most Harmful Event	Road Type	Body Type/ Veh. Config.	Wt.
Hit Fixed Obj.	2	Driver Lost Control	Fire	Interstate	Truck/Semi-Trailer	80,000
Hit Fixed Obj.	1	Driver Lost Control	Struck Tree	Interstate	Truck/Semi-Trailer	80,000
Hit Fixed Obj.[a]	3	Failure to Respond to Unknown Traffic Control Device	Struck Heavy Truck	PTK-Main.	Truck/Semi-Trailer	73,280
Non-Collision	1	Engine Failure	Fire	Interstate	Unknown Camper/ Mobil Home	b/
Hit Fixed Obj.	1	Driving Wrong Side	Struck Tree	Interstate	Truck/Semi-Trailer	80,000
Rear-End	1	Driver Drinking	Fire	State Hwy.	Unknown Heavy Truck	80,000
Non-Collision	1	Engine Failure	Fire	Interstate	Truck/Semi-Trailer	52,000
Rear-End	2	Too Fast for Conditions, Traffic	Struck Heavy Truck	Interstate	Truck/Semi-Trailer Truck/Semi-Trailer	80,000 80,000
Non-Collision	1	Other Tire/wheel Problems	Fire	Interstate	Single Unit Truck	b/
Non-Collision	1	Unknown Contributing Factor-Sole Cause	Fire	State Hwy.	Medium/Heavy Truck Based Motor Home	b/
Sideswipe	2	Too Close to Center Line	Struck Heavy Truck	Interstate	Truck/Semi-Trailer	80,000
Hit Fixed Obj.	1	Suspension System Failure	Struck Median Barrier	State Hwy.	Single Unit Truck With 3 or More Axles	73,280
Hit Fixed Obj.	1	Careless Passing	Struck Median Barrier	State Hwy.	Single Unit Truck	b/
Rear-End	2	Failed to Heed Stopped Veh.	Struck Auto	State Hwy.	Truck/Semi-Trailer	80,000
Non-Collision	1	Engine Failure	Fire	Interstate	Truck/Semi-Trailer	80,000
Rear-End	2	Failed to Heed Stopped Veh.	Fire	State Hwy.	Single Unit Truck	b/
Rear-End	2	Improper Entrance to Hwy.	Struck Heavy Truck	Interstate	Truck/Semi-Trailer Truck/Semi-Trailer	80,000 80,000
Hit Fixed Obj.	1	Driver Lost Control	Fire	PTK-Main.	Truck/Semi-Trailer	80,000

[a]Crash occurred at a construction zone and also involved the release of a hazardous material (nonflammable gas).

[b]Not recorded.

Source: Developed by LB&FC staff from data obtained from the Pennsylvania Accident Reporting System (PARS), PA Department of Transportation.

Table 3

Numbers of Large Truck Crashes Involving Fire and Related Injuries and Fatalities, by County

(2000)

County	# of Crashes[a]	Fatalities	Injuries	County	# of Crashes[a]	Fatalities	Injuries
Adams	0	0	0	Lancaster	6	0	3
Allegheny	3	0	0	Lawrence	1	1	3
Armstrong	0	0	0	Lebanon	3	0	0
Beaver	1	0	0	Lehigh	7	1	5
Bedford	1	0	0	Luzerne	3	1	0
Berks	3	0	0	Lycoming	1	0	0
Blair	6	1	0	McKean	0	0	0
Bradford	0	0	0	Mercer	3	1	2
Bucks	4	1	2	Mifflin	3	1	1
Butler	2	2	2	Monroe	0	0	0
Cambria	2	0	0	Montgomery	6	3	15
Cameron	0	0	0	Montour	0	0	0
Carbon	1	0	0	Northampton	1	0	0
Centre	4	4	3	Northumberland	3	2	1
Chester	5	2	3	Perry	2	0	0
Clarion	2	0	0	Philadelphia	2	0	3
Clearfield	6	0	1	Pike	2	0	2
Clinton	2	0	0	Potter	0	0	0
Columbia	1	0	0	Schuylkill	4	0	0
Crawford	0	0	0	Snyder	1	0	0
Cumberland	3	0	1	Somerset	3	0	3
Dauphin	2	0	1	Sullivan	0	0	0
Delaware	0	0	0	Susquehanna	2	0	0
Elk	0	0	0	Tioga	1	0	0
Erie	0	0	0	Union	1	0	2
Fayette	0	0	0	Venango	0	0	0
Forest	0	0	0	Warren	0	0	0
Franklin	1	0	0	Washington	3	0	0
Fulton	1	0	0	Wayne	1	1	0
Greene	1	1	0	Westmoreland	4	0	0
Huntingdon	0	0	0	Wyoming	1	0	0
Indiana	1	0	0	York	4	0	0
Jefferson	3	0	0				
Juniata	0	0	0				
Lackawanna	3	0	2	Total	126	22	55

[a]Includes Fatal, Injury, and Property-Damage-Only Crashes.

Source: Developed by LB&FC staff using information obtained from the Pennsylvania Department of Transportation.

Table 4

Descriptive Information on Large Truck Crashes Involving Fire on the Pennsylvania Turnpike
(Calendar Year 2000)

Description	Crash Severity	Prime Contributing Factor	Most Harmful Event	Road Type	Body Type/ Veh. Config.	Wt.
Non-Collision	PDO[a]	Other Contributing Factor	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Other Tire/wheel Problem	Fire	PTK-Main.	Single Unit Truck With 3 or More Axles	58,000
Hit Fixed Obj.	Fatal	Unsecured/Shift Load	Fire	PTK-Main.	Truck/Semi-Trailer	50,000
Hit Fixed Obj.[b]	Min Inj[c]	Failed to Respond to TCD[d]	Struck Heavy Truck	PTK-Main.	Truck/Semi-Trailer	73,280
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	Medium/Heavy Truck Based Motor Home	f/
Hit Fixed Obj.	Fatal	Driver Lost Control	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-NE	Unknown Camper/ Motor Home	f/
Non-Collision	PDO	Other Contributing Factor	Fire	PTK-Main.	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	Medium/Heavy Truck Based Motor Home	f/
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	Single Unit Truck	f/
Rear-End	PDO	Illegal Stopped on Road	Struck Automobile	PTK-NE	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-NE	Truck/Semi-Trailer	80,000
Non-Collision	PDO	Engine Failure	Fire	PTK-Main.	TT/Double Trailers	52,000
Hit Fixed Obj.	Mod. Inj[e]	Driver Lost Control	Fire	PTK-Main.	Truck/Semi-Trailer	80,000

[a]Property-Damage-Only Crash.

[b]Crash occurred at a construction zone and also involved the release of a hazardous material (nonflammable gas).

[c]Minor Injury Crash.

[d]TCD refers to Traffic Control Device.

[e]Moderate Injury Crash.

[f]Not recorded.

Source: Developed by LB&FC staff from data obtained from the Pennsylvania Accident Reporting System (PARS), PA Department of Transportation.

were involved in crashes where fatalities resulted, whereas 5 trucks that weighed between 26,000 lbs and 80,000 lbs. were involved in fatal crashes. The vehicle weight is not always completed in the crash report by police crash investigators. No weight information was provided for 39 trucks (29.8 percent of total).

GVWR	Number of Trucks: Fatal Crashes	Number of Trucks: Non-Fatal Crashes	Number of Trucks: Total	% of Total
10,000 to 26,000 lbs.	0	1	1	0.8%
26,001 to 79,999 lbs.	5	18	23	17.6
80,000 lbs. and Over	12	56	68	51.9
Unknown	0	3	3	2.3
Not Indicated	0	36	36	27.5
Total	17	114	131	100.0%

6. Vehicle Configurations of Large Trucks in Crashes Involving Fire

Police crash reports also report on the vehicle configurations and cargo body types of commercial large trucks in crashes involving fire. As shown below, 11 of the 17 large trucks involved in fatal crashes with fires involved tractors with semi-trailers; 52 of the 114 large trucks involved in non-fatal crashes with fires also involved this vehicle configuration. A total of 36 vehicles in the crash reports did not list either a vehicle configuration or a cargo body type. These are the same vehicles for which GVWR were also not indicated. In most cases, these vehicles were the single unit straight trucks, but in a few instances the vehicles were described in the crash reports as truck based motor homes or camper/motor homes. Because our definition of large truck included vehicles over 10,000 lbs., a number of smaller as well as non-commercial type vehicles were included in the selection process.

Vehicle Configuration	Number of Trucks: Fatal Crashes	Number of Trucks: Non-Fatal Crashes
Single Unit Truck, 2-axle	0	5
Single Unit Truck, 3-axle	4	8
Truck/Trailer	1	7
Truck Tractor(s) (Bobtail)	1	1
Tractor/Semi-trailer	11	52
Tractor/Double	0	3
Unknown/Heavy Truck	0	2
Unknown/Not Applicable	0	36
Total	17	114

7. Cargo Body Types of Large Trucks in Crashes Involving Fire

Commercial trucks include a variety of body types for cargo transport. The cargo body type referred to as "van/enclosed box" type was involved in five fatal crashes and 48 non-fatal crashes involving fire. Additionally, five fatal crashes involved "dump trucks" and four fatal crashes involved "flatbed trucks."

Cargo Body Type	Number of Trucks	
	Fatal	Non-Fatal
Van/Enclosed Box	5	48
Flatbed	4	7
Dump	5	6
Cargo Tank	0	3
Garbage/Refuse	1	7
Auto Transport	0	2
Other Cargo Body Type	1	2
Other/Unknown Body Type	1	3
Unknown/Not Applicable	0	36
Total	17	114

8. Crashes Involving Large Trucks Carrying Hazardous Materials

Crashes involving large trucks transporting hazardous materials are of particular concern, especially when a fire results. Fortunately, only two of the 126 large truck fire-related crashes involved hazardous material, and neither crash resulted in serious injury. In one case, a non-collision/non-injury crash involved a single unit truck transporting gasoline and weighing 33,000. The primary contributing factor was listed as "blow out-sudden failure." The other crash involved two vehicles, one of which was a tractor-trailer truck weighing 73,280 pounds that was struck by the other vehicle in a construction zone on the Pennsylvania Turnpike. In this case, the crash involved the release of a "non-flammable gas." Three persons were injured, but the injuries were reportedly minor in nature.

9. Registration of Large Trucks Involved in Fire-Related Crashes

The PENNDOT database records whether crash-involved large trucks have an in-state, out-of-state, Canadian, foreign, U.S. Government, or international registration. In the 2000 data for large truck fire-related crashes, 67 (51 percent) of the vehicles involved were registered in Pennsylvania.

Crash Severity	Number of Trucks				
	PA Registered	Out-of-State Registered	Canadian Registerd	U.S. Gov't. Registered	International Registered
Fatal	8	9	0	0	0
Injury	5	14	0	1	0
Property-Damage-Only	54	35	3	1	1
Total	67	58	3	2	1

10. Road Types on Which Large Truck Fire-Related Crashes Occurred

In the case of the large truck fire-related crashes occurring in 2000, 39.7 percent occurred on interstate highways, 37 percent occurred on other state highways, and nearly 13 percent occurred on the Turnpike.

Road Type	Crashes	% of Total
State Highway (Interstate)	50	39.7%
State Highway (Other)	47	37.3
Turnpike	16	12.7
Street/Township Road	10	7.9
Ramp	3	2.4
Total	126	100.0%

11. Large Truck Crashes in Construction Zones.

Of the 126 crashes, only one took place in a construction zone. Occurring on the Pennsylvania Turnpike, this crash, classified as a "minor injury" crash, involved another vehicle colliding with a tractor-trailer truck after first hitting a temporary construction barrier. Three persons reportedly sustained minor injuries. Also, this crash was one of the two crashes cited above that involved the release of a hazardous material (non-flammable gas).

12. Road Surface Conditions at the Time of Large Truck Crashes

Most of the large truck crashes involving fire in 2000 occurred under dry road surface conditions. According to the crash data, 106 (84 percent) of the 126 crashes occurred under dry conditions.

13. Large Truck Crashes by Month and Time of Day

Based on 2000 data, more large truck crashes involving fires occurred during June (18) than in any other month. The next largest months were July (14) and May (13). The month of January (6) had the fewest of these kinds of crashes during 2000.

The majority, 80, of the crashes occurred during regular work hours (6:00 a.m. to 6:00 p.m.). A total of 50 of the crashes occurred from 12:01 p.m. to 6:00 p.m., and 30 crashes occurred between 6:00 a.m. and noon.

C. Ten-Year Trend Data

This section reviews the trend in large truck crashes during the ten-year period 1991 through 2000. Information is also provided to place the number of large truck crashes involving fire in perspective with all motor vehicle crashes and all large truck crashes.

During the ten-year period we reviewed, the number of vehicle miles traveled by large trucks on a daily basis on Pennsylvania highways increased by nearly 26 percent (from 23,197,000 miles in 1991 to 29,181,000 miles in 2000). (See Table 5.) On an annualized basis, this translates to 10.65 billion miles traveled in CY 2000.

Table 5

Estimated Number of Vehicle Miles Traveled Daily by Large Trucks in PA

Calendar Year	# of Miles
1991	23,197,000
1992	23,399,000
1993	23,805,000
1994	24,573,000
1995	25,484,000
1996	27,005,000
1997	27,416,000
1998	28,286,000
1999	29,090,000
2000	29,181,000
Total	261,436,000

Source: Developed by LB&FC staff using information obtained from PENNDOT.

Between calendar years 1991 and 2000, a total of 1,045 large truck crashes that involved a fire event occurred on Pennsylvania roadways. As shown on Table 6, 87 percent occurred on state and local roads while 13 percent occurred on the Pennsylvania Turnpike. Table 6 provides a detailed breakdown of large truck crashes with fire statistics, by year and crash severity. This data is derived from PENNDOT's Pennsylvania Accident Record System (PARS).

During this ten-year period, there were 1,045 large truck crashes involving fires that resulted in 195 deaths and 424 injuries. The 1,045 large truck crashes involving fires represented 1.4 percent of all large truck crashes and 0.08 percent of all vehicular crashes that occurred on Pennsylvania roadways during the period. Similarly, the 195 deaths due to large truck crashes involving fires represented 9.7 percent of all large truck crash deaths and 1.3 percent of all vehicular crash deaths that occurred in Pennsylvania between 1991 and 2000. The 424 injuries that resulted from large truck crashes involving fires is 0.7 percent of all injuries sustained by people in large truck crashes and 0.03 percent of all injuries sustained in vehicular crashes in Pennsylvania between 1991 and 2000. (See also Appendices B and C.)

Table 6

Ten-Year Trend Data on Large Truck Crashes Involving Fires on Pennsylvania Highways

(Calendar Years 1991 Through 2000*)

State and Local Roads Only Calendar Year	Large Truck Crashes Involving Fires					
		Fatal Crashes		Injury Crashes		Property Damage Only Crashes
	Total	Number	Fatalities	Number	Injuries	
1991	81	12	14	15	34	54
1992	78	13	15	16	33	49
1993	71	10	14	15	50	46
1994	97	18	23	16	38	63
1995	78	11	16	17	32	50
1996	107	10	10	22	41	75
1997	98	15	15	15	30	68
1998	94	13	20	18	38	63
1999	95	16	26	12	36	67
2000	110	13	20	16	48	81
Subtotal	909	131	173	162	380	616
PA Turnpike Only						
1991	15	0	0	3	7	12
1992	10	0	0	1	1	9
1993	17	2	3	2	9	13
1994	6	0	0	1	1	5
1995	20	4	4	0	7	16
1996	14	0	0	0	0	14
1997	17	2	2	3	5	12
1998	6	0	0	0	0	6
1999	15	4	11	1	7	10
2000	16	2	2	2	7	12
Subtotal	136	14	22	13	44	109

Table 6 (Continued)

Total – All Highways		Large Truck Crashes Involving Fires				
		Fatal Crashes		Injury Crashes		Property Damage
Calendar Year	Total	Number	Fatalities	Number	Injuries	Only Crashes
1991	96	12	14	18	41	66
1992	88	13	15	17	34	58
1993	88	12	17	17	59	59
1994	103	18	23	17	39	68
1995	98	15	20	17	39	66
1996	121	10	10	22	41	89
1997	115	17	17	18	35	80
1998	100	13	20	18	38	69
1999	110	20	37	13	43	77
2000	126	15	22	18	55	93
Total	1,045	145	195	175	424	725

*Calendar year 2000 data is the latest data available form PENNDOT's accident reporting system.

Source: Developed by LB&FC staff using data obtained from the PA Department of Transportation's "Pennsylvania Accident Reporting System" (PARS).

D. Primary Contributing Factors

Truck Crash Causation Generally

No reliable Pennsylvania-specific or nationwide information exists on the exact causes of crashes involving large trucks. Some data exists, however, on factors that may contribute to these crashes.[1] These include (1) "driver factors," such as excessive speed, fatigue, inattentiveness, and reckless driving; (2) factors related to vehicle condition, such as worn brakes, bald tires, and improperly secured loads; (3) factors related to the road, such as the type of road and its design; and (4) environmental factors, such as bad weather and darkness. However, neither the federal government nor PENNDOT is currently able to conclusively establish crash causation or fault because existing databases do not contain sufficiently complete information on contributing factors.

Driver error, on the part of both the truck driver and/or the passenger vehicle driver, is generally cited as a principal factor in crashes, with speeding, inattention, and drowsiness being major contributing factors. Based on federal estimates, mechanical defects contribute to between 5 and 13 percent of truck crashes. Highway design and environmental factors also contribute to crashes.

Complete and reliable data for these factors in large truck crashes are unavailable, in most instances, for assessment of crash causes. A 1999 study by the U.S. General Accounting Office concluded that the federal Office of Motor Carrier and Highway Safety was hampered by limited information on the factors that contribute to crashes involving large trucks. The absence of this data in turn limits the design and implementation of effective crash mitigation strategies.

The Federal Motor Carrier Safety Improvement Act of 1999 requires that the U.S. Department of Transportation conduct a comprehensive study of the causes of commercial motor vehicle crashes on a five-year cycle. The act also requires that the National Highway Traffic Safety Administration operate a program in cooperation with the Federal Motor Carriers Safety Administration (FMCSA) to improve the collection and analysis of commercial vehicle crash data. This project, known as the "Large Truck Crash Causation Project" is to determine the causes of serious large truck crashes so that the most effective countermeasures to reduce the number and severity of large truck crashes can be implemented. Pennsylvania is one of four states participating in this project.

Several years ago, PENNDOT engaged in a project with a consultant on a special analysis of Pennsylvania crash databases. The resulting report analyzed crash data for the entire state for the period 1993 through 1997 in order to identify "primary contributing factors" in crashes involving commercial vehicles and large

[1]The presence of a contributing factor does not necessarily identify fault or the cause of a crash, but, rather, the presence of a contributing factor increases the likelihood of a crash.

trucks. The results of this study appeared to confirm the belief that driver error, and not mechanical defects, is more often the primary contributing factor in commercial vehicle and large truck crashes. Among the factors cited most frequently in large truck crashes were "Tailgating," "Failed to Heed Stopped Vehicle," and "Careless Lane Change."

Truck Crashes Involving Fire

Obtaining sufficient and reliable information regarding large truck crashes involving fire is even more problematic. A primary reason for this is that vehicle fires involving trucks have not been a major focus for researchers. During this project, LB&FC staff succeeded in identifying only a few published industry or government reports related to the subject of this study, and these were often at least a decade old.

Database deficiencies constitute another stumbling block for obtaining information about large truck fire-related crashes. For example, research sponsored by General Motors in the mid-1990s assessed the adequacy of existing databases for the purpose of studying the causes and effects of vehicle fire events. The researchers determined that existing data sources contain insufficient information to enable researchers to satisfactorily understand the causes of vehicle fires.

Examination of the "primary contributing factors" appears to be the best approach, although imperfect, to understanding why and how crashes take place. Consequently, we examined the crash records for the large truck crashes involving fires in order to identify what law enforcement officers and PENNDOT crash investigation analysts classified as the primary contributing factors in those crashes. We found that the most frequent primary contributing factors associated with property-damage-only truck crashes involving fire were not driver-related but vehicle-related. In fact, the most frequent factor cited was "Engine Failure" in nearly 50 percent of all the fire-related truck crashes during the ten-year period examined.

Table 7 presents a classification of the primary contributing factors for the 1,045 crashes that occurred over the ten-year period. As shown, two of the top three factors are clearly vehicle-related. Another factor designated as "Other Contributing Factors" is too ambiguous a term to classify as either driver or vehicle-related. Based on our review of all the data, and our 2000 profile in particular, we noted that "engine failure" was predominantly associated with "non-collision" crashes as well as with non-injury or PDO crashes. Additionally, in most (but not all) cases, fire was listed as either the first harmful event or the most harmful event, or both. We spoke with PENNDOT officials in order to obtain their perspective on the nature of these incidents and why they are reportable crashes. It appears that, in these cases, fires occur in or on large trucks while in motion and these incidents result in the vehicle being towed. As such, they are deemed reportable crashes under the definition used by PENNDOT for inclusion in the accident database (PARS).

Table 7

Primary Contributing Factors Reported for Large Truck Crashes Involving Fires
(1991-2000)

Contributing Factors[a]	Number of Crashes
Engine Failure	485
Mechanical Problems Other Than Engine	113
Improper/Illegal Driver-Related Actions	99
Improper/Careless Driver-Related Behavior	85
Speed Related	51
Driver Health/Drowsiness/Fatigue Problems	19
Unknown Contributing Factor (Sole Cause)	18
Driver Drinking (Charged or Indicated)	15
Failure to Heed or Obey a Traffic Control Device	13
Act of Nature	11
Vehicle Load-Related Problems	9
Driver Distracted	6
Reacting to Obstacle on the Roadway	2
Sudden Roadway Surface Condition Change	2
Other Contributing Factors	117
Total	1,045

[a]This listing of primary contributing factors provides a summary classification of factors; see Appendix A for a detailed breakdown of all reported primary contributing factors.

Source: Developed by LB&FC staff from information contained in the Pennsylvania Accident Record System (PARS).

E. Crash/Fire Involvement Rates

Crash statistics are often expressed as a rate per 100 million vehicle miles traveled (VMT). This section calculates crash/fire involvement rates for Pennsylvania for the period 1997 through 2000 and compares these rates to national rates for the same period.

For the most part, the unit of measure used in this report is the number of large truck crashes involving fire. Calculation of a crash/fire involvement rate, however, requires that the unit of measure be the number of large trucks involved in crashes with fire as opposed to the number of crashes. For example, in Calendar Year 2000, Pennsylvania had 126 large truck crashes involving fire. These crashes involved a total of 131 large trucks. (See Appendix B for a breakdown of the number of large trucks involved in crashes by year from 1991 to 2000, and Appendix C for a breakdown of the number of motor vehicle crashes, fatalities, and injuries, by year, from 1991 to 2000.)

1. Large Truck Crash With Fire Involvement Rate

The large truck crash with fire involvement rate represents the number of large trucks involved in crashes with a fire per 100 million vehicle miles traveled. The 131 large trucks involved in crashes with fires in Pennsylvania in 2000 translate to a crash involvement rate of 1.23 (i.e., 131 large trucks involved in crashes with fires for the 10.65 billion miles of travel by large trucks on Pennsylvania roadways in 2000). Table 8 shows a comparison between the large truck crash with fire involvement rate in Pennsylvania and with that on the Nation's highways for 1997 through 2000. The 2,666 (estimated) large trucks involved in a crash with a fire in 2000 nationally translate to a crash involvement rate of 1.30 (i.e., 2,666 large trucks involved in crashes with fires for the 205.52 billion miles of travel by large trucks on the Nation's roadways in 2000).

Table 8

Involvement Rate for Large Truck Crashes With Fires
Pennsylvania and U.S. Highways
(CY 1997 to CY 2000)

	1997	1998	1999	2000
Pennsylvania	1.25	1.05	1.17	1.23
United States	0.44	0.81	0.65	1.30

Source: Developed by LB&FC staff using data provided by the PA Department of Transportation; data obtained from the National Highway Traffic Safety Administration's *Traffic Safety Facts 1997, 1998, 1999, 2000;* and data obtained from the Federal Highway Administration's *Highway Statistics 1997, 1998, 1999, 2000, 2001.*

2. Large Truck Fatal Crash With Fire Involvement Rate

The large truck fatal crash with fire involvement rate is the number of large trucks involved in a fatal crash with a fire per 100 million miles traveled by large trucks. The 17 large trucks involved in fatal crashes with fires on Pennsylvania roads in 2000 resulted in 22 fatalities. The Commonwealth experienced a fatal crash involvement rate of 0.16 (i.e., 17 large trucks involved in fatal crashes with fires for the 10.65 billion miles of travel by large trucks on Pennsylvania roadways in 2000). Table 9 shows a comparison between the large truck fatal crash with fire involvement rate in Pennsylvania and with that on the Nation's highways for 1997 through 2000. The 262 large trucks involved in fatal crashes with fires in 2000 nationally translate to a fatal crash involvement rate of 0.13 (i.e., 262 large trucks involved in fatal crashes with fires for the 205.52 billion miles of travel by large trucks on the Nation's roadways in 2000).

Table 9

Involvement Rate for Large Truck Fatal Crashes With Fires
Pennsylvania and U.S. Highways
(CY 1997 to CY 2000)

	1997	1998	1999	2000
Pennsylvania	0.22	0.16	0.24	0.16
United States	0.11	0.14	0.13	0.13

Source: Developed by LB&FC staff using data provided by the PA Department of Transportation; data obtained from the National Highway Traffic Safety Administration's *Traffic Safety Facts 1997, 1998, 1999, 2000;* and data obtained from the Federal Highway Administration's *Highway Statistics 1997, 1998, 1999, 2000, 2001.*

3. Large Truck Injury Crash With Fire Involvement Rate

The large truck injury crash with fire involvement rate is the number of large trucks involved in an injury crash with a fire per 100 million miles traveled by large trucks. The 20 large trucks involved in injury crashes on Pennsylvania roads in 2000 resulted in 55 injuries. This translates to an injury crash involvement rate of 0.19 (i.e., 20 large trucks involved in injury crashes with fires for the 10.65 billion miles of travel by large trucks on Pennsylvanian roadways in 2000). Table 10 displays a comparison between the large truck injury crash with fire involvement rate in Pennsylvania and with that on the Nation's highways for 1997 through 2000. The 404 (estimated) large trucks involved in injury crashes with fires in 2000 nationally translate to a injury crash involvement rate of 0.20 (i.e., 404 large trucks involved in injury crashes with fires for the 205.52 billion miles of travel by large trucks on the Nation's roadways in 2000).

Table 10

Involvement Rate for Large Truck Injury Crashes With Fires
for Pennsylvania Highways and U.S. Highways
(CY 1997 to CY 2000)

	1997	1998	1999	2000
Pennsylvania	0.22	0.20	0.20	0.19
United States	0.15	0.18	0.35	0.20

Source: Developed by LB&FC staff using data provided by the PA Department of Transportation; data obtained from the National Highway Traffic Safety Administration's *Traffic Safety Facts 1997, 1998, 1999, 2000;* and data obtained from the Federal Highway Administration's *Highway Statistics 1997, 1998, 1999, 2000, 2001.*

IV. Potential Means of Reducing the Incidence of Large Truck Crashes Involving Fires

A. Ongoing Truck Safety Initiatives

State

Four separate agencies have responsibility for administering programs and conducting activities that impact truck safety in the Commonwealth: the Pennsylvania Department of Transportation (PENNDOT), the Pennsylvania State Police (PSP), the Pennsylvania Turnpike Commission, and the Pennsylvania Public Utility Commission (PUC).[1] These agencies carry out a number of ongoing large truck safety initiatives. These programs and activities can be classified into one of the following categories:

- Inspections/Audits,
- Licensing/Registration Programs,
- Law Enforcement Initiatives,
- Data Collection/Analysis, and
- Infrastructure and Technology Improvements.

An inventory of and further information on Pennsylvania's truck safety efforts are provided in a July 2000 report by the LB&FC entitled *State Government Efforts to Reduce Crashes Involving Large Trucks on Pennsylvania Highways.* Additional information on truck safety activities is contained in the LB&FC's July 2002 *Performance Audit of the Pennsylvania Department of Transportation.*

The Committee's 2000 "Truck Safety Study" recommended that PENNDOT should take the lead in coordinating the development of a formal statewide strategy to reduce the number and severity of crashes involving large trucks. In response to this recommendation, PENNDOT conducted a Statewide Truck Safety Symposium in January 2002. The purpose of this event was to focus attention on those truck safety programs, technologies, and initiatives that would produce the greatest improvement or gains relative to truck-related crashes and fatalities.

The product of the symposium was Pennsylvania's "Unified Truck Safety Strategy." (See Exhibit 2.) At the time of its release, it was described as a "blueprint for a comprehensive program of education, enforcement, and engineering actions to reduce the incidence of truck-involved crashes on Pennsylvania's highways.

[1]To a lesser degree, the Department of Environmental Protection (DEP) and the Department of Revenue are involved in motor carrier enforcement activities. DEP is involved in waste hauler inspection operations and the Department of Revenue carries out roadside checks for Motor Carriers Road Tax/International Fuel Tax Agreement decals.

Exhibit 2

Pennsylvania *Unified Truck Safety Strategy*

Vision

Pennsylvania will achieve significant reductions in truck related crashes, fatalities and injuries, and the Commonwealth will serve as a benchmark for other states on truck safety best practices.

Mission

Performance improvements in highway transportation and reductions in truck related crashes, fatalities, and injuries are delivered through a balanced program of seven key Strategic Focus Areas (SFAs).

Key Strategic Focus Areas

- Enforcement of Traffic Laws
- Improve Behavior of All Drivers
- Highway Safety Improvements
- Education of Truck Drivers
- Commercial Vehicle Enforcement
- Focused Use of New Technology
- Motor Carrier Industry "Best Practices"

Source: Pennsylvania *Unified Truck Safety Strategy.*

Implementation of the *Unified Truck Safety Strategy* is expected to significantly contribute to a reduction in the incidence of truck-involved crashes on Pennsylvania highways. According to PENNDOT officials, implementation of the strategy is ongoing.

While the *Unified Truck Safety Strategy* does not include a specific component addressing large truck crashes involving fire, it does include many objectives which, if successfully implemented, could contribute to the goal of reducing such crashes. Examples of such objectives from the *Unified Truck Safety Strategy* include the following:

- Developed/refined procedures to identify highway corridors for enhanced enforcement.
- Deploy advanced enforcement techniques and technologies to reduce traffic crashes, injuries and fatalities.
- Enhance the training of police officers to improve overall enforcement of moving violations most directly related to truck involved crashes.
- Improve driver awareness of the unique characteristics of trucks with an emphasis on defensive driving when near or around trucks, their stopping distance, blind spots, wide turning radius, etc.

- Develop a comprehensive "Construction Work Zone Strategy" directly related to reducing crashes, injuries, and fatalities.
- Develop carrier-based programs to educate, train, and test truck drivers about defensive driving including crash causation factors, work zones (including pre-zones), and how to recognize and deal with fatigue, distractions, and inattentiveness.
- Define a process to identify unsafe intrastate carriers for compliance reviews and follow-up enforcement.
- Increase the number of MCSAP inspections with a focus on the driver.
- Continue to establish highway safety corridors and implement "Ready to Use" highway technology. Examples include curve rollover warning, safe following distance positioning dots, advance warning traffic signal signage, weather related warnings, and runaway truck arrestor beds.
- Identify the "Best Practices" that will improve truck safety in Pennsylvania and disseminate the "Best Practices" to identified motor carriers in Pennsylvania and promote them through "Improving Driver Behavior" programs.

Fifteen of the Strategy's 38 objectives have target implementation dates falling between June 2002 and July 2003. Twelve are "ongoing" and do not have a specified target date. (See Appendix D for a listing of the 38 objectives and the implementation target date for each.)

We also found that, as called for in the *Unified Truck Safety Strategy*, PENNDOT has (in conjunction with the Pennsylvania State Police and the Public Utility Commission) increased the annual number of Motor Carrier Assistance Program (MCSAP) roadside inspections. In FY 2001-02, these agencies conducted a combined total of 67,335 inspections. This represents an increase of 56 percent over the FY 1998-99 level that was reported in the LB&FC's July 2000 report on large truck safety.

Both the Pennsylvania State Police and the Pennsylvania Turnpike Commission are active participants in the Commonwealth's *Unified Truck Safety Strategy* and engage in highway safety activities on an ongoing basis. The Pennsylvania State Police (PSP) responsibilities include to promote traffic safety, enforce existing statutes, recognize and eliminate traffic-hazards, and encourage motorists to practice safe driving techniques. The PSP has undertaken a number of law enforcement initiatives to reduce the number of traffic crashes and with the special emphasis of some program activities to specifically reduce the number of truck crashes occurring in Pennsylvania.

- *Troop Truck Crash Prevention Initiative.* Under the "Troop Truck Crash Prevention Initiative," the State Police are aggressively carrying out enforcement and intervention activities on high truck crash corridors in each PSP Troop area. The PSP identifies the high crash corridors on the interstates as well as other state highways with maps produced by PENNDOT's GIS mapping technology.
- *Construction Work Zones.* Since construction work zones pose significant potential highway dangers, the PSP continues to provide strict, aggressive enforcement programs conducted in the vicinity of, and within construction zones. These are most effective when used in conjunction with pre-queue stationary patrols in select situations. This effort appears to continue to reduce crashes and congestion, ensure traffic law compliance, and promote safer highways.
- *Project NO.* This is a program of "zero tolerance" for commercial driver and vehicle safety violations. This particular program was originated by the reasoning that the number of commercial vehicle crashes might be reduced and highway safety improved if a higher percentage of the MCSAP violations resulted in citations.
- *Operation Centipede.* This program is designed to positively influence driving behavior by using aggressive speed enforcement tactics. Aimed at eliminating the comfort level of drivers who habitually speed up after passing a stationary patrol, the program makes use of hidden and decoy radar enforcement, as well as other detection methods. This program was initiated based on the recognition that increased speed on the highways may be one of a number of factors contributing to crashes.
- *TAG-D.* Ticket the Aggressive Driver is a program that focuses on motorists who disregard safety, travel at high rates of speed, weave in and out of traffic, tailgate, and/or illegally pass other motorists, change lanes abruptly, and ignore weather conditions. This program was also initiated based on the recognition that increased speed on the highways may be one of a number of factors contributing to crashes.

The PA Turnpike Commission has established an incident detection and response network spanning the entire Turnpike network. Early warning detection measures help to promote safety and issue prompt responses. The focal point of this system is the 24 hours a day, 365 days a year Operations Control Center located in the Administration Building in Harrisburg. The Center continuously monitors Turnpike activities via an extensive radio system; roadway conditions, construction status, and weather conditions are also monitored.

The Operations Control Center handles radio communications for Commission personnel, customers, State Police, authorized services, and emergency fire and medical services. The Center is equipped with a computer-aided dispatch (CAD)

system designed to provide the Commission's radio operators with instantaneous access to the closest emergency services and to the State Police for any incident at any point on the Turnpike.

In July 2001, the PA Turnpike Commission, as part of a cooperative effort between the Pennsylvania Fire and Emergency Services Institute, the PA State Fire Commissioner, the PA State Fire Academy, the PA State Police, and PA Department of Transportation, began formulating a new model for Unified Incident Command to be utilized on the Pennsylvania Turnpike. Unified Incident Command is a team effort that allows all the agencies with responsibilities for an incident to coordinate the effort of that response through one incident manager. The primary objectives of Unified Incident Command are to arrive on the scene as quickly as possible, conduct a thorough and accurate assessment of the incident, secure the scene of the incident, protect the workers at the scene, and ensure that the backlog resulting from the incident is managed in a safe fashion. (See Appendix E.)

Federal

At the federal level, six separate governmental organizations deal in some manner with motor vehicle transportation safety issues. These entities, all within the U.S. Department of Transportation, include: (1) the Federal Highway Administration, (2) the National Highway Traffic Safety Administration, (3) the Research and Special Programs Administration and its Office of Hazardous Materials Safety, (4) the Federal Railroad Administration, (5) the Bureau of Transportation Statistics, and (6) the Federal Motor Carrier Safety Administration (formerly the Office of Motor Carrier and Highway Safety of the Federal Highway Administration). The National Transportation Safety Board also operates in the highway safety arena but independently of the U.S. Department of Transportation. In addition to federal legislation, programs and initiatives emanating from these agencies have a significant impact on truck safety programs and activities at the state level.

The Federal Motor Carrier Safety Administration (FMCSA) was established on January 1, 2000, within the U.S. Department of Transportation (DOT). The FMCSA's mission is to improve truck and bus safety on the nation's highways through the administration of a motor carrier safety action plan. The top priority goal of FMCSA is to reduce the number of fatalities resulting from crashes involving large trucks by at least 50 percent from the 1998 baseline by the end of 2009. This new DOT modal administration replaced the federal Office of Motor Carrier and Highway Safety.

The FMCSA is responsible for the issuance, administration, and enforcement of the Federal Motor Carrier Safety Regulations (FMCSRs), 49 CFR Parts 325, 350, 382-399, the Hazardous Materials Regulations, 49 CFR Parts 100-180, and Part 40 as it pertains to drug and alcohol testing requirements. The head of the agency is

an administrator appointed by the President by and with the advice and consent of the Senate.

On May 25, 1999, the U.S. Secretary of Transportation and the Federal Highway Administrator announced a safety action plan to reduce the number of deaths on the nation's highways associated with commercial vehicles. The plan provides for stronger enforcement, tougher penalties, new regulations, advanced technology, and expanded education and research. The plan has a long-range goal of reducing fatalities by 50 percent over ten years (by the end of calendar year 2009) through a comprehensive effort by governmental, safety, and industry officials.

The safety action plan is intended to marshal the resources of the FHWA which enforces safety requirements for carriers and drivers; the National Highway Traffic Safety Administration, which develops new vehicle safety performance regulations; the Research and Special Programs Administration, which administers the hazardous materials program; the Federal Railroad Administration which conducts a comprehensive highway-rail grade crossing safety program; the Federal Transit Administration, which oversees the safety of transit bus operations; and the Bureau of Transportation Statistics (BTS), which tracks and analyzes travel and crash trends.

Following the introduction of the draft *Safety Action Plan*, the U.S. Secretary of Transportation sought comments on the plan, and Congress and the National Transportation Safety Board held public hearings which focused exclusively on the subject of motor carrier safety. Representatives of safety groups, industry, driver associations, and state enforcement agencies provided comments.

In February 2000, the FMCSA issued a final plan, the *Safety Action Plan 2000-2003*. This document describes the activities that FMCSA will undertake to address the "national problem" of commercial motor vehicle safety and make immediate progress toward its primary goal of reducing fatalities by 50 percent by the end of 2009.

The plan directs attention to those areas of greatest concern--poor drivers, unsafe carriers, and substandard vehicles--and focuses special attention on truck and bus safety at the nation's borders. Among the challenges faced by FMCSA in meeting its goal are a continued increase in truck travel, a need for better safety data and added improvements to the commercial drivers license program, leveraging existing resources to address the rapid expansion of the motor carrier population, and a need for further testing and demonstration of crash avoidance technologies. (See Exhibit 3 for key actions in the Federal Motor Carrier *Safety Action Plan*.)

Exhibit 3

Key Actions in the Federal Motor Carrier *Safety Action Plan*
(2000-2003)

Increasing Enforcement:

- Federal investigators will increase compliance reviews of high-risk carriers.
- Higher penalties will be imposed for violators of federal safety regulations.
- New entrant requirements will ensure greater safety compliance by motor carriers.
- A nationwide effort with the states will link vehicle registration and safety fitness.
- More funding will be provided to states to increase roadside inspections.

Increasing Safety Awareness:

- The use of No-Zone educational and media materials will be expanded.
- Seminars on fatigue recognition and management will be developed for commercial drivers and safety personnel.
- Federal and state inspector skills will be improved through training in crash data collection, motor coach inspection, drug interdiction, and new technologies.

Improving Safety Information Systems and Technology:

- The causes of commercial truck and bus crashes will be analyzed.
- All individual carrier census records will be verified and updated.
- A new system to collect data on all truck and bus crashes will be introduced.
- A register combining carrier information with licensing and insurance records will be established.
- Commercial vehicle collision warning and electronic braking systems will be tested.
- Driver alertness, driving assistance, and control intervention systems will be evaluated.
- A crash investigation data collection course will be developed for police officers.

Strengthening Federal Standards for Operations and Equipment:

- New commercial driver hours-of-service regulations will be proposed.
- The safety rating process used to determine motor carrier safety fitness will be revised.
- New rules that define an unfit carrier will be issued.
- Training requirements for entry-level commercial motor carrier vehicle drivers will be established.
- Convictions for all moving traffic violations will be recorded on commercial drivers license records.

Source: *Safety Action Plan, 2000-2003,* Federal Motor Carrier Safety Administration, February 2000.

Currently, no national database exists that contains information describing the causes or contributing factors for large truck crashes. Special effort is, however, underway at the federal level to improve data collection on and understanding of truck crash causation. The Motor Carrier Safety Improvement Act of 1999 requires the U.S. Department of Transportation to conduct and periodically update a comprehensive study of the causes of commercial motor vehicle crashes and provide an opportunity for public comment on the study. Additionally, the act requires that the National Highway Safety Traffic Administration administer a program in

cooperation with FMCSA to improve data collection and analysis on commercial vehicle crashes.

In October 1999, the U.S. Department of Transportation and the National Highway Traffic Administration initiated the "Large Truck Crash Causation Project." As stated at its initiation, the goal of this project is to determine the causes of serious large truck crashes so that the most effective countermeasures to reduce the occurrence and severity of large truck crashes will be implemented. "Fire occurrence" is one of the data collection elements in this study. It is, therefore, conceivable that improved understanding of large truck crashes involving fires may result from the project. An interim report on Large Truck Crash Causation Study (LTCSS) was prepared in late 2002 and work on the study was continuing as of spring 2003.

Trucking Industry

The Pennsylvania Motor Truck Association (PMTA) also has an ongoing program of initiatives to promote traffic safety, especially as it relates to commercial vehicles. Exhibit 4 provides a listing of initiatives underway as of mid-2003 as reported by PMTA.

B. Regulatory Changes

Recent research suggests that additional federal regulatory changes, especially to regulations relating to fuel systems, may provide significant potential safety benefits. This research contrasts U.S. fuel system regulations and technology to those in effect in the European Community.

Federal regulations at 49 CFR Subpart E—Fuel Systems (393.65-69) specify the design and installation of fuel systems on commercial vehicles. Pertinent regulatory requirements include the following:

- The fuel tank(s) must be securely attached to the vehicle.
- No part of the fuel system may extend beyond the widest part of the vehicle.
- No part of the fuel system may extend forward of the front axle of the power unit.
- Fuel that spills "vertically" from a fuel tank when it is being filled must not drop on any part of the exhaust or electrical systems.
- Pipes for adding fuel to the fuel tank must be located outside the passenger and cargo compartments.
- Fuel must not be fed from the fuel tank to the injector using gravity or a siphon (i.e., a pump or pressure device is required).

Exhibit 4

Truck Safety Initiatives Reported by the Trucking Industry

1. Industry-wide support for the Commercial Drivers License (CDL) Program.
2. Industry-wide support for the Motor Carrier Safety Assistance Program and funding for increased inspections.
3. Support for drug and alcohol testing.
4. Pennsylvania Motor Truck Association's (PMTA's) Safety Management Council (composed of 250 safety personnel providing assistance to Association safety initiatives).
5. PMTA's sponsorship of statewide student driving competitions with scholarships presented to the winners.
6. PMTA Safety Familiarization Program presented to State Police cadets.
7. Sponsorship of PMTA Chapter-wide Truck Driving Championships and hosting of the Annual State Championships.
8. Sponsorship and support of Pennsylvania's Road Team which consists of volunteer truck drivers travelling to schools, civic clubs, and other locations to deliver the trucking industry's safety message.
9. Sponsorship of statewide educational seminars for members and nonmembers covering issues such as hours-of-service, drug and alcohol, and state and national enforcement regulations.
10. Partnership with PENNDOT on the Wilmington/Harrisburg Freight Study Committee and safety advisory committees on Route 41 and Route 30 in Lancaster and Chester Counties.
11. Participation on PENNDOT's Workzone Safety Committee and Motor Carrier Safety Advisory Committee.
12. Participation with other statewide organizations such as the Manufactured Housing Association and the Pennsylvania Highway Safety Information Association to promote safety.
13. Promote the development of additional roadside rest areas for commercial operators.
14. Participation with the State Police, PENNDOT, and Turnpike Commission in the nationwide "Highway Watch Safety Program."
15. Participation with the State Police, PENNDOT, and AAA to improve safety on I-80 in Stroudsburg; I-78 in Allentown; and the Harrisburg Beltway, Route 581.

Source: Developed by LB&FC staff using information obtained from the Pennsylvania Motor Truck Association (PMTA) and other trucking industry representatives.

- A fuel line not wrapped in protective housing may not extend more than two inches below the fuel tank.
- When pressure devices are used to move fuel from the fuel tank, an excess flow valve must be installed on the system.

The specifications governing fuel systems for commercial vehicles are less detailed than those regulating the fuel systems of smaller vehicles, i.e., passenger cars, light trucks, and buses with a gross vehicle weight rating (GVWR) of 10,000 pounds or less. The U.S. regulations governing the latter (49 CFR 571.301 Standard No. 301; Fuel System Integrity) specifies a series of tests that must be performed on the fuel systems of these smaller vehicles. For instance, *S5.6 Fuel Spillage; Rollover* stipulates the following:

> Fuel spillage in any rollover test, from the outset of rotational motion, shall not exceed a total of 142 g for the first five minutes of testing at each successive 90-degree increment. For the remaining test period, at each increment of 90-degree fuel spillage during any 1 minute interval shall not exceed 28 g.

No comparable test requirements are required on the fuel systems of U.S. commercial vehicles.

The National Transportation Safety Board, which investigates certain significant vehicle collisions recommended in one of its findings where a vehicle fire was involved, that NHTSA "extend its proposed rulemaking on motor vehicle safety standards, relating to the integrity of automobile fuel tanks in vehicle crashes, to include standards for the fuel retention integrity of all components of the fuel system which are subject to damage and subsequent spillage of fuel," and that NHTSA "extend its proposed rulemaking on motor vehicle safety standards to include performance standards for all electrical circuits and components (through design, placement, protective covering or devices, etc.) to minimize the risk of undesired ignition of spilled automotive fuels in a vehicle crash or upset."

In contrast to the Unites States, the European Community does not differentiate between fuel systems pertaining to heavy trucks and smaller vehicles. Nevertheless, the specifications governing liquid fuel tanks for motor vehicles are quite specific (*Document 300L0008; Chapter 13.30.10—Motor Vehicles).* Pertinent specifications include the following:

- Liquid fuel tanks must be "corrosion-resistant."
- Suitable devices (e.g., vents or safety valves) may compensate for excess pressure in the tank.

- The vents must be designed to "prevent. . . fire risk." For instance, fuel that leaks when a tank is being filled must not be able to fall on the exhaust system.
- The tank must not be located in—or in any way form a part of—the "occupant compartment."
- Tanks must be installed on the vehicle in a manner such that it will be protected from the consequences of an impact to the front or rear of the vehicle. There shall be "no protruding parts, sharp edges, etc., near the tank."
- The fuel tank and filler neck are to be designed to avoid accumulation of static electricity charges on their entire surface.
- Tanks may be constructed of metallic or plastic material, although the latter must be subjected to a series of rigorous tests (see below).

Fuel tanks and their component parts must all be subjected to a series of tests. These include a (1) leakage test, (2) hydraulic internal pressure test, and (3) overturn test. Additionally, tanks made of plastic materials must be further tested for (1) impact resistance, (2) mechanical strength, (3) fuel permeability, (4) resistance to fuel, and (5) resistance to fire. During the fire test, the tank, when exposed to fire for two minutes, must not leak any fuel.

The Federal Motor Carrier Safety Administration has stated that it will strengthen federal commercial vehicle equipment and operating standards as part of its ongoing "Safety Action Plan." For example, in recent years, federal regulatory actions were taken to require: antilock brake systems on large trucks and buses (1998); rear impact or underride guards on trucks with a gross vehicle weight rating of 10,000 pounds or more (1999); the use of retroreflective tape or reflex reflectors to increase the visibility of commercial motor vehicle trailers (1999); changes to the current hours-of-service (HOS) regulations (2000); and revisions to broaden the scope of the Motor Carrier Safety Administration Program by requiring participating states to assume greater responsibility for improving motor carrier safety (2000).

As part of this study, we examined pertinent federal regulatory changes made at the federal level since 2000. Descriptions of these changes, none of which relate directly to fire safety, are described below

Hours-of-Service Regulations. Reform of the HOS regulations has been under consideration by the Federal Motor Carrier Safety Administration (FMCSA) for several years. In 1995, Congress, concerned about the effect of fatigue as a contributing factor in commercial motor vehicle crashes, directed the FMCSA to begin a rulemaking to increase driver alertness and reduce fatigue-related incidents.

In response to the congressional directive, FMCSA analyzed the scientific research, convened expert panels, held hearings and roundtable discussions, and reviewed over 53,000 individual comments submitted during the rulemaking process. In April 2003, FMCSA issued the first significant revision to the HOS regulations in over 60 years. The new regulations provide an increased opportunity for drivers to obtain necessary rest and restorative sleep, and at the same time reflect operational realities of motor carrier transportation.

Specifically, the rule increases required time off duty from 8 to 10 consecutive hours, prohibits driving after the end of the 14th hour after the driver began work, allows an increase in driving time from 10 to 11 hours, and allows drivers to restart the 60- or 70-hour clock after taking 34 hours off duty. Together, these provisions are expected to reduce the effect of cumulative fatigue and prevent many of the accidents and fatalities to which fatigue is a contributing factor.

Commercial Driver's License with a Hazardous Materials Endorsement. In May 2003, the FMCSA issued an interim final rule that amends the Federal Motor Carrier Safety Regulations to prohibit states from issuing, renewing, transferring, or upgrading a commercial driver's license with a hazardous materials endorsement unless the Transportation Security Administration has first conducted a background records check of the applicant and determined that the applicant does not pose a security risk warranting denial of the hazardous materials endorsement. This interim final rule implements certain provisions in the USA Patriot Act dealing with explosives.

Graduated Commercial Driver's Licensing. The FMCSA is exploring whether a graduated commercial driver's licensing concept can be adapted to commercial motor vehicle drivers. The FMCSA is inviting comments responding to a series of questions concerning the need for and potential benefits and costs of implementing such a graduated licensing system. The Transportation Equity Act for the 21st Century (TEA-21) requires this action. A graduated driver's license is a system designed to ease beginning drivers into the traffic environment under controlled exposure to progressively more difficult driving experiences. A graduated or provisional licensing system helps novice drivers improve their driving skills and helps them acquire on-the-road experience under less risky conditions by progressing, or graduating, through driver licensing stages before unrestricted licensure. The deadline to submit comments and responses to the questionnaire is May 27, 2003.

Performance-Based Brake Testers. In August 2002, the FMCSA published amendments to the Federal Motor Carriers Safety Regulations to establish pass/fail criteria for use with performance-based brake testers (PBBT), which measure the braking performance of commercial motor vehicles. The FMCSA began this rulemaking process in August 2000; this final rule is effective as of February 5, 2003. A PBBT is a device that can assess vehicle braking capability through quantitative

measure of individual wheel brake forces or overall vehicle brake performance in a controlled test. The specific types of PBBTs addressed in this rule are the roller dynamometer, breakaway torque tester, and flat-plate tester. Only these PBBTs that meet certain functional specifications, developed by FMCSA, can be used to enforce the FMCSRs. The rule allows motor carriers and state and local enforcement officials to use PBBTs to determine compliance with the commercial motor vehicle braking performance requirements as specified in 49 CFR Part 393. Part 393 sets braking requirements based on minimum braking force as a percentage of actual gross vehicle weight, minimum deceleration, and maximum stopping distance, respectively, all from a vehicle speed of 20 mph. For service brake systems all three requirements must be met to achieve compliance with the regulation.

Inspections prior to this involved visual, "hand-on" examination of brake system components to identify unsafe vehicles, based on guidelines developed by the Commercial Vehicle Safety Alliance (CVSA). While successful and productive, this method had limitations, such as the number of vehicles that can be inspected on a given day. PBBTs, on the other hand, have the advantage of being able to measure actual vehicle braking performance as well as the potential for increased commercial motor vehicle volume during roadside inspections.

Certification of Safety Auditors, Safety Investigators, and Safety Inspectors. The FMCSA amended the Federal Motor Carrier Safety Regulations in 2002 in response to Section 211 of the Motor Carrier Safety Improvement Act of 1999 (MCSIA), which requires that a certified motor carrier safety auditor perform any safety audit or compliance review conducted after December 31, 2002. This rule establishes procedures to train, certify, and maintain certification for safety auditors and investigators. In addition, it requires certification for state and local government Motor Carrier Safety Assistance Program (MCSAP) employees performing driver/vehicle roadside inspections.

C. Technology Advancements

Truck-safety related research done for PENNDOT in 2002 also cited the potential of technologies currently on the market that could be modified for use by the commercial truck industry to reduce the occurrence of fires. These innovations come from auto racing and the heavy equipment industry. Researchers also cite the airline safety industry as a possible source for additional fire prevention techniques.

The first of these regards the fuel tanks themselves. Auto racing currently employs a specialized fuel cell technology, consisting of a form-filled, rubber-lined, closed fuel cell that minimizes gasoline spills in a collision. A typical fuel cell has a capacity of 22 gallons. The fuel cell is located in roughly the same position as a passenger car but it is secured with four braces to prevent movement in a collision.

Race cars also have check valves on the fuel cell to prevent fuel from leaking during a rollover incident.

Another potential advancement is from the construction and specialty equipment industry. Large off-road vehicles such as excavators, shovels, wheeled loaders, and tunnel boring machines have on-vehicle fire suppression systems (dry and liquid). For these large vehicles, it is necessary to have these systems because they have hundreds of feet of pressurized hydraulic lines carrying hundreds of gallons of potentially flammable fluid. An on-board detection system detects the problem and then an alarm sounds, systems are shut down and the fire suppression agent is discharged to the protected portions of the vehicle. A potential application for large trucks (and other vehicles) could be to suppress fire in high risk or critical areas such as in or around the battery box and the passenger compartment. One industry group has recommended that the batteries be protected by moving them to a more secure location on the truck or by bolting a cage around them to ensure that they are not damaged in a collision.

V. Appendices

APPENDIX A

Detailed Listing of Primary Contributing Factors Reported for Large Truck Crashes Involving Fires

(CY 1991-2000)

Contributing Factors	Number of Crashes
Engine Failure	485
Other Contributing Factor	117
Mechanical Problems Other Than Engine Failure	
Total Brake Failure	26
Other Tire or Wheel Problems	23
Other Type Brake Failure	19
Blow Out - Sudden Failure	15
Wheel Problems (Failures)	7
Transmission Problem	6
Suspension System Failure	5
Exhaust System Failure	4
Brakes Grabbed, Locked Permanently, etc.	3
Total Steering System Failure	3
Modified Suspension System	1
Other Lighting Problems	1
Subtotal - Mechanical Problems Other Than Engine Failure	113
Improper/Illegal Driver-Related Actions	
Driving on Wrong Side of Roadway	49
Failure to Heed Stopped Vehicle	14
Illegal Stopped on Highway	5
Proceeded Without Clearance	5
Did Not Stop for Unknown Reasons	4
Driving in Two Lanes (Same Direction)	4
Careless or Illegal Backing on Roadway	3
Over/Under Compensation at Curve	3
Illegal/Careless Turning	2
Improper Towing	2
Making an Improper Exit From Highway	2
Illegal/Careless Right Turn on Red	1
Turned From Wrong Lane or Position	1
Driving Too Close to the Center Line	1
Hit and Run	1
Did Not/Could Not Stop for Other Reasons	1
Driving the Wrong Way on a One Way Street	1
Subtotal - Improper/Illegal Driver-Related Actions	99

Appendix A (Continued)

Contributing Factors	Number of Crashes
Improper/Careless Driver-Related Behavior	
Tailgating	31
Driver Lost Control	15
Careless Lane Change	11
Making an Improper Entrance to Highway	8
Careless Passing	7
Sudden Slowing or Stopping	4
Other Improper Driving Techniques	1
Improper or No Signals While Turning	1
Careless Parking or Unparking	1
Delayed Braking Response/Pumping Required	1
Driver Inexperienced in General	1
Assumed Vehicle Would Fit Under Overpass	1
Other Sudden Entrance	1
Improper Use of Lights	1
Other Driving Factors	1
Subtotal - Improper/Careless Driver-Related Behavior	85
Speed Related	
Over Posted Speed Limit	23
Too Fast for Conditions - Combination of Road Design, Traffic, Weather	8
Too Fast for Conditions - Inclement Weather	8
Too Fast for Conditions - Traffic, Pedestrians, etc.	6
Speed Related – Other	3
Too Fast for Conditions - Road Design	3
Subtotal - Speed Related	51
Driver Health/Drowsiness/Fatigue Problems	
Drowsiness, Sleep, Fatigue	17
Blackout	1
Seizure, Epilespy, etc.	1
Subtotal - Driver Health/Drowsiness/Fatigue Problems	19
Unknown Contributing Factor (Sole Cause)	18
Driver Drinking (Charged or Indicated)	15
Failure to Heed or Obey a Traffic Control Device	
Ran Red Light for Unknown Reasons	3
Ran Red Light - Did Not See Change to Red	3
Failure to Respond to Railroad Crossing Control	2
Failure to Respond to Other/Unknown Traffic Control Device	2
Ran Red Light for Other Reasons	1
Ran Red Light - Did Not See the Signal	1
Failure to Respond to Flashing Signal	1
Subtotal - Failure to Heed or Obey a Traffic Control Device	13

Appendix A (Continued)

Contributing Factors	Number of Crashes
Act of Nature	
Slippery Pavement	4
Weather	2
Deer	2
Obstacle on Roadway	2
Wind	1
Subtotal - Act of Nature	11
Vehicle Load-Related Problems	
Unsecured or Shifting Load	7
Overloaded	2
Subtotal - Vehicle Load-Related Problems	9
Driver Distracted	
Inside Distraction - Event in Car	3
Other Distraction (Daydreaming, etc.)	2
On Road Distraction	1
Subtotal - Driver Distracted	6
Reacting to Obstacle on the Roadway	
Reacting to Other Obstacle on the Roadway	1
Reacting to Rock on Roadway	1
Subtotal - Reacting to Obstacle on the Roadway	2
Sudden Roadway Surface Condition Change	2
Grand Total	**1,045**

Source: Developed by LB&FC staff using information from the Pennsylvania Accident Record System (PARS).

APPENDIX B

Number of Large Trucks Involved in Crashes With Fire in PA (Fatal, Injury, and Non-Injury)

(Calendar Years 1991-2000)

Calendar Year	Truck Crashes by Year	Number of Large Trucks Involved				Large Truck Crash w/Fire Involvement Rate[1]
		Total	In Fatal Crashes	In Injury Crashes	In Non-injury Crashes	
1991	96	102	14	22	66	1.20
1992	88	93	15	19	59	1.09
1993	88	99	16	24	59	1.14
1994	103	114	23	21	70	1.27
1995	98	105	17	19	69	1.13
1996	121	131	14	26	91	1.33
1997	115	125	22	22	81	1.25
1998	100	108	17	21	70	1.05
1999	110	124	26	21	77	1.17
2000	126	131	17	20	94	1.23
Total	1,045	1,132	181	215	736	

[1]The figures in this column represent the numbers of large trucks involved in crashes with fires per 100 million vehicle miles traveled. In CY 2000, large trucks traveled more than 10.65 billion miles in Pennsylvania.

Source: Developed by LB&FC staff using information provided by PENNDOT from the Pennsylvania Accident Record System (PARS).

APPENDIX C

Total Number of Motor Vehicle Crashes on Pennsylvania Highways and Associated Fatalities and Injuries*

(CY 1991 Through CY 2000)

Year	Number of Crashes	Number of Fatalities	Number of Injuries
1991	130,756	1,661	130,845
1992	134,208	1,545	133,479
1993	134,524	1,530	131,730
1994	134,319	1,440	130,840
1995	136,927	1,480	133,278
1996	143,081	1,470	137,141
1997	144,547	1,562	139,347
1998	141,427	1,486	134,559
1999	145,044	1,549	134,650
2000	147,467	1,520	131,697
Total	1,392,300	15,243	1,337,566

*Includes all motor vehicle crashes, including crashes involving large trucks.

Source: Developed by LB&FC staff using information provided by PENNDOT from the Pennsylvania Accident Record System (PARS).

APPENDIX D

Target Dates for Objectives Contained in Pennsylvania's Unified Truck Safety Strategy

Objective	Target Implementation Date
Enforcement of Traffic Laws	
Deploy advanced enforcement techniques and technologies to reduce crashes	March 2003
Develop/refine procedures to identify highway corridors for enhanced enforcement	December 2002
Enhance police officer training to improve enforcement of moving violations directly related to truck involved crashes	June 2003
Establish focused program for judicial education about moving violations and their impact on safety	September 2003
Identify key legislative changes for improved enforcement and reduction of moving violations	December 2002
Improve Behavior of All Drivers	
Improve driver awareness of truck operating characteristics with emphasis on defensive driving around trucks	December 2002
Determine effective methods for educating all drivers about the causes of truck involved crashes	March 2003
Update the Driver's Manual and test to include more information on safe truck-car interaction	June 2004
Highway Safety Improvements	
Continue ongoing deployment of cost effective reliable safety improvements in areas of high risk and frequent occurrences	No Target Date
Develop comprehensive construction work zone strategy directly related to crash reduction.	December 2002
Conduct a comprehensive study on how to improve rest areas to relieve driver fatigue	December 2003
Develop plan to reduce secondary crashes at incident locations through better unified incident command	July 2003
Education of Truck Drivers	
Develop carrier-based programs to educate, train and test truck drivers on defensive driving	June 2003
Develop and implement a carrier and operator program to provide different training/education for new vs old drivers	December 2003
Establish process to ensure commercial truck driving schools meet specific regulations and requirements	June 2004
Require successful completion of written knowledge test prior to receiving a CDL permit	December 2002
Pursue legislation to require minimum time period of 30 days between issuance of CDL permit and taking of skill test	No Target Date
Implement provisions of MCSIA of 1999 within Federal timelines	No Target Date

Appendix D (Continued)

Objective	Target Implementation Date
Commercial Vehicle Enforcement	
Implement ongoing safety audit program for motor carriers	October 2002
Develop process to identify unsafe intrastate carriers for compliance reviews and follow-up enforcement	July 2003
Develop a process which will take corrective action against repeat offenders of safety regulations	December 2003
Continue to provide more roadside inspection sites on designated highways	No Target Date
Implement roadside safety screening process	March 2004
Develop means to publicize inspection findings and trends to industry	December 2002
Provide ongoing training and supervision for inspectors to ensure uniformity and consistency	No Target Date
Evaluate feasibility of conducting safety inspections in conjunction with traffic stops by PSP	October 2003
Increase the number of MCSAP inspections with focus on driver	No Target Date
Continue to work aggressively with FMCSA on improving and implementing national policies, regulations and statutes	No Target Date
Study the benefits of consolidating commercial vehicle enforcement activities	No Target Date
Focused use of New Technology	
Continue to establish highway safety corridors and implement ready to use highway technology on them	No Target Date
Begin use of advanced driver warning alert devices in work zones	Target: (On at least one interstate/expressway by 2002 construction season April-November)
Continue to utilize and promote expansion of ITS communication devices	No Target Date
Evaluate feasibility of providing incentives for installation of equipment that improves driver and vehicle performance	December 2002
Motor Carrier Best Practices	
Determine effectiveness of industry best practices that have lead to reductions in truck involved crashes	No Target Date
Identify best practices that will improve truck safety in PA	December 2003
Disseminate best practices to identified carriers and promote their use through Improving Driver Behavior program	No Target Date
Implement secure on-line internet capability for motor carriers to access drivers' records	December 2004
Complete a feasibility study on providing automatic motor carrier notification for moving violation convictions of their drivers	December 2003

Source: *Pennsylvania Unified Truck Safety Strategy.*

APPENDIX E

Supplemental Information on Two Recent Large Truck Crashes Involving Fire on the Pennsylvania Turnpike

Crash A. On February 6, 2003, at 19:37 hours, a call was received from a passing motorist at Milepost 256.2 westbound, advising that the brakes of a tractor-trailer were on fire. The driver was not aware of the situation. The tractor was detached from the trailer, which was well involved. The trailer was hauling pesticides and other materials. The fire was extinguished and the roadway was finally opened on February 7, 2003, at 12:02 hours. Additionally, several area residents were evacuated due to the fumes from the fire.

Crash B. On April 5, 2003, at 10:53 hours, a call was received advising a vehicle was pinned against a wall and was on fire with possible entrapment. A second call was received at 10:58 hours advising a tractor-trailer was fully engulfed in the fire. There were a total of 20 vehicles involved with 26 injuries and 4 fatalities. This accident was the result of severe fog in the area of Milepost 166 eastbound and is still under investigation. The roadway was closed for a total of 12 hours.

Pennsylvania Turnpike Commission Comments Regarding Crash B and Efforts to Address Fog Problems. Prior to the incident at Milepost 166, the Pennsylvania Turnpike Commission had issued a bid request for the furnishing and installation of a completely functional Highway Advisory Radio Sign System (HAR), Closed Circuit Television (CCTV), Variable Message Sign System (VMS), Roadway Weather Information System (RWIS), Traffic Flow Detection System (TFDS), and Truck Rollover Warning System (TRWS), on August 28, 2002, with a bid awarded to Carr and Duff in the amount of $2,984,976.00, on October 1, 2002. This contract covers the area from just west of the Allegheny Valley Interchange to east of the Breezewood Interchange, along with the area near Hickory Run (Pocono). A notice to proceed was granted on November 13, 2002, with the system to be operational by October 15, 2003. Following the operational date, there will be a 60-day operational test and the final completion will be February 15, 2004.

The Pennsylvania Turnpike Commission is currently utilizing the existing ATIS equipment and a system of portable Variable Message Signs along with increased roadway patrols consisting of Maintenance and Pennsylvania State Police to inform customers of fog conditions in this area. This system will be in place until the above-described permanent system is implemented.

These devices will provide motorists with advance information concerning roadway conditions and visibility to better prepare motorists for the existing or changing roadway conditions.

The Pennsylvania Turnpike Commission is currently conducting a study for additional ways to deal with fog issues.

Source: Pennsylvania Turnpike Commission.

APPENDIX F

Pending State Legislation Relating to Truck Safety

(As of June 19, 2003)

Senate Bill 519: Limits the speed limit on the Turnpike to 60 miles per hour for trucks having a registered gross weight of more than 26,000 pounds.

Senate Bill 520: Sets a fine of $100 for drivers of motor carrier or maxi-cube vehicles for following too closely to other vehicles and for driving too fast for conditions; doubles the fines for exceeding the maximum speed limit.

Senate Bill 583: Provides that PENNDOT's motor carrier enforcement vehicles may be equipped with revolving or flashing red lights. Also House Bill 363.

House Bill 29: Requires every construction truck to be equipped with an audible warning device that will sound when the vehicle is placed in reverse.

House Bill 1092: Requires PENNDOT's Deputy Secretary for Highway Administration to conduct a continuing study of means to prevent accidents and injuries on the highways. (This is currently the responsibility of the Deputy Secretary for Safety Administration.)

Source: Developed by LB&FC staff from a review of proposed legislation.

APPENDIX G

Key Work Zone and Highway Safety Provisions of Act 2002-229

- Sets felony penalties and a one-year license suspension for drivers who "recklessly or with gross negligence" kill or seriously injure a road worker in a construction zone (penalty for serious bodily injury would be a second degree felony carrying a mandatory minimum jail term of nine months and a mandatory minimum fine of $2,500; penalty for death would be a second degree felony with a mandatory minimum jail term of 16 months and a mandatory minimum fine of $5,000);
- requires white strobe or similar illuminated devices to be erected at the beginning of all active work zones (where workers are on the road, berm, or shoulder);
- requires motorists to use headlights in work zones, regardless of the time of day;
- gives PENNDOT broader authority to regulate work zones and assess penalties on contractors who fail to comply;
- requires PENNDOT to refuse registration to any motor carrier vehicle that does not provide proof of a valid certificate of inspection; owners of motor carrier vehicles would have to self-certify that the vehicle has a valid certificate of inspection before being issued a registration;
- requires PENNDOT to suspend the registration of a motor carrier vehicle for three months if it determines that the vehicle did not carry a valid inspection certificate at the time of registration;
- requires that a motor carrier vehicle, bus, or school bus be placed out-of-service and issued a fine in the range of $100 to $500 for operating without a valid certificate of inspection;
- establishes a fine of double the registration fee for the maximum weight at which a motor carrier vehicle could have been registered for persons convicted of operating a motor carrier vehicle without valid registration;
- defines motor carrier vehicle as a truck, truck tractor, or combination having a gross vehicle weight rating of 17,001 pounds or more, and defines a motor carrier vehicle used in interstate commerce as weighing more than 10,001 pounds;
- requires PENNDOT, based on traffic and engineering investigations, to establish "highway safety corridors" along any highway that presents a safety hazard or concern for motorists;
- requires PENNDOT to post all highway safety corridors with appropriate signs and doubles fines for many moving violations in such corridors;
- establishes stringent fines (from $150 to $600) for motor carrier vehicles, buses, or school buses that have such major brake problems that an out-of-service order is issued;
- requires police to request that a driver of a motor carrier vehicle, bus, school bus, or hazardous waste transporter, which is involved in an accident, to undergo a drug and alcohol test; and
- requires the Department to suspend for 15 days the license of any driver convicted of driving more than 11 mph over the posted speed limit in a work zone.

Source: Developed by LB&FC legal staff from a review of Act 2002-229.

APPENDIX H

Department of Transportation's Response to This Report

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
HARRISBURG, PENNSYLVANIA 17101-1900

OFFICE OF
SECRETARY OF TRANSPORTATION

June 27, 2003

Mr. Philip R. Durgin, Executive Director
Legislative Budget and Finance Committee
P.O. Box 8737
Harrisburg, PA 17105-8737

Dear Mr. Durgin:

Reference is made to your letter of June 20, 2003, which transmitted the draft report on your committee's review of large truck crashes involving fire on Pennsylvania's highways.

As requested, members of our department have reviewed the draft report and have advised me that we have no comments on the draft. The information presented in the report is accurate and we concur with the recommendations you have made.

As noted in your letter, this report is to be released at the June 30, 2003 meeting of the LB&FC. Mr. Dean Schreiber, Acting Chief Engineer, will be representing the department at that meeting.

We want to thank you for the opportunity to review the draft report prior to its release.

Sincerely,

Allen D. Biehler

Allen D. Biehler, P.E
Secretary of Transportation

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