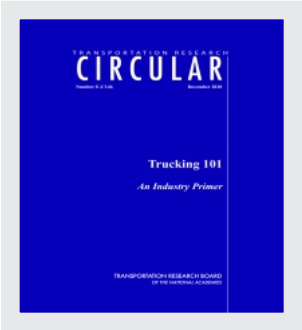

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Trucking 101

An Industry Primer

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Trucking 101

An Industry Primer

Stephen V. Burks
Michael Belzer
Quon Kwan
Stephanie Pratt
Sandra Shackelford

Sponsored by the
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500 Fifth Street, NW
Washington, DC 20001
www.TRB.org

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Preface

The beginnings of this primer date to the early days of TRB's Trucking Industry Research Committee. The members of what was then a task force in the process of applying for permanent committee status realized that, with the exception of those who participate in the trucking industry or specialize in studying it, few people understand the industry's most important basic facts. As a result, as early as 2006 they began to discuss creating a basic industry briefing document. In 2007, with status as a standing technical committee, the members voted to establish the Subcommittee on Trucking 101, whose goal was to carry forward the creation of such a document.

The document's authors are Stephen V. Burks, Michael Belzer, Quon Kwan, Stephanie Pratt, and Sandra Shackelford. It is intended to provide a basic picture of the structure of the U.S. trucking industry for public officials, policy makers, engineers, administrators, planners, academic researchers, journalists, and anyone who needs to think about issues affecting, or affected by, trucking. Committee members emphasize two important realities of the industry. First, many of the distinct parts of the trucking industry have different characteristics that are policy relevant, such as different operational conditions, different compensation practices, and different customers. Second, the effective use of various types of publicly available data on the industry requires some understanding of the strengths and weaknesses of each data source as well as knowledge of how different data sources link to or omit particular parts of the industry.

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The membership of the Subcommittee on Trucking 101 has included the following people:

Stephen V. Burks, Subcommittee Chair, *University of Minnesota, Morris*
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Chuck Rombro, *(formerly) Federal Motor Carrier Safety Administration*
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The authors also thank many other members and friends of the Trucking Industry Research Committee for their extensive work reading, reviewing, and commenting on numerous versions of the document and thus improving it.

The authors are responsible for any remaining errors. The views expressed in this publication are those of the authors and do not necessarily reflect the views of TRB, the National Research Council, or any of the institutions with which the authors and subcommittee members are affiliated. This document has not been subjected to the formal TRB peer review process.

—Michael H. Belzer, Chair
Trucking Industry Research Committee

Contents

Overview of the U.S. Trucking Industry

Trucking in the United States emerged from horse-drawn teaming in the last part of the nineteenth century.

BEGINNINGS

The large-scale use of trucks for military logistics in World War I (1914–1918) accelerated this transition by demonstrating the potential benefit of using motor-driven vehicles for freight transport. The deep economic turmoil of the Great Depression slowed the entire economy, however, and by 1935, motor freight carriage came under formal economic regulation, with the stated policy aim of "limiting destructive competition," both between trucking firms, and also between trucks and the railroads, which were then still the dominant mode of surface freight transportation. Economic regulation meant that under the supervision of the Interstate Commerce Commission (ICC), entry into trucking was restricted, and rates were set collectively.[1]

The depression ended with World War II, which was followed by sustained economic expansion. In the post-war era, and with the additional stimulation provided by the construction of the Interstate highway system beginning in 1957, trucking resumed the rapid growth it had exhibited before the Depression. Trucking enabled manufacturers, distributors, and customers to disengage themselves from rail lines and still obtain direct delivery service. In 1980, following an initial period of administrative deregulation, Congress passed the Motor Carrier Act that radically reduced economic regulation of the trucking industry. The dismantling of economic regulation produced a major wave of bankruptcies combined with a surge in the number of trucking operations, and a decline in the prices charged for most types of trucking.[2]

The number and the size distribution of the motor carrier population is one indicator of the vibrant nature of trucking today. In 1980 there were fewer than 20,000 for-hire carriers registered with the ICC. Today the primary motor carrier database, the Motor Carrier Management Information System (MCMIS) is maintained by the Federal Motor Carrier Safety Administration (FMCSA)[3], and it registered 152,000 for-hire motor carriers of freight in the same "authorized" category that were "recently active" as of 2007.[4] While there are several useful but different ways to count trucking operations, by any measure, there are a lot of them in the United States today.

The more than sevenfold increase in for-hire carriers from the end of economic regulation by the ICC gives an indication of how much trucking has grown since then. While some segments of trucking are home to very large firms, the same estimate showed 56% of all for-hire carriers have only one truck, and another 34% have between two and nine trucks.[4] The high proportion of small carriers indicates the lively competition that exists in most parts of trucking.

ROLE OF TRUCKING IN U.S. ECONOMY AND TRADE

The trucking industry (in the broad sense that includes private carriage, defined below) is central to the modern U.S. economy. As can be seen from the revenue levels by mode shown in Figure 1, the combination of local and intercity trucking dominates expenditure for freight

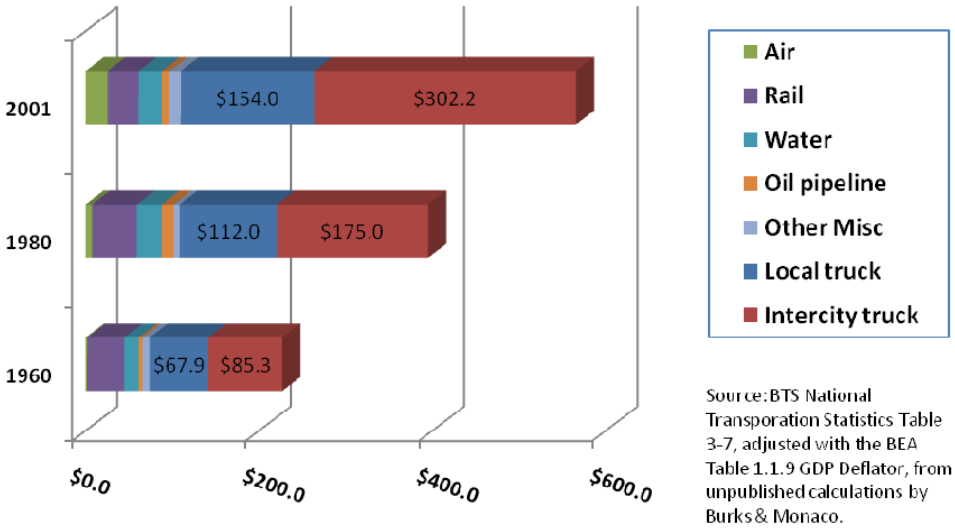

FIGURE 1 Real U.S. freight expenditures by mode, 1960–2001 (in billions of 2000 U.S$).

transportation services in the United States, and this dominance has grown over time. Already in 1980, the year Congress removed most economic regulation from the industry, *Transportation in America* estimated that the broad trucking industry earned about 71% ($162 billion) of the $213.7 billion spent on all modes of freight transportation in the United States.[5] By 2005, according to an estimate by the American Trucking Associations (ATA), the broad trucking industry had increased its revenue share to 84.3% ($622.9 billion) of the total of $739.1 billion spent on all modes of freight transportation in the United States.[6]

Trucking is an essential part of international trade, as well. When goods are imported from or exported to other countries, trucks are frequently used for all or part of the U.S. leg of the trip. When the freight moves between the United States and another continent, of course, a ship or an airplane may play an even more important role. However, the biggest use of trucks in international trade is in the land transport of goods between the United States and Mexico and Canada, its partners in the North American Free Trade Agreement (NAFTA). These countries are also the largest trading partners by dollar volume of the United States overall. The Bureau of Transportation Statistics (BTS) estimated that in 2006, trucks hauled 61% of the goods transported between the United States and Canada and Mexico by the value of the cargo, and these goods accounted for 26% of the tons of cargo moved between the United States and its NAFTA partners.[7]

TRUCKS AND THE HIGHWAY SYSTEM

There were 243 million vehicles registered in the United States in 2004, and those vehicles are estimated to have traveled 2.989 trillion miles during that year, or a bit more than 12,300 miles per

vehicle.[8] The vast majority of them are small vehicles with (only) four wheels, such as cars, SUVs, and pickup trucks. But the trucking industry, in its economically central function of moving much of the nation's freight, relies on the same highway network that passenger cars and other non-commercial vehicles use. In the same year, 8.2 million trucks with at least six wheels were registered in the United States, or 3.36% of the total motor vehicle count. Trucks of this size and larger are typically used more intensively than private cars. The BTS estimated that they ran 220.8 billion miles in 2004, which is about 7.45% of the total for all vehicles, or more than twice their share of the vehicle count.[9] If we include the business use of lighter trucks, the ATA estimates that trucks traveled 13.1% of all vehicle miles in 2004.[10]

However, motorists and policy makers usually are more concerned about heavier trucks, for both safety and pavement wear reasons. In 2004 the category of "combination trucks" contained 6.16 million vehicles, or 2.5% of the total vehicle count, and the BTS estimated that combination trucks traveled 142.4 billion miles, or about 4.8% of total vehicle miles (again, about twice their share of the vehicle count; Figure 2 shows the time trend for combination truck miles).[11] ATA estimated that the heaviest trucks (Class 8, which have a total weight, including cargo, of 33,000 lbs. or more) ran 117.8 billion miles, or about 3.9% of all vehicle miles, which implies an average of 43,000 miles per year per Class 8 truck.[12]

SAFETY AND SECURITY

Because truck safety has significant implications for both truck drivers and other motorists with whom they share the road, safety is a major consideration for the trucking industry. Congress established the Federal Motor Carrier Safety Administration (FMCSA) to improve motor carrier safety by reducing crashes, injuries, and deaths involving commercial motor vehicles (CMVs).

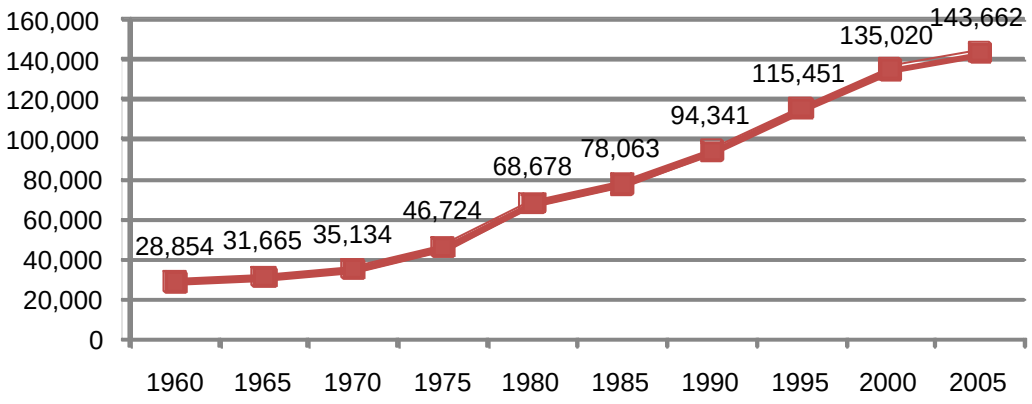

FIGURE 2 Millions of miles traveled by combination trucks, 1960–2005.

FMCSA's primary function is promulgating and enforcing safety regulations applicable to CMVs: the Federal Motor Carrier Safety Regulations (FMCSRs). It also sponsors research in support of its safety enforcement mission, and supports a number of nonregulatory safety initiatives related to new technology, safety management practices, and safe driving behaviors.

Despite large increases in the number of large trucks registered and the annual number of vehicle miles traveled (VMT), truck safety in the United States has improved in the past three decades. Figure 3 shows that after declining between the late 1970s and the early 1990s, the number of fatal large-truck crashes held fairly steady through 2005, varying between 4,200 and 4,600 annually. However, the rate of fatal crashes per 100 million VMT declined over the 30-year period, from a high of 5.2 in the late 1970s to about 2.0 since 2002.

The Transportation Security Administration (TSA) of the U.S. Department of Homeland Security oversees the security of hazardous materials (hazmat) shipments made by trucks, and sponsors the Trucking Security Program, which provides grants for the implementation of truck and trailer tracking systems and monitoring systems. It also issues the endorsement to the commercial driver's license (CDL) needed by each driver who will haul hazmat. The U. S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) is the federal safety authority for the transportation of hazmat by air, rail, highway, and water. The agency was created under the Norman Y. Mineta Research and Special Programs Improvement Act (P.L. 108-426) of 2004. Prior to the Act, the programs to ensure safety in both pipeline and hazardous materials transportation were a part of the Research and Special Programs Administration. PHMSA registers hazmat carriers and issues their special permits, reports on hazardous materials incidents, and takes penalty actions for noncompliance with hazardous materials handling regulations. It also issues the *Emergency Response Guidebook for First Responders*, and operates a Hazardous Materials Emergency Preparedness grants program.

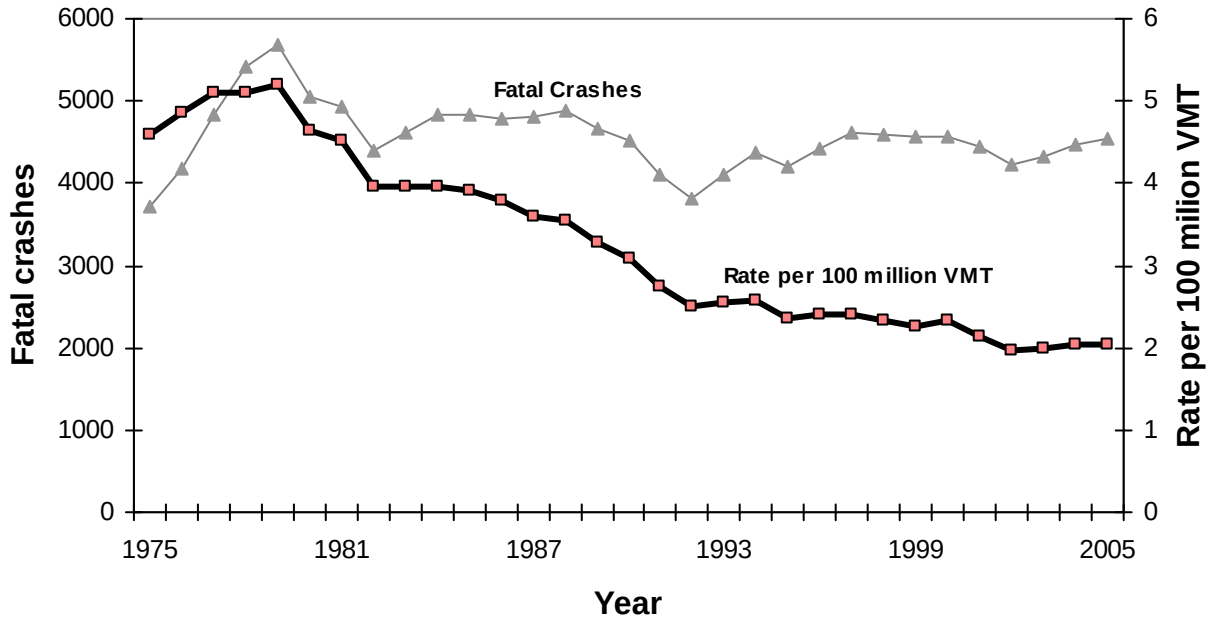

FIGURE 3 Fatal large truck crashes and crash rates, 1975–2005.

ISSUES AND TRENDS

Despite the downturn of the last 2 years, the secular trend is for the volume of goods transported to continue to increase in line with the long-run growth trend of the U.S. economy.[13] The increasing volume is positive for the industry but presents some challenges. First, road capacity shortages have become a concern for transportation officials and motor carriers. Roads are becoming more crowded, contributing to increased vehicular emissions and slower delivery times.

Second, the growth in congestion raises a longer-term issue of considerable importance: how much should the nation spend for maintenance and capacity expansion of highways and other highway-related transportation infrastructure, and how should it finance this spending? The potential for an underlying policy tension is created by the contrast between the huge share of the nation's freight that moves by truck and the modest share of trucks accounting for the nation's total vehicle miles—and the even more modest share of trucks making up the nation's total vehicle count.

The public depends on the vital economic functions of trucking, as consumers and as employees or self-employed businesspersons. But most of that dependence takes place in ways not obvious to those not directly involved. By the same token, the vast majority of adult U.S. citizens use a car for essential aspects of their daily lives, and as motorists they have a natural preference for the highway system—and highway investment—designed and maintained for their convenience when using their cars. In addition, the public must determine how much urban public transit it wants, and how to finance that investment.

Educational efforts by the trucking industry about its central economic role can address this tension to some extent. However, because the trucking industry has a vested financial interest in its own success, after a certain point the public has a natural skepticism about the degree to which the needs articulated by the industry represent the national interest. One important role of the Transportation Research Board generally, and the Committee on Trucking Industry Research more specifically, is to provide the kind of forum in which experts from the industry, government, and academia can discuss relevant issues, identify areas of existing agreement or in which research is needed, and assist in the educational process around infrastructure and related issues.

Although increasing levels of congestion are leading to rising emissions, trucks are becoming "greener" overall. The Environmental Protection Agency (EPA) expects that a combination of federal regulations requiring lower sulfur content in diesel fuel and cleaner engines will lead to overall sulfur emission reductions of 97% from the content level in 2000.[14] Biodiesel fuels, made from soybeans, vegetable oil, fats, and used cooking oil, are also being blended with standard diesel fuels to further reduce pollutants emitted from the operation of trucks.[15] Unlike ethanol produced from corn, the University of Minnesota estimates that the production of biodiesel from soybeans produces a substantial net energy gain. However, the full diversion of soybean production into biofuels would provide only approximately 6% of current needs, and food prices are likely to be affected at levels well below full diversion. So the long-term role of fuels such as biodiesel is as yet unclear.[16]

Major concerns in the trucking industry as of 2009 are the apparent long-term trend towards increasing fuel prices, a slow freight environment due to the economic recession that began in 2008, and how fast a recovery from recession and the downturn in freight is likely to be. Concerns about the supply of drivers have moderated significantly with the recession, but many analysts expect that labor supply issues will reemerge when growth resumes, especially in the truckload (TL) segment.

Counting Truckers Can Be Complicated

Counting trucking operations and judging the size of the trucking industry turns out to be a bit complicated. Because trucking is involved in the economy in many different ways, there are also several different ways trucking data are collected and presented, each of which has specific strengths and limitations. To understand even the most basic statistics about the industry, one must understand something about these differences.

DEFINING THE TRUCKING INDUSTRY: WHEN IS PRIVATE CARRIAGE INCLUDED?

Government statistics that involve measuring business activity by industry, such as the Economic Census produced every 5 years and the Economic Surveys produced annually, assign firms only to the industry in which their primary business lies, before tabulating any results. So, these surveys include only firms whose primary business is selling trucking services on the open market, or "for-hire carriers," as part of the trucking industry in this standard, but narrow, sense.

However, this way of talking about trucking leaves out all the trucks operated by many firms whose primary business is in other industries, but which run "in-house" trucking operations. The main purpose of such "private carriers" is to haul freight owned by the company that runs the trucking operation. A large-scale example is Wal-Mart, which does ship by for-hire carriers, but which also runs a large private carriage operation, handling much of the collection and distribution of goods to its retail stores in trucks that it owns and operates itself.[17] While private carriage operations are included in the FMCSA database of motor carriers, it is important to understand that they are not part of the "trucking industry" in the narrow meaning of the term that is used when statistical agencies as the Bureau of the Census or the Bureau of Labor Statistics provide data based on industry classifications or broken out by industry.

Leaving out private carriers leaves out a lot that is important about trucking. In 2005, Global Insight estimated that private carriers handled about 49% of the freight volume by weight (5,240 million tons out of a total of 10,690 million tons) hauled by all trucks, and their services cost about 45% of the total dollars spent ($280 million of a total of $623 million) on all trucking.[18] For-hire carriers hauled the remainder.

For many policy-relevant purposes, it is often important to take trucking as an industry in the broad sense, which joins private carriage together with for-hire carriage. Whatever the purpose, it is even more important *not* to confuse information about this broad version of the industry with data that only refer to the narrow version, which includes just the for-hire carriers. When people make reference to the trucking industry or to "trucking," industry insiders generally can tell which version of the term "industry" the commentator is talking about by the context in which is it used, but sometimes those new to the study of trucking are confused by the way those who write about the industry can switch meanings "on-the-fly," without explicitly saying so. The authors' intention is to be clear throughout this document about the appropriate definition at each point.

FOR-HIRE TRUCKING: WHAT ABOUT PARCEL CARRIERS?

Information from the Economic Census on the for-hire trucking industry can be difficult to interpret. Two of the largest for-hire trucking operations in the country are United Parcel Service (UPS) and Federal Express (FedEx). However, both firms are categorized by the Bureau of the Census as having their primary business in the air courier industry.[19] As a result, industry-based statistics about trucking do not include these two giants of the industry, nor do they include other smaller parcel carriers.[20] In contrast with the Economic Census and related data sources, MCMIS does include parcel carriers, as it includes all operators of commercial vehicles. However, MCMIS has little of the economic information about motor carriers that is the strength of the Economic Census.[21] Bottom line: it is important to remember which data on the "narrow" or for-hire trucking industry include the parcel carriers, and which data do not.

MCMIS VERSUS THE ECONOMIC CENSUS: WHAT IS A MOTOR CARRIER?

The following example illustrates the statistical hazards in counting truckers. Now that we are clear on the difference between private and for-hire carriage, and clear on the gap in some of the for-hire data caused by missing parcel firms, consider the following facts. First, data from MCMIS maintained by FMCSA shows that 152,000 for-hire carriers existed in 2007. By contrast, the quinquennial Economic Census, which statute requires and the U.S. Bureau of the Census intends to be a complete enumeration of all businesses, is expected to tally only about 124,000 for-hire firms in the same year when its data for this year are released.[22] Where does this rather large difference come from, and who is right?

The best answer is that the two data sets are constructed through different processes for different purposes, and to some extent they measure different things. Where we can try to compare directly what they say, each has different specific strengths and weaknesses. While the true number of distinct for-hire trucking businesses undoubtedly is somewhere between these two numbers, the Economic Census is probably a little on the low side, while the MCMIS is probably quite far on the high side.

While the Economic Census indeed is intended to be a complete enumeration of all the firms in the nation, the Bureau of the Census does not actually send out census forms to most of the very large number of firms that have fewer than 10 employees.[23] Instead, it uses existing administrative records from other agencies (which may include the MCMIS in the case of trucking), as the basis for an estimate. With high probability the Economic Census misses a significant number of owner–operator and small fleet trucking companies, and it puts parcel firms in a different industry from the rest of for-hire carriage. On the other hand, the MCMIS is a regulatory database, and the nature of the regulations, plus some very significant lags and gaps in updating the database when firms exit the industry, cause the database to contain many more registrants than the number of actually existing and actually competing trucking firms, even after all possible internal adjustments to the MCMIS count have been made.

The main strengths of the Economic Census—its detailed information about operation type, revenues, establishment counts, and employees—are offset by two weaknesses. First, statute protects the identity of individual firms, so users can derive only statistical results from it; and second, it only covers for-hire trucking, completely omitting private carriage, and it groups parcel firms in another industry where they cannot be identified separately.

The main strengths of MCMIS—its public-record-based identification of individual firms, its vehicle-type-used breakouts, and its unified coverage of private carriage with for-hire trucking—are offset by three weaknesses. First, its regulatory-registration-based definition of a carrier naturally causes the carrier count to be higher than the count of the number of competitors customers would observe; second, the data set contains many records that have out-of-date information or that should have been purged due to business exits; and third, the operational and economic information collected is significantly limited.

Four Ways to Categorize the Trucking Industry

Why Industry Segments Can Matter

To the typical motorist, one heavy truck looks much like another. But in fact, the broad trucking industry is composed of a number of distinct segments. Distinguishing these segments is important for both economic and policy reasons. Economically, segmentation of the industry is important because firms compete vigorously with other firms in their home segment, but competition is less sharp, and in some cases nonexistent, across segment boundaries. Industry segmentation is important in regard to policy questions because while the broad industry has a number of key issues in common, each segment also has particular features that generate specific policy questions and specific policy interests among that segment's stakeholders. For instance, the operations of firms in different segments can differ in ways that matter for understanding the firm's costs, and for predicting how those costs might change under different regulatory scenarios. A good example is the difference between for-hire firms based on the average size of the shipment they haul.

WHO OWNS THE FREIGHT? FOR-HIRE VERSUS PRIVATE CARRIER

This distinction is actually defined by a legal fact: whether the carrier owns the freight it is hauling (private carriage) or alternatively whether the carrier is moving freight that belongs to its transportation customer (for-hire carriage). Private carriers are "in-house" transportation functions operated by firms that primarily are engaged in nontransportation businesses, but which move the freight as an internal part of the supply chain or distribution process for their main business. In 2005, a study commissioned by ATA estimated that private carriers handled about 49% of the freight volume by weight (5,240 million tons out of a total of 10,690 million tons) hauled by all trucks, and their services cost about 45% of the total dollars spent ($280 million of a total of $623 million) on all trucking.[18] For-hire carriers haul the balance.

In Figure 4 we look at this breakout using late 2007 MCMIS data,[24] and we find that fewer than half (41%) of all registered motor carriers are for-hire (once the "exempt" and "regulated" categories[25] are combined), and that a significant group (8%) have both for-hire and private carriage registrations. A small number of miscellaneous types (1%) comprise the remainder of for-hire, while half of all carriers are private-only operations.

Trucking—and "teaming" before trucking—always has featured independent contracting and subcontracting. A small trucking company may consist simply of a single driver and a single truck, which he or she may own and drive. If the owner has registered for operating authority with the FMCSA, which requires creating a specific type of new record in the MCMIS, then the firm may solicit freight as a for-hire carrier directly from the shipping public. Some countries—such as Australia—do not require a motor carrier to have operating authority, so the barriers to individual entry are even lower. Regardless of the regulatory framework, the fact that an owner–operator books his own freight and operates on his own authority or company certification is one clear measure of true independence.

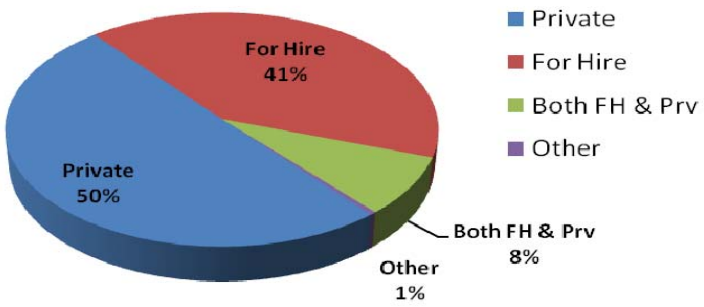

FIGURE 4 Types of motor carriers of freight from the MCMIS.

Owner–Drivers

Data collected by the University of Michigan Trucking Industry Program (UMTIP) in 1997–1998 showed that approximately 74% of all over-the-road drivers are employees. The remainder are owner–drivers, about 1% of whom consider themselves "employed" by motor carriers (most or all of these by unionized firms). Most of these owner–drivers operate under permanent contracts with motor carriers to which they lease their trucks and they receive load assignments either from the carrier to which they lease or by searching load boards for their own freight. According to this survey, however, only 15% of all owner–drivers have their own operating authority, and a substantial fraction of those possessing authority use it irregularly, if at all.[26] Those who have and use their own operating authority are true owner–operators and can safely be defined as independent contractors, while the former group act either as dependent contractors or employees, depending on the legal framework that governs them.

Owner–Operators

Owner–operators exist, in larger or smaller numbers, in most segments of trucking. A relatively large group is found in drayage operations. Drayage is the short-distance hauling of trailers or intermodal containers (loaded or unloaded) between a (*a*) rail head, seaport, or airport and (*b*) terminal, distribution center, manufacturing plant, or warehouse. An example in the news in 2007 and 2008 was that of drayage drivers at the Ports of Los Angeles and Long Beach, California. These ports handle a substantial fraction of all international container traffic from the Pacific rim, and the status of the owner–operator draymen, who in this setting tend to operate older vehicles, has been called into question as the ports have moved towards stricter standards for engine emissions.[27]

The term "owner–operator" has political significance that transcends its technical definition. Horse team drivers who owned their own horses helped to found the International Brotherhood of Teamsters, and owner–drivers have been an important part of the union since its founding (though not without controversy, because employee–drivers and owner–drivers always

have jousted over control). The term owner–operator connotes independence and the implications embedded in the concept led to a successful challenge to unionization of owner–driver steel-haulers who had decertified the Teamsters and attempted to certify their representation by the Fraternal Association of Steel Haulers (FASH) in 1970. In this case, the motor carrier that opposed the effort by FASH to represent former Teamster drivers argued that the law did not require the company to recognize a majority vote in favor of representation by FASH because the drivers actually were self-employed independent businessmen.

Careful analysis distinguishes between dependent and independent contractors. While an independent contractor operates under its own authority, locates its own freight, and manages its own financial and operational affairs, a dependent contractor operates under another motor carrier's authority, hauls that motor carrier's freight, and that motor carrier manages its affairs to a significant degree. Canada, for example, considers owner–drivers who subcontract themselves to motor carriers to be "dependent contractors," and the use of this designation made it possible for the Port of Vancouver to resolve a major conflict between these drivers and their employers, and the Port and the shippers that use the port. Historically, what prevailing U.S. federal court precedent now considers "independent businessmen" previously were considered employees who also lease their trucks to motor carriers. The bargain allows the carrier to operate without having to invest in its own rolling stock, yet ensures that the employee truck driver retain his status as a covered employee with the right to workers' compensation insurance, standardized company wages and benefits, and the right to collective bargaining, thus satisfying the overall purpose of the National Labor Relations Act.

More recently, local pickup-and-delivery drivers for FedEx have challenged their classification as "owner–operators."[28] A California court ruled in a declaratory judgment that these drivers actually are employees who own their own trucks and should properly be entitled to protection as employees.[29] The Internal Revenue Service (IRS) also has ruled that these truck drivers have been misclassified as owner–operators and ordered FedEx to pay $319 million in back taxes and penalties.[30] FedEx has appealed these rulings.

FREIGHT TYPE: GENERAL VERSUS SPECIALIZED

The second way to categorize motor carriers is by whether the freight requires specialized trailers. When a carrier can fit its freight into basic enclosed van trailers, it is a "general freight" or "general commodity" hauler, and when something more specific is required (for example, cargo tanks, dump bodies, refrigerated vans, flatbeds, or car transporters), it is a specialized freight or specialized commodity hauler.

Within the for-hire (or narrow) trucking industry, the Economic Census divides firms by this distinction. In 2002, 99,000 for-hire trucking firms (excluding couriers and private carriage) employed 1,435,000 people and generated $164.2 billion in revenues.[31] Although the firms were almost evenly divided between general (49.5%) and specialized (50.5%) freight haulers, general freight haulers dominated employment, with 989,000 (68.9%) workers to the 446,000 (31.1%) employed by specialized freight haulers.

The Annual Survey of Services provides updated revenue figures: in 2006 the total revenue of for-hire motor carriers was $219 billion. $146 billion (67%) was earned by general freight firms, while $73 billion (33%) went to specialized firms[32] (see Figure 5). The basic picture is an even split by firm count, but the general freight firms dominate employment and revenue.

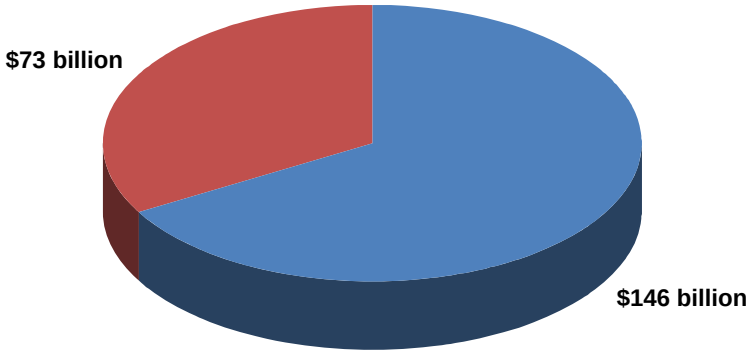

FIGURE 5 Specialized ($73 billion) versus general freight firms ($146 billion), 2006.

GEOGRAPHIC SCOPE: SINGLE METROPOLITAN AREA VERSUS INTERCITY

The third way motor carriers can be categorized is geographical. Is the operation essentially local and confined to one metropolitan area, or does it move freight between cities? No clear way exists with which to measure the importance of this difference for private carriers,[33] but within the narrow, or for-hire, trucking industry (excluding couriers and parcel carriers), the Economic Census makes this distinction within the category of general freight. In 2002, the census captured almost 50,000 for-hire general commodity trucking firms, and 59% were long distance, while 41% were local. These firms employed 989,000 workers, of which 815,000 (82%) worked for long-distance firms, with 174,000 (18%) employees working for local firms.[31]

The Annual Survey of Services does not provide firm or employee counts, but it does provide revenue figures (see Figure 6). In 2007 the total annual revenue of for-hire trucking firms was $228.9 billion, of which $126.6 billion (67%) was from long-distance firms, and $58.8 billion (26%) from local firms (the balance of 7% was from household goods trucking, which is not broken out by geographic scope in the survey results). These data show basically that the firm count is evenly split, but the long distance firms have the lion's share of the revenue and employment.

AVERAGE SHIPMENT SIZE: BIG, MEDIUM, OR SMALL

Finally, motor carriers can be categorized by the average size of each shipment. Here we can divide shipments into three categories, from largest average shipment size to smallest.

Most of the statistics on the for-hire (narrow) trucking industry do not account separately for parcel carriers (such as UPS and FedEx), as explained above. Parcel firms handle small shipments, with weights from letter size up to 150 lbs, but with an average typically less than 50 lbs. Less-than-truckload (LTL) firms handle shipments ranging widely in size and weight but with an average weight typically around 1,000 lbs. The key thing that unites LTL and parcel

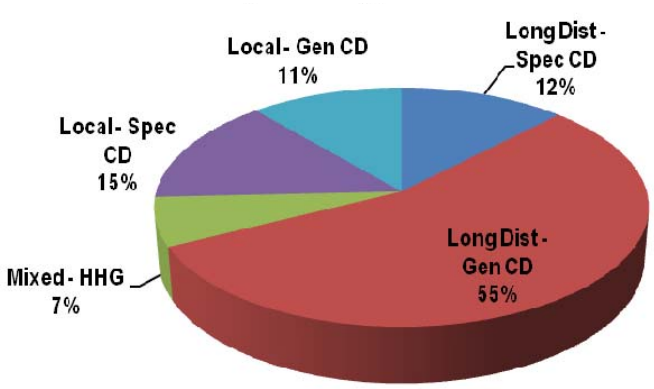

FIGURE 6 Revenue by distance and specialized versus general commodity.

firms that provide intercity service is that they need terminals in each city they serve, at which small shipments can be consolidated together into full trailer loads for over-the-road movement, and then be broken out again for local delivery upon arrival. Parcel and LTL firms generally have one group of drivers who do local pickup and delivery at each terminal, and a second group who move trailers between terminals over relatively fixed routes.

TL carriers operate primarily in point-to-point service, filling the truck up at a shipper's location, going wherever in the 48 states the load delivers to empty out, and then running empty to pick up a (preferably nearby) new load. The maximum payload of a standard 5-axle tractor trailer loaded to an 80,000 lb gross vehicle weight (GVW)[34] is about 48,000 lbs, but many kinds of less-dense freight fills up the trailer before reaching the weight limit, so average shipment weights typically range in the neighborhood of 20,000 to 35,000 lbs. A load reaching the maximum cubic capacity of a trailer before the weight limit is also reached is referred to as "cubing out."

Although private carriers handle shipments of different sizes, and some have specialized operations by shipment size, this distinction is most important among intercity for-hire firms, because the nonlocal for-hire marketplace pays firms to specialize their operations in one of these three segments. Within for-hire carriage, a key economic difference between the parcel and LTL firms on the one hand, and the TL firms on the other, is the nature of competition within each segment. All parts of trucking are generally quite competitive, but parcel and LTL have modest entry barriers: creating a terminal network and generating dense enough shipment flows over it to be cost-competitive creates sunk costs to entering this part of the business. By contrast, in TL there are essentially no entry barriers. As a consequence, LTL and parcel competition tend to be among established incumbents, while the TL segment experiences continual entry and exit, especially at the smaller firm sizes.

Among for-hire carriers (not including parcel and courier), the 2002 Economic Census breaks out LTL versus TL within the general freight category. Of 28,111 general freight firms, 23,198 (82.5%) were TL, employing 489,299 (61.2%) workers, while 4,989 (17.5%) were LTL,

employing 309,639 (38.8%) workers. According to the Annual Survey of Services, in 2006 $204.4 million in total freight transportation revenue (now including both general and specialized carriers), $153.9 (75.3%) was received for TL shipments, while $50.5 million (24.7%) was received for LTL shipments. So, the bottom line is that LTL is significantly smaller in firms and revenue than TL, but it is relatively more labor-intensive (as one would expect, given the freight handling of LTL firms).

Employment

Trucking employment may be viewed in two ways: by industry, which counts persons who work for a company in any kind of job in the trucking industry (narrowly construed to include just the "for-hire" motor carriers, as explained earlier), or by occupation, which counts persons who work as truck drivers, regardless of the industry in which they are employed and whether they are employees or considered self-employed. Both are examined here.

EMPLOYMENT SIZE AND CHARACTERISTICS

In 2006 there were an estimated 2,034,000 persons employed in the trucking industry, working at all kinds of jobs. This estimate looks at "industry" in the narrow sense defined earlier in the circular,[35] which basically includes only those firms whose primary business is providing trucking services to others, and leaves out all the firms that haul their own goods. Women made up 12.5% of industry employment. An estimated 13% of trucking industry employees was African American, and 14% were of Hispanic origin.[36]

The examination of data on truck drivers as an occupation, and then by industry within that occupation, provides a more complete picture of the diverse industries that employ truck drivers, because it includes all the drivers in private carriage, who work for firms that haul their own goods. Although the Occupational Employment Statistics (OES) Survey has one key limitation, in that it excludes self-employed workers such as owner–drivers, it is the only available source for national employment estimates by occupation and industry.[37]

The OES and other U.S. government surveys provide data on two different truck-driving occupations. The first of these, "Truck Drivers, Heavy and Tractor-Trailer,"[38] covers workers driving heavy freight vehicles and using a CDL. A second occupation, "Truck Drivers, Light and Delivery Services," covers operators of lighter vehicles, who generally do not require a CDL.[39,40] However, parcel service drivers, who pick up and deliver packages up to 150 pounds for UPS and FedEx, will fall within the latter truck driver category yet do not fall within the trucking industry even though they perform pickup and delivery work for what many in the industry consider to be trucking industry firms.

As Table 1 shows, the majority of the nearly 1.7 million heavy-truck drivers in the United States in 2006 (54.9%) were employed in the transportation industry, i.e., by motor carriers. The remaining 45% worked for private carriers, primarily in the wholesale trade, services, or manufacturing industry. In contrast, employment of light-truck drivers was distributed across a number of industries, with no single industry predominating. Transportation, wholesale trade, and retail trade each accounted for over 20% of employment in this occupation.

The detailed industries that employed the greatest numbers of heavy and tractor-trailer truck drivers in 2006 were General Freight Trucking (583,710); Specialized Freight Trucking (220,290); Cement and Concrete Product Manufacturing (78,210); Grocery and Related Product Wholesalers (61,220); and Other Specialty Trade Contractors (Construction) (47,570). The detailed industries that employed the greatest numbers of light and delivery services drivers in 2006 were Couriers (150,360); General Freight Trucking (40,650); Building Material and Supplies Dealers (38,820); Automotive Parts, Accessories, and Tire Stores (38,080); and Grocery and Related Product Wholesalers (37,580).

DRIVER SHORTAGES AND TURNOVER

The trucking industry faces two labor supply issues: high rates of driver turnover (or churning) in some segments of the industry, and a long-term demographic problem about where the truck drivers of the future will come from. The turnover problem primarily affects the TL segment of the industry, while the long-term demographic issue affects all segments.

The turnover issue in TL trucking is driven by the nature of competition in the industry. In point-to-point service like that offered in TL (whether long haul or drayage), small firms can directly compete with large ones for most services, and this industry segment has virtually no entry barriers. The nearly perfectly competitive structure of the industry creates stiff price competition and a labor cost ceiling. The archetypal TL driver spends long and irregular work hours and is gone long and irregular periods from home, while maneuvering a big rig through weather and congestion, and dealing with shipping and receiving personnel. Since ATA began keeping track of turnover rates by industry segment in the 1990s, the annualized turnover rate at large TL carriers did not drop under 100% per year until the last part of 2008, during the worst recession since the Great Depression, and the rate for smaller ones doesn't normally drop below 80% per year.[41]

TABLE 1 Employment Characteristics for Truck Driver Occupations, United States, 2006[42]

	Truck Drivers, Heavy and Tractor-Trailer	Truck Drivers, Light and Delivery Services
Total employed	1,673,950	941,590
Mean annual wage ($)	36,320	27,520
Mean hourly wage ($)	17.46	13.23
Industry		
Agriculture, forestry, fishing, and hunting	13,280 (0.8%)	1,240 (0.1%)[a]
Mining	26,790 (1.6%)	1,800 (0.2%)
Construction	110,290 (6.6%)	27,720 (2.9%)
Manufacturing	164,490 (9.8%)	66,600 (7.1%)
Wholesale trade	207,360 (12.4%)	195,930 (20.8%)
Retail trade	68,910 (4.1%)	210,490 (22.4%)
Transportation, warehousing, and utilities	917,680 (54.9%)	260,230 (27.6%)
Truck transportation	804,000	65,750
Services	141,740 (8.5%)	167,850 (17.8%)
Government	22,410 (1.3%)	9,720 (1.0%)

[a]Because of rounding, percentages in this column do not sum to 100.

The TL labor market has been in a "high turnover equilibrium" essentially since the TL segment emerged in its modern form after the economic deregulation of 1980.[43] Short-term fluctuations in the demand for drivers compared to the demand for other occupations with similar educational requirement (for example, semiskilled construction jobs) drives differences in relative pay, and exacerbates or improves the turnover rates in TL trucking. For instance, a consulting report by Global Insight commissioned by ATA in 2005 found that during the late 1990s the strong demand for drivers increased relative pay to about 7% above that in construction. However, for 2 or 3 years after 2000 the slowing of the economy slowed freight shipments and lessened demand for drivers, while a continuing construction boom increased demand in construction, which lowered relative pay to about 7% less than construction.[44]

The same report also addressed the long-run problem. Over half the current driver population is made up of white males 35–54, a group that will lose 3 million members over the next decade, as the growth rate of the labor force overall drops from 1.4% per year to .5% per year. Looking at all demographic groups that can potentially supply drivers, Global Insight estimated that the driver workforce would grow by 1.6% per year, but that demand would grow at 2.2% per year.[44] These demographic facts present a long-term challenge to the industry.

COMPENSATION APPROACHES

Many drivers, and most over-the-road drivers employed in the long-haul TL sector, are compensated on a per-mile basis rather than a per-hour basis; the technical term for this compensation structure is "piece work" and in trucking, the concept of piece work often extends to payment of a percentage of freight revenue, which is determined generally by a combination of market factors such as weight, distance, and commodity type. The UMTIP Truck Driver Survey found that 67% of all over-the-road drivers earn mileage-based pay and 87% of these drivers earn either mileage- or percentage-based compensation.[26] A driver compensation study completed by ATA revealed that 82% of all team drivers and 60% of all solo drivers are paid per mile.[45]

Many trucking companies are also exploring steps that improve the quality of life of long-haul drivers. The biggest detractors from job satisfaction in long-haul truck driving are that drivers often have very unpredictable schedules and are required to spend long periods of time away from home. Among TL firms, companies that are experiencing lower turnover rates are those that are able to provide drivers with predictable schedules and coordinate around the various obligations the drivers may have. Firms must balance the costs of scheduling drivers to return home more frequently with the costs of high turnover rates.

Industry Operating Characteristics by Segment

PRIVATE FLEETS

Description

Private fleets are operated by a wide range of manufacturers, distributors, retailers and other businesses to meet internal shipping needs. The capacity of a private fleet primarily serves the distribution requirements of the parent company, but many fleets also sell their unused backhaul capacity to generate additional revenue. In fact, the ATA reports that half (53%) of private fleets have for-hire authority,[46] although the MCMIS motor carrier database shows only about 14% with joint registrations (30,000 out of 212,000).[47] Long-distance private carriage tends to be primarily TL by shipment size, but short-range private carriage can also involve specialized local delivery work handling smaller shipments.

Sector Characteristics

In 2004, private shipments accounted for 48.3% of total truck tonnage moved. Revenues generated by the 4.75 billion tons of freight shipped totaled $293.9 billion, 43.8% of truck revenue. The value of these goods is estimated to be $2.3 trillion.[46] According to the 2007 MCMIS, there were 212,079 private fleets, of which about half had only one truck. Private carriers (including those with some variety of for-hire registration) made up 58% of all motor carriers reported in the "recently active" MCMIS registrations.[47]

Most (75%) private-fleet hauls are less than 500 miles, with an average haul distance of 71 miles. The predominance of short-haul deliveries helps the private sector avoid the high turnover rates experienced in other sectors. Drivers are able to work more regular schedules and return home frequently. As a result, the private-fleet sector experiences a driver turnover rate of 16%, compared to a rate of over 100% for the TL sector.[6]

Sector-Specific Issues

The National Private Truck Council recently conducted the 2006 Private Fleet Benchmarking Survey. Among other questions, respondents were asked to identify the most pressing internal and external issues for the private-fleet sector. Respondents identified driver-related issues as the most pressing issue, followed by fuel costs and customer demands.

Although driver turnover is not a major challenge for private fleets, identifying and employing safe, productive drivers is an ongoing process. Compared to the for-hire sector, private fleets have a 45% better safety record, according to ATA.[6] However, the trucking industry is committed to improving highway safety. To improve the quality of drivers, fleets have used a number of strategies including raising the age of drivers the company hires, limiting the number of moving violations a driver may have on record prior to employment and stricter drug test practices. On-board safety technologies may also help improve driver safety.

Rising fuel costs have a major impact on the entire trucking industry, and the private-carrier sector is no exception. Throughout 2006, prices steadily increased throughout the year. Fuel prices in 2008 increased steadily, reaching as much as $5.00 per gallon by mid-year, before falling back to about half this level with the onset of the economic recession.

Meeting customer demands is another challenge that the private-fleet sector faces. About two-thirds (65%) of fleets surveyed by the National Private Truck Council cited better service to key customers as a reason for operating a private fleet.[48]

Like all businesses, motor carriers must have insurance to protect their assets, and federal law requires each carrier to have at least $750,000 in coverage. In recent years, insurance rates have increased substantially. In 2003, ATA estimated insurance costs at approximately 7 cents per mile.[49] According to the Truck Insurance Survey that ATA conducted in 2002, many carriers' insurance costs increased as much as 45% over the preceding 2-year period.[50] Per million vehicle miles traveled, truck-related accident rates have been decreasing, but related pay-outs have been increasing. These costs are difficult to pass along to customers.[51]

The Single State Registration System (SSRS), administered by the states, requires that all for-hire motor carriers file evidence of liability insurance and pay a fee per vehicle for each state of operation. Under the SSRS, motor carriers selected the participating state in which they have residence, and that state collected and distributed fees to all the other states in which the carrier operated. The costs were substantial for the for-hire carriers, but the states were able to use the revenue to supplement their general funds and for other safety-related programs. To relieve some of the financial burden without removing this source of revenue, Congress expanded the pool of registrants required to participate in the system, including private carriers, and changed the name to the Unified Carrier Registration (UCR) Agreement. The states implemented the UCR in 2007 and 2008[52] and all interstate carriers must participate.[53]

TL CARRIERS

Description

TL carriers generally haul single shipments weighing between 10,000 and 48,000 pounds. The driver delivers the shipment directly to the consignee (recipient) and picks up another TL shipment to deliver. Because TL shipments are picked up from the shipper and delivered directly to the consignee, there is not a need for terminals, distribution centers or regularly scheduled routes for the truckload carrier to remain competitive.

TL carriers employ long-haul road drivers who make cross-country trips and may remain away from home for extended periods. The UMTIP Truck Driver Survey showed that the average long-haul road driver returned home only once every 3 weeks. Road drivers (whatever their trucking segment) generally are paid on a per-mile basis and drive a large number of miles each year, averaging 113,843 miles annually in 1997–1998.[26] TL drivers are the largest group of such drivers, and because of the customer-to-customer service across multiple customers typically provided by their employers, tend to have the most irregular routes and work-time patterns among all road drivers.

Sector Characteristics

In 2004, truckload shipments accounted for 50.3% of total truck tonnage moved. Revenues generated by the 4.95 billion tons of freight shipped totaled $312 billion, 46.5% of truck revenue.[46] The key economic fact to understand about the TL segment is that the barriers to entry are very low or nonexistent. This affects the nature of competition in the segment.

Sector-Specific Issues

Driver turnover and driver shortages are a major challenge for the TL sector. In 2005, ATA estimated that there was a current shortage of 20,000 long-haul drivers and that the shortage would increase to 111,000 by 2014. The industry is adopting a number of strategies to retain and attract new drivers. Several programs offer financial assistance for training new drivers and ATA launched a nationwide campaign in the summer of 2006, targeting recent military veterans, drivers over 50 and between the ages of 24 and 35, and English-speaking Hispanics.

Fuel costs have been one of the two leading concerns for the trucking industry. Historically, motor carrier operations have shown a strong sensitivity to fuel costs demonstrated through the correlation of trucking business failures and the price of fuel. The price of fuel reached as high as $5.00 per gallon in 2008, before falling to about half that level with the onset of recession at the end of 2008.

A shortage in asset capacity is another major challenge for the truckload industry due to increased demand for shipments, increasing urban congestion, fuel costs, a shortage of available drivers, and hours-of-service regulations. Although the recession has cut demand more sharply than capacity, during more normal economic times it is not unusual to have carriers and even shippers express frustration at being unable to find trucks and drivers to haul shipments.

Compliance with environmental regulations is another challenge faced by the TL sector. Environmental regulations impact trucking technology, equipment, fuel and operations. Trucking companies must comply with regulations controlling emissions, the type of fuel used, and idling times. Title II of the 1990 Clean Air Act imposed strict standards on vehicle emissions and fuel content. In 1999, EPA issued new standards for the amount of allowable sulfur in gasoline to be phased in from 2006 to 2009.[54] By 2009, the sulfur content in diesel fuels can be no more than 15 parts per million; the sulfur content limit was 500 parts per million in 2000.[55]

A related regulation involves the adoption of “greener” truck engines. Starting in 2007, the emissions standards for trucks became stricter. By using low-sulfur diesel fuel and high-efficiency exhaust emission control devices on diesel engines, EPA expects total sulfur emissions to decline by 97% from their 1999 levels. These regulations also reduce emissions of nitrogen oxides, hydrocarbons, and particulate matter.[56]

Many states also have strict regulations limiting the amount of time a truck can idle. Where restricted, the times range from 0 to 15 minutes and may provide exemptions allowing trucks to remain idle in adverse weather and traffic conditions.[57] Although good for the environment, idling regulations present challenges for long-haul drivers who use sleeper berths for their required off-duty hours because they often cannot use heating and air-conditioning without running the truck. Many carriers now equip their trucks with auxiliary power generation systems to provide heat and air conditioning for the drivers after they shut down the truck.

Several jurisdictions (Yellowstone National Park, the City of Seattle, the U.S. military, and the State of Minnesota) have also implemented regulations requiring trucks to use biodiesel fuel blends. The benefits of using biodiesel include reduced emissions of carbon monoxide, hydrocarbons, particulate matter, sulfates and nitrogen oxide.[58] These fuels can be made from soybeans, vegetable oil, animal fat, and used cooking oil blended with standard diesel fuel.[59] The University of Minnesota estimates that, unlike ethanol produced from corn, the production of biodiesel from soybeans produces a substantial net energy gain. However, the full diversion of soy bean production into biofuels would provide only approximately 6% of current needs, and food prices are likely to be affected at levels well below full diversion. So the long-term role of fuels such as biodiesel is as yet unclear.[16]

LTL CARRIERS

Description

LTL carriers aggregate smaller shipments from multiple shippers and transport goods to their final destinations by organizing and sometimes reorganizing shipments at terminals as the freight progresses to final destination. LTL shipments can range from 50 to 48,000 pounds in weight but generally weigh about 1,000 pounds on average. LTL carriers require a number of terminals because of their need to reorganize and consolidate shipments. LTL drivers generally earn their pay by the hour when working in city pick-up and delivery operations, and by a mileage rate, occasionally with supplemental hourly pay for particular tasks, when working over-the-road. While LTL carriers are more likely to be unionized than TL carriers (hourly employees of two of the largest LTL carriers belong to the International Brotherhood of Teamsters), nonunion carriers have grown faster since deregulation and hold the dominant share of revenue in the short-haul and interregional markets.

Sector Characteristics

In 2004, LTL shipments accounted for 1.4% of total truck tonnage moved. Revenues generated by the 138.5 million tons of freight shipped totaled $65.3 billion, 9.7% of truck revenue.[46] LTL shipments can consist of higher value goods but will cover the entire gambit of commodities. The key economic fact to understand about this segment is that building a viable terminal network, which has to be operated at a loss at first until density over the links in the network is sufficient to make costs competitive, creates sunk costs of entry. This affects the nature of competition in the segment.

Sector-Specific Issues

Rising fuel costs have a major impact on the entire trucking industry, including the LTL sector. The majority of LTL carriers employ a fuel surcharge mechanism that generally allows for recovery of increased fuel costs. Between 2005 and 2007, fuel prices increased steadily, with diesel reaching $5.00 per gallon in the middle of 2008, before dropping to about half that level at the end of the year.

Since deregulation, long-distance LTL shipments have grown approximately as fast as the economy, while shipments of shorter distance have grown more rapidly. This reflects two underlying trends. One is competitive encroachment on long-distance LTL by express trucking and air freight at the high-value/high-speed end, and at the lower value/lower-speed end by consolidators who build full truckloads of LTL shipments that they then can move between cities by TL carriers. The second is the tendency for shippers to move towards smaller and more frequent shipments over shorter distances, as part of the “logistics revolution” in how supplies and inventories are replenished. As a result, LTL firms that specialize in next-day and second-day delivery within distinct geographic regions have grown to dominate the industry, and many of these firms have grown or linked together to make short-haul LTL networks that cover the entire United States. This trend appears unlikely to halt, as fuel- and labor-cost trends appear to favor a continuation of higher growth in shipments over shorter distances.

PARCEL AND EXPRESS DELIVERY CARRIERS

Description

Package delivery firms, also commonly referred to as couriers or package express, pick up and deliver small packages to various locations such as businesses and private residences. Small courier firms may use motor vehicles or bicycles to deliver small packages in downtown big cities. UPS, FedEx, and the U.S. Postal Service do this on a national and international basis and may deliver packages as big as 150 pounds. Similarly to LTL carriers, couriers pick up packages and letters and deliver them to distribution centers where they are sorted and aggregated by final destination. While LTL carriers carry multiple shipments on their trucks weighing between 50 and 48,000 pounds, couriers generally carry thousands of smaller shipments at any one time.

Package delivery services have become an important part of American commerce. In 2006, package delivery motor carriers had the largest fleets and highest revenues.[60] There are several large couriers that dominate national small-package movements, but smaller companies also provide expedited service locally.

Sector Characteristics

At the national level the exit in 2008 of DHL/Deutschebundespost from the domestic parcel and courier business left only the three competitors mentioned above. This illustrates the fact that the barriers to entry at this large scale in this segment are very large. As with LTL, the essential barrier is the sunk costs of operating a terminal network at low density (and therefore high per-unit cost) until a shipment flow is generated sufficient to raise density and lower cost to a competitive level—a challenge DHL never managed to meet. Thus at large scale the competition in parcel delivery, while vigorous, is between three incumbents. However, at the local level (where only one or a very small number of terminals are required) entry barriers are low, and within most major metropolitan areas there is a thriving local community of small-parcel and courier firms.

Express Delivery Issues

Because such a large portion of couriers' business involves local deliveries, congestion presents special problems for these carriers. According to the Texas Transportation Institute, the congestion in urban areas is continuing to increase. In addition, the number of urban areas that are experiencing high levels of congestion is also increasing.[61] High levels of congestion result in time delays, increased fuel consumption, and possibly the need for additional drivers to satisfy delivery schedules. In consideration of the variability in fuel prices, couriers have only recently been able to recover the impact of fuel costs on business operations through fuel surcharges.

The nature of express delivery operations also involves a large number of frequent stops at various addresses. Drivers must understand the idling regulations in the localities they serve to avoid unnecessary fines and penalties. The American Transportation Research Institute (ATRI) maintains an online compendium of idling regulations that trucking companies can access and consult.

HAZARDOUS MATERIALS AND SPECIALIZED CARRIERS

Description

Specialized carriers transport goods which require equipment or operating procedures particular to the specific type of freight hauled, such as military materials, construction machinery, steel, oversize or overweight goods, and hazardous materials (hazmat). Many carriers transport specialized commodities in addition to more traditional truckload goods movement. The tank truck may be the most specialized type of carrier. Tank trucks—which come in liquid and dry formats—primarily haul bulk commodities such as petroleum products, food products, chemicals, and intermediate products such as paints, solvents, and cement. More than 70% of all tank trucks transport hazmat.[62]

Hazmat-Specific Issues

For a carrier to haul hazmat, the drivers and the equipment must adhere to strict regulatory requirements. Hazmat carriers must register with the DOT Pipeline and Hazardous Materials Safety Administration. In addition, the transportation of certain "highly hazardous materials" requires the motor carrier to obtain a Hazardous Materials Safety Permit. Violations of hazmat regulations may result in civil penalties ranging from fines of $275 to $100,000 per violation to criminal penalties including imprisonment.[63]

When hauling hazmat, the motor carrier must meet a number of requirements. The carrier must ensure that the cargo space is suitable for the material being transported and that the vehicle is functioning properly. Other responsibilities include the verification of the identity of the materials being transported, verification that incompatible hazmat are properly segregated, verification that the shipping papers are filled out properly, as well as placarding the vehicle (to publicly identify the contents), reporting hazmat incidents, and securing the shipment during transport. Hazmat drivers also must be trained to properly handle hazardous materials, and they must receive security training. Drivers who transport placarded quantities of hazmat must receive a special hazmat endorsement on their CDL.[63]

To transport hazmat, carriers also must develop and implement a security plan to enhance the security of the materials in transport. Before transporting hazmat, carriers must train the drivers and other carrier personnel to understand the security plan. Drivers also must notify the National Response Center when certain hazmat releases occur.

Specialized Transport–Specific Issues

Although hazmat transporters may be the most easily recognized specialized sector, other specialized fleets face other challenges, namely compliance with oversize and overweight shipment regulations. Vehicles may have a gross weight up to 80,000 pounds and must comply with various axle and bridge weight limits as well. To operate heavier vehicles, carriers must obtain a permit from the state in which the operation occurs (some states allow heavier vehicles to operate without special permits). The states may issue overweight permits for "nondivisible" loads—those that cannot be separated into smaller shipments without compromising the intended use, destroying the value, or requiring more than 8 work hours to disassemble.[64]

Similarly, federal regulations limit vehicles to 102 inches wide. States may issue permits to allow vehicles to haul wider shipments. The most common oversize shipment is manufactured housing.[64]

AGRICULTURAL AND FOOD TRANSPORT CARRIERS

Description

Agricultural commodities and food, inseparable from trucking, play a key role in the nation's livelihood and economy. According to the Government Accountability Office (GAO), the agriculture sector accounted for 13% of the U.S. GDP and 18% of domestic employment in 2003. The vast majority of agricultural and food products are shipped throughout the United States via the trucking industry. Agricultural production typically occurs in areas that are removed from the final market destinations. The distance between production and processing also can be great and requires a range of transportation services.[65]

Sector Characteristics

Agricultural and food transport includes the movement of farm inputs, raw agricultural commodities, products of preservation, and processed agricultural and food products. Agricultural products account for 23% of total freight tonnage and 31% of total ton-miles of freight moved. Trucks move over 90% of the nation's fresh fruits and vegetables (by market share) and 95% of livestock transportation.[65] In addition, trucks participate in 69% of domestic grain movements (by tonnage). Vegetables, meat, poultry, frozen foods, flowers, nursery stock, forest products and fertilizers also primarily travel by truck.

Sector-Specific Issues

Because agriculture is so important to the well-being of the United States, a number of regulations focus on the transportation of agriculture and food products. In addition to regulations governing general motor carrier transportation, carriers hauling agricultural and food products must also comply with regulations from the U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA). For example, the Sanitary Food Transportation Act of 1990 does not allow carriers to use the same containers or tanks to transport both food and nonfood products.[66] Also, the Bioterrorism Act of 2005 regulates the transport of all foods as defined by the U.S. Food and Drug Act.

Food security is a major concern for the agricultural and food transport sector, especially since the events of September 11. Because of the many opportunities to introduce contaminants throughout the food distribution process, both the government and industry place great emphasis on tight security measures on food transport. New regulations issued by the USDA and the FDA have affected the transportation of food in general, and eggs, meat, and poultry specifically.[67] The Agricultural & Food Transporters Conference (AFTC) of ATA also has developed a guide to help transporters ensure the security of the food they are transporting.[68] These publications are no-cost, voluntary guidelines available for download at the AFTC website.[69]

Although motor carriers hauling agricultural products must still comply with hours-of-service regulations limiting the number of hours driven during a 24-hour period, these drivers may be exempt from certain aspects of the rules during harvesting seasons in some states. These exemptions are determined by the individual states.[70]

Truck Vehicle Configurations and Sizes

Standard truck configurations can take a variety of forms. Straight trucks are single units containing both the power unit and the trailer. Other configurations consist of separate power units (referred to as tractors) and trailers. Common U.S. configurations appear on the following page. Standard truck configurations can operate in all 50 states and have a GVW up to 80,000 pounds. Longer combination vehicles (LCVs) may only operate in certain states. In 2002, TRB produced *Special Report 267: Regulation of Weights, Lengths, and Widths of Commercial Motor Vehicles* in response to a congressional mandate. [71]

TRUCK WEIGHT REGULATIONS

Current federal regulations limit trucks to a maximum GVW of 80,000 pounds. Before 1956, vehicle weight regulations were determined by the individual states. Federal weight limits first became effective in 1956, originally limiting vehicle weights to 73,280 pounds. Congress increased the maximum weight limit on the Interstate system to 80,000 pounds in 1974, and then the Surface Transportation Act of 1982 (STAA) required states to allow trucks of 80,000 pounds or less to operate on the full National Highway System (interstates plus most other federal aid highways).[72] States that allowed higher maximum vehicle weights before the STAA were permitted to continue allowing heavier vehicles; trucks with greater GVWs can operate in 22 states.

Truck weight regulations are enforced by a combination of weigh-in-motion sites and roadside weigh and inspection stations. [Weigh and inspection stations are further discussed in association with Radio Frequency Identification (RFID) later in this circular.] Weigh-in-motion is a subset of weigh scale technology using sensor technology embedded in the roadbed of the mainline lanes of a highway that calculates truck weight without requiring stopping. Of course, the most accurate truck weight is obtained from stopping the vehicle at fixed-site scales. Thus, weigh-in-motion sites are used in conjunction with both fixed-site weigh and inspection stations and virtual weigh and inspection stations. Commercial vehicle enforcement officers use data from weigh-in-motion to screen trucks for compliance. Potentially overweight trucks are pulled over to either a fixed-site weigh and inspection station or a virtual weigh and inspection station for a more accurate weight determination. A virtual weigh station has all the elements of a fixed-site scale except that it is transportable. The advantages of a virtual weigh station are its much lower capital cost, capability for random weight enforcement, and the ability to set up on (i) roads used by trucks to evade fixed-site weigh stations and (ii) highway segments without fixed-site weigh stations.

LCVs

LCVs are truck configurations whose length and weight dimensions exceed the size of more conventional truck-and-trailer or tractor–semitrailer combinations. Several examples are shown in Figure 7.

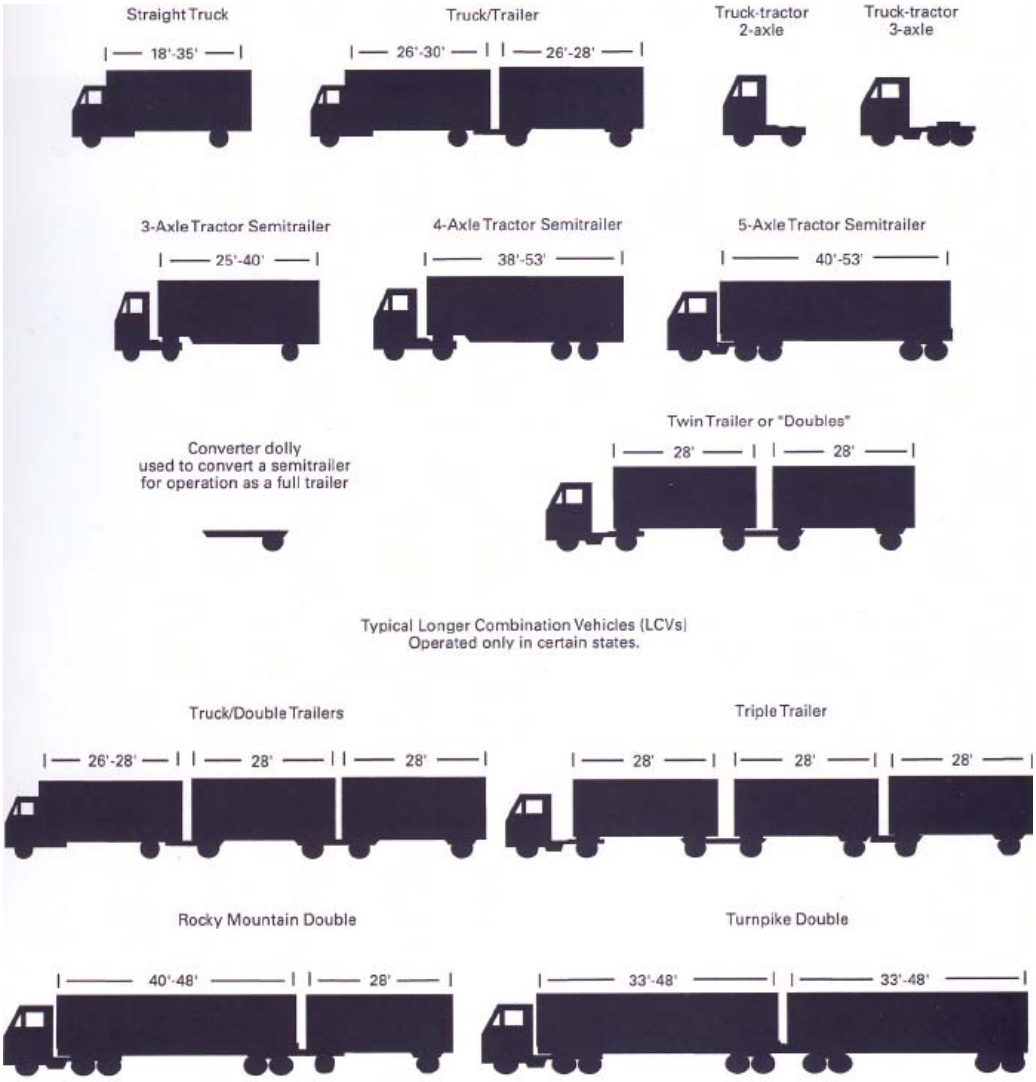

FIGURE 7 U. S. commercial truck configurations.[6]

PRODUCTIVITY CONSIDERATIONS

ATRI released a study in 2004 suggesting that increasing the amount of cargo each truck carried could reduce the actual number of trucks on the road and improve emissions per ton-mile. Adding an additional axle to a standard truck–semitrailer configuration and increasing the total vehicle weight to 100,000 pounds, for example, effectively reduced the resulting emissions per ton-mile.[73] Opponents claim greater safety risks from the greater discrepancy between shrinking automobile weights and growing large trucks. Many opponents also point out the damage heavy vehicles do to highway infrastructure and claim that trucks do not pay their fair share of highway costs, arguing that more freight should ship by rail.[74] Numerous studies in recent years have attempted to balance benefits and costs both of highway funding and truck size and weight.[75]

Highway Funding for Trucking and Transportation

Highway projects are financed through the U.S. Highway Trust Fund (HTF), which was established in 1956 to generally support the construction of the National Highway System. The HTF is currently the key federal financing mechanism that accounts for tax receipts for highway expenditures. Highway funding shortages are a serious concern for the trucking industry. In 2005, the U.S. Chamber of Commerce reported that the HTF was in danger of going bankrupt.[76] Congress had to add approximately $8 billion to the HTF in 2008,[77] and in 2009 the GAO estimated almost twice this amount would be needed to keep the fund solvent through 2010.[78]

FEDERAL FUNDING

Fuel taxes are the primary source of highway funding. The current federal gasoline tax is 18.4 cents per gallon, and the current federal diesel fuel tax is 24.4 cents per gallon. Fuel taxes account for 89% of the highway revenues collected at the federal level and 28% of the revenues collected at the state level.[8] In 2005, the Transportation Research Board published *Special Report 285*: *The Fuel Tax and Alternatives for Transportation Funding* to address the continuing viability of relying on the fuel tax for highway funding.

Trucks also pay Federal Excise Tax on tires, new trucks and trailers, and a separate Federal Heavy Vehicle Use Tax. Tires are taxed on a sliding scale based on the weight. Tires weighing less than 40 pounds are not taxed. Tires weighing between 40 and 70 pounds are taxed at a rate of 15 cents per pound in excess of 40 pounds, and those weighing between 70 and 90 pounds are taxed at $4.50 plus 30 cents per pound in excess of 70 pounds. Finally, tires weighing over 90 pounds are taxed at $10.50 plus 50 cents per pound in excess of 90 pounds.[8]

Motor carriers pay a 12% federal sales tax on trucks weighing over 33,000 pounds and trailers weighing over 26,000 pounds. The Federal Heavy Vehicle Use Tax applies to trucks over 55,000 pounds. This tax is intended to recover the extra costs of serving large trucks. It is an annual fee of $550 on trucks with gross weight of 75,000 pounds or more and $100 to $550, depending on weight, for trucks between 55,000 and 75,000 pounds. The revenue from this tax is dedicated to the HFT. Federal law requires that states verify that the Heavy Vehicle Use Tax be paid before allowing a truck to be registered. States are audited, and those that do not comply risk losing their federal aid for highways. [8]

STATE FUNDING

States typically receive relatively equal portions of their highway funding from federal allocations and state-imposed fuel taxes and other fees. State fuel taxes range from 8 cents to 32.9 cents for gasoline and 8 cents to 38.1 cents for diesel fuel. Other sources of state highway revenue include tolls, vehicle fees and bond proceeds. More than 3,800 miles of toll roads in the United States generated nearly $12.6 billion of revenue for state and local governments.[8]

TOLLING

The concept of using tolls on the transportation system has drawn increasing interest in recent years, not only to generate additional revenue for highway projects, but also to manage demand, congestion and pollution along heavily used roads and corridors. California, for example, has implemented congestion pricing techniques along several key corridors that use variable pricing schemes to manage congestion at peak travel times. States such as Virginia and Georgia have considered the implementation of truck-only toll (TOT) lanes that would provide separate, optional use lanes for commercial vehicles in exchange for a paid toll. RFID technology has facilitated the electronic payment of tolls and expedited movement of trucks through traffic at toll plazas.

The use of tolls is highly contentious within the trucking industry, and the industry prefers tolling mechanisms that are optional and that offer operational benefits. Most recently ATA has come out in support of some increase in the fuel tax as long as it is used to support highway functions.[79]

PUBLIC–PRIVATE PARTNERSHIPS

To help manage the limited funding currently available, state and local governments are relying more heavily on the private sector to invest in transportation infrastructure. These public–private partnerships take any number of forms but generally result in initial private investments that are recovered through the collection of tolls. For example, the City of Chicago leased its Skyway (Interstate 90) to a private toll road operator through a 99-year contract in exchange for $1.8 billion, and Indiana leased the Indiana Toll Road (Interstate 80/90) to the same toll road operator for 75 years.

TRUCKING INDUSTRY CONTRIBUTIONS

In 2003, the trucking industry paid $31.3 billion in federal and state highway user taxes, accounting for 33.7% of the total highway user-based taxes collected.[49] In addition, approximately $4.9 billion (39%) of the total toll revenues collected can be attributed to the trucking industry. In 2004, the trucking industry paid over $6.4 billion in state registration fees accounting for nearly 24% of state fees collected.[8] This does not include additional state fees that motor carriers may have paid, such as licensing fees or charges associated with certification of titles.

Operating Credentials

Operating credentials are registrations, licenses, permits, or certifications that a trucking operation is required to obtain before it may operate a truck. Operating credentials arise in response to both federal and state requirements.

FEDERAL REQUIREMENTS

The federal requirements are applicable if a truck (i) crosses a state border or (ii) carries a shipment in interstate commerce or a federally regulated commodity, even if the truck itself does not cross a state border.

USDOT Number

All motor carriers that haul cargo in interstate commerce must be registered with FMCSA and must have a USDOT Number. Also, commercial intrastate hazmat carriers who haul quantities requiring a safety permit must register for a USDOT Number. The USDOT Number serves as a unique identifier when collecting and monitoring a company's safety information acquired during audits, compliance reviews, crash investigations, and inspections. A state may require a USDOT Number even if a truck does not cross a state border or carry cargo in interstate commerce, and many states do.[80]

New Entrants

All first-time motor carrier applicants for a USDOT Number are automatically enrolled in the FMCSA New Entrant Safety Assurance Program. This program requires new entrants to pass a safety audit and maintain acceptable roadside safety performance over an initial 18-month period before they are given permanent registration status. In most cases, companies operating exclusively as brokers or non-vehicle-operating shippers or freight forwarders do not need to obtain a USDOT Number.

Interstate Operating Authority

In general, motor carriers that operate as for-hire carriers that transport federally regulated commodities, or arrange for their transport, in interstate commerce are also required to have interstate operating authority. Operating authority, when issued by FMCSA, is also referred to as an "MC," "FF," or "MX" number, depending on the type of authority that is granted. Unlike the USDOT Number application process, a company may need to obtain multiple operating authorities to support its planned business operations. Operating authority dictates the type of operation a motor carrier may run, the cargo it may carry, and the geographical area in which it may legally operate.

The requirement for operating authority is rooted in the history of direct economic regulation of for-hire trucking under the ICC. As a result of the economic turmoil of the Great Depression, starting in 1935 the ICC, which had been established in the nineteenth century to

regulate railroads, was given authority over hire motor freight. Most of the resulting economic regulations—which controlled entry and affected pricing—were removed in 1980, and ICC itself was ended through a "sunset" statute in 1995.[81] However, the requirement for operating authority was moved to FMCSA and retained as a registration framework.

Operating authority registration also dictates the level of insurance (proof of financial responsibility) a motor carrier must maintain. Carriers not required to have operating authority include private carriers, for-hire carriers that exclusively haul exempt commodities (cargo that is not federally regulated), or carriers that operate exclusively within a federally designated "commercial zone" that is exempt from interstate authority rules. A commercial zone is, for example, a geographic territory that includes multiple states bordering on a major metropolitan city, such as Virginia–Maryland–Washington, D.C.

STATE REQUIREMENTS

In addition to the federal requirements, trucking companies are also responsible for understanding and complying with applicable state rules and regulations pertaining to registration and licensing. In general, companies are subject to relevant state requirements for each state in which they conduct business (this includes transport operations passing through a state) or where they have established a company office. Only requirements common to all states will be discussed here: International Registration Plan (IRP) credential, International Fuel Tax Agreement credential, and permits for special movements or loads, such as over dimensional permits, and hazmat permits.

IRP Agreement

IRP is a registration reciprocity agreement among states of the United States and provinces of Canada providing for payment by a motor carrier of state-level vehicle registration fees on the basis of total distance operated by a fleet in all states and related jurisdictions. All states (except Alaska and Hawaii), Washington, D.C., and all Canadian provinces (except northwestern territories, Nunavut and Yukon) are members of the plan.

Motor carriers that travel in two or more states must register fleets of vehicles in their home or "base" jurisdiction. A fleet, for IRP purposes, is comprised of one or more vehicles that pay vehicle registration fees in multiple states. The base jurisdiction collects the appropriate registration fees and distributes them to the other jurisdictions in which the carrier requested IRP registration. IRP registration fees are determined by the type of operation requested (private, for-hire, or rental) and by the percentage of miles traveled in each jurisdiction, registered gross weight of each vehicle, and number of vehicles in the carrier's fleet.

The IRP Clearinghouse serves to ensure the timely, secure, and accurate electronic exchange and reconcilement of registration information and fees among states and provinces and distributes the registration revenue among the member jurisdictions. Each state or province receives its proportional share of registration fees for each vehicle registered under the IRP fleet.

Carriers are issued one registration cab card and one license plate for each vehicle in their fleet. Vehicles registered under IRP are considered registered, for vehicle registration purposes only, and this does not exempt carriers from any jurisdiction's other requirements including operating authority requirements, vehicle size and weight requirements, motor fuel or road tax licensing and reporting, and insurance filing requirements.

Single State Registration System and Unified Carrier Registration

Unfortunately, IRP only covers vehicle registrations, and does not collect per-vehicle fees related to interstate operating authority nor record financial responsibility information about interstate for-hire motor carriers. A separate system was established under ICC for receiving and apportioning operating authority fees and recording financial responsibility information; it was known as the "bingo card" system, for its cardboard cards carried in truck cabs with stamps affixed for each relevant state.[82]

In 1991 Congress directed the ICC to replace the bingo card regime with a new system, the Single State Registration System (SSRS), under which a carrier's per-vehicle annual registration with any one state that had participated in the bingo card system would be deemed to satisfy the registration requirements of all other such states.[83] In 2005 Congress again changed the game, replacing the SSSR with the Unified Carrier Registration Agreement (UCR). The SSRS officially ended as of January 1, 2007 and was replaced by the UCR Agreement. The UCR will also eventually replace the USDOT Number, which is a large change, and partially unifies the several distinct registrations systems bequeathed to trucking by its complex history.[84]

States are in the process of implementing the UCR. Because the UCR is to replace the USDOT number, unlike its predecessors (bingo cards and the SSRS) the UCR registration requirement has been extended to match the coverage of the USDOT registration presently obtained through FMCSA. This means in addition to for-hire motor carriers it is to also cover private carriers (carrying goods in interstate commerce regardless of whether the truck crosses a state border), leasing companies, freight forwarders and brokers. UCR fees paid by a company are flat sums based on fleet size, unlike IRP fees paid by the motor carrier, discussed above, which are based on distance traveled. States keep the UCR fees that they collect and receive excess fees from other states until their entitlement limit is reached.

Under UCR, motor carriers no longer pick and choose states, as they do with the SSRS. One UCR fee covers all states. Proof of registration under UCR will not be carried in the truck, but will be available electronically to those charged with enforcing the registration requirement.

International Fuel Tax Agreement

In addition to vehicle registrations and per-vehicle registration fees for motor carrier vehicles, most states also assess taxes on fuel used by commercial vehicles based on the miles traveled through their states, which may be distinct from the locations at which the fuel is actually purchased. The International Fuel Tax Agreement (IFTA) is an agreement among all states (except Alaska and Hawaii) and Canadian provinces (except Northwestern Territories, Nunavut and Yukon) to simplify the reporting of fuel used and fuel tax thereby due from motor carriers operating in more than one jurisdiction. Trucks are subject to IFTA credentialing.

Upon application, the carrier's base (home) jurisdiction will issue credentials that allow a truck to travel in all states (except Alaska and Hawaii) and provinces (except Northwestern Territories, Nunavut and Yukon). The IFTA credential offers several benefits to the interstate/interjurisdictional motor carrier. These benefits include one IFTA credential, one set of IFTA decals, one quarterly fuel tax report that reflects the net tax or refund due. These advantages result in cost and time savings for the carrier and the member jurisdictions.

Other State Credentials

States may also require and issue over dimensional and hazardous materials permits. Over dimensional permits are compulsory for trucks that are oversize and/or overweight, i.e., exceeding the regulated threshold for size or weight. Such permits may require an escort and limit travel during certain hours on certain roads. Hazmat permits are mandatory for trucks that carry hazmat; in addition, drivers of such vehicles must also have a hazardous materials endorsement on their CDL. Such permits may also restrict travel to certain routes.

Commercial Vehicle Information Systems and Networks

To facilitate the issuance of credentials to truckers, FMCSA has funded states through the Commercial Vehicle Information Systems and Networks (CVISN) grant program to develop, operate, and maintain electronic credentialing systems. These electronic systems allow truckers to obtain and pay for their credentials via the internet, 24 hours per day, 7 days per week, all year, without ever having to wait in line or appear at a state agency office.

Safety

Safety is a key issue for the trucking industry, and is of vital interest to the motoring public. It is also the primary mission of FMCSA, the agency charged with improving motor carrier safety by reducing crashes, injuries and deaths involving commercial motor vehicles. A large body of research studies and technical reports addresses risk factors for large-truck crashes, and numerous safety initiatives (regulatory and nonregulatory) seek to promote safer operations within the industry.

SAFETY TRENDS

Despite strong growth in the number of large trucks registered and in the annual number of vehicle miles traveled, truck safety in the United States has improved in the past three decades. Between 1975 and 2005, the number of large trucks registered increased by 58% from 5.4 to 8.5 million, and the number of VMT annually by large trucks nearly tripled. If accident rates had stayed constant the number of fatal accidents involving trucks would have increased greatly. Instead, the data show that except for a big spike leading up to 1979, the number of fatal large-truck crashes held steady through 2005, varying between 4,200 and 4,600 annually. The total number of fatal crashes has stayed relatively stable because there has been a sustained decline in the rate of fatal crashes per 100 million vehicle VMT over a 25-year period, from a high of 5.2 in the late 1970s to about 2.0 since 2002 (see Figure 8[85]).

In addition, injury-producing crashes involving large trucks have declined since 1988 (the first year these data were available). Between 1988 and 2005, these events declined 17% from 94,000 to 78,000, and the rate declined by half, from 67.9 to 34.8 injury crashes per 100 million VMT. The only indicator that did not do quite as well over the same period was the number of property-damage-only crashes involving large trucks, which increased by 17% from 291,000 to 341,000 per year. However, this increase was still lower than the increase in annual miles traveled, so the rate of these events per 100 million VMT decreased 27% from 210.7 to 153.0.[85]

Other trucking safety indicators also show long-term improvements. For instance, alcohol involvement [blood alcohol concentration of 0.01 gram per deciliter (g/dL) or more] for drivers of large trucks in fatal crashes declined from 10.2% in 1982 to 2.4% in 2005. Using the current legal limit of 0.08 g/dL, the proportion decreased from 6.2% in 1982 to 1.3% in 2005. By any measure, alcohol involvement for large-truck drivers was much lower than for drivers of passenger vehicles, which in 2005 was 25.8% at 0.01 g/dL and 22.0% at 0.08 g/dL.[85]

Large-truck crashes present both a public safety problem and an occupational safety problem. From the public safety perspective, given the substantial differences in vehicle mass, it is not surprising that the majority of persons who die in large-truck crashes are occupants of other vehicles or nonmotorists (82% in 2005). However, it is important to note that more truck drivers die on the job than do workers in any other single occupation. Using the Fatality Analysis Reporting System data,[86] there were 803 large-truck occupants killed in 2005.[85] BLS data for the occupation classification of “Heavy and Tractor-Trailer Truck Driver” reported 835 fatalities that year. Truck drivers consistently account for about 15% of all occupational fatalities in the United States, and from year to year, motor vehicle crashes account for two-thirds to three-fourths of these deaths.[87]

MAJOR CONTRIBUTING FACTORS TO LARGE TRUCK ACCIDENT RISK

The federally-funded Large Truck Crash Causation Study (LTCCS) collected data on which analysts might determine contributors to large-truck crashes, using a nationally representative sample of fatal and injury-producing crashes investigated during 2001–2003. Each crash involved at least one large truck and resulted in at least one fatality or injury, with up to 1,000 data elements collected. FMCSA assigned a "critical reason" and one or more contributing factors for each crash.[88] However, the study always assigns the "critical reason" to the driver whose last possible action made the crash inevitable; it does not in any way attribute "fault" to that person. In many cases, the vehicle to which the study assigns the critical reason for the critical event may not be responsible for the crash at all.

Many of the contributing factors involved the driver and particularly the condition of the truck driver at the time of the crash. While the survey documented use of legal drugs, both prescription and over-the-counter, in a large number of cases, the survey showed comparatively rare use of illegal drugs and alcohol. Truck driver fatigue was a prominent factor, however, ranking sixth among driver factors, with 13% of the truck drivers coded as being fatigued at the time of the crash. See Table 1 in Appendix A for more detailed data on primary contributing factors identified in the LTCCS.

Several studies, including the LTCCS, have addressed the relative roles of truck driver and passenger-vehicle driver actions as contributors to crashes. In the LTCCS, the critical reason was assigned to the truck driver in 55% of the fatal and injury crashes (77,000 of the estimated 141,000 crashes represented by the study) and to another motorist or a pedestrian in the remaining 45% crashes (64,000). For truck drivers assigned the critical reason, the study noted most frequently crossing over the lane line or going off the road, followed by loss of control, of course without explaining why this occurred, since the Perchonock Method used cannot answer the "why" question (see Table 2, Appendix A).

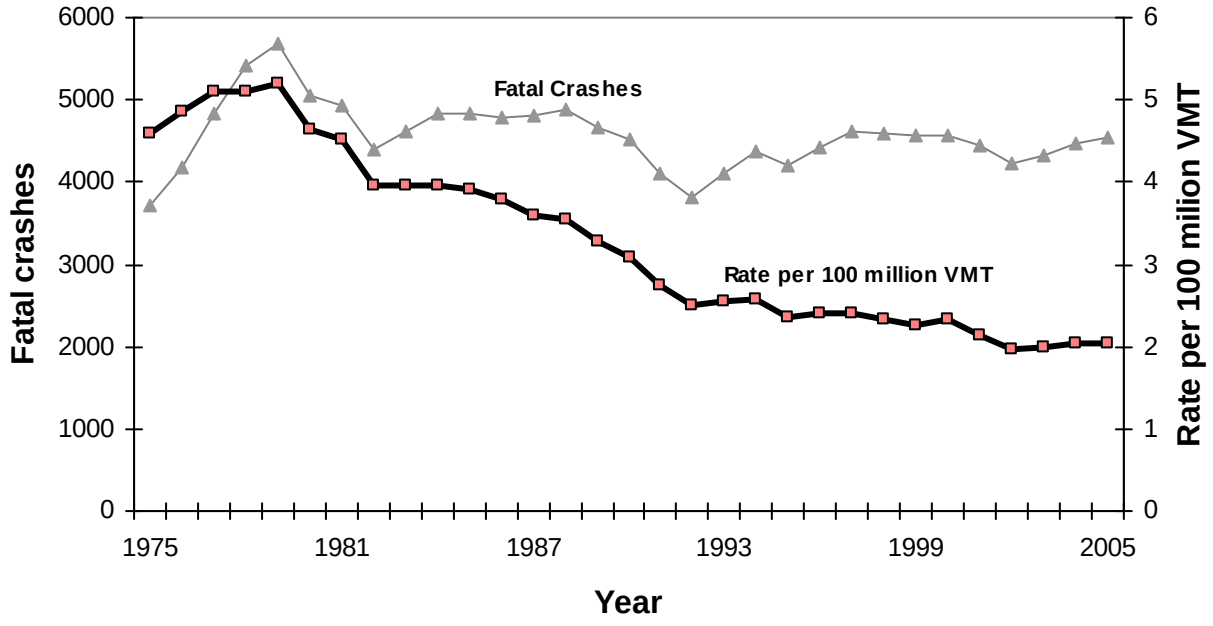

FIGURE 8 Fatal truck crashes (count and rate).

Comparison of LTCCS data on contributing factors for large trucks and contributing factors for passenger vehicles involved in two-vehicle crashes shows many similarities between the two groups. Use of prescription and over-the-counter medications were the leading factors present for both truck and passenger-vehicle drivers, although this does not allow one to conclude that these medications contributed to the crash. Notable differences between truck and auto drivers include unfamiliarity with the roadway, brake failure, and illness, while fatigue was a contributing factor for passenger-vehicle drivers twice as frequently as for truck drivers. In addition, illegal drug use on the part of the automobile driver was involved in 17 times more cases as for truck drivers and alcohol use was involved in 30 times more cases for automobile drivers as for truck drivers (see Table 3, Appendix A).

In contrast with LTCCS results, a study of 1995–1998 fatal truck crashes found that a contributing factor was assigned to the car driver far more frequently than to the truck driver (80% versus 27%). Further, most fatal truck–car crashes were characterized by the same driver errors and behaviors noted for fatal car–car crashes.[89] Five factors (failing to keep in lane, failing to yield right-of-way, driving too fast for conditions or in excess of posted speed limit, failing to obey traffic control devices and laws, and inattention) were noted for the car driver in about 65% of both car–car and car–truck fatal crashes. The report concluded that educational programs to reduce car–truck crashes should continue to promote fundamental safe driving behaviors, emphasizing the severe consequences of truck crashes for passenger-vehicle drivers.

An ATRI study predicted truck drivers' likelihood of future crash involvement using data on driving history.[90] Previous convictions for improper lane change, failure to yield right-of-way, improper turn, and failure to keep in proper lane all were associated with 90% to 100% greater crash risk. The study showed that a citation for reckless driving without conviction increased the likelihood of future crash involvement by 325%, and a conviction for this offense meant a 53% increase in risk (still statistically significant). Among the many other factors associated with increased risk were: log book violations (+56% crash risk), previous disqualification from driving (+51% crash risk), hours-of-service violation (+41% crash risk), and a previous crash (+87% crash risk).

SAFETY TECHNOLOGIES

Rapidly evolving technological advancements have great potential for improving the safety of trucking operations and truck drivers. FMCSA offers product guides for a number of safety and security technologies at http://www.fmcsa.dot.gov/facts-research/systems-technology/product-guides/productguides.htm.

SAFETY IMPROVEMENT INITIATIVES

Federal Motor Carrier Safety Regulations

FMCSA is the operating modal administration of the U.S. Department of Transportation that regulates safety in the trucking industry. FMCSA issues FMCSRs, which cover three general areas of trucking safety: (1) motor carrier, (2) vehicle, and (3) driver.

The FMCSRs governing the motor carrier pertain to new entrants, financial responsibility (liability), insurance, surety bonds, safety ratings, routing, operating authority, and registration. The FMCSRs governing the vehicle pertain to definition of commercial vehicles; parts and accessories (e.g., brakes, lights, and fuel system) necessary for safe operation; inspection, repair, and maintenance; and cargo securement. The FMCSRs governing the driver pertain to the CDL standards and endorsements, commercial driver physical qualifications (medical program is discussed in more detail below); qualifications for drivers of LCVs; hours of service; and drug and alcohol testing.

See http://www.fmcsa.dot.gov/rules-regulations/rules-regulations.htm.

FMCSA Medical Program

FMCSA, with the advice of an expert medical review board, has undertaken a comprehensive review to ensure that safety regulations related to physical qualifications of drivers reflect current clinical knowledge and practice. The newly established National Register of Certified Medical Examiners is intended to ensure that all CMV drivers obtain medical certificates from appropriately certified health care providers.

See http://www.fmcsa.dot.gov/rules-regulations/topics/medical/medical.htm.

Cross-Border Safety

NAFTA allows motor carriers of all three countries to own and operate trucking companies across all three countries.[91] This has led to initiatives to ensure that carriers domiciled outside the United States adhere to U.S. motor carrier safety regulations, and as of this publication, Mexican carriers are still restricted in their access to U.S. highways primarily to zones immediately adjacent to the U.S.–Mexican border. The NAFTA Safety Stats site presents inspection and crash statistics for registered intrastate and interstate motor carriers operating in the United States by country of domicile (United States, Canada, or Mexico).

See http://ai.fmcsa.dot.gov/international/border.asp.

Share the Road Safely

The goal of this FMCSA-sponsored program is to improve the knowledge of all highway users to minimize the likelihood of a crash with a large truck, and reduce the consequences of those that do occur.

See www.sharetheroadsafely.org.

Safety Belt Partnership

This initiative is designed to increase use of safety belts among truck drivers through outreach, education, and research. Although belt use increased from an estimated 48% in 2002 to 59% in 2006, it is still well below belt use rates for motorists in general.

See www.fmcsa.dot.gov/safety-security/safety-belt/index.htm.

Safety Is Good Business

This website offers resources to help motor carriers better understand their responsibilities under the FMCSRs, the economic benefits of safe operations, and initiatives that can help improve safety performance.

See http://www.fmcsa.dot.gov/safety-security/good-business/index.htm.

Truck Parking

The lack of adequate truck parking facilities on or near national highways is a major problem for the trucking industry, particularly in the Northeast region.[92] Lack of adequate truck parking facilities can affect the safety of truck drivers who want or need to use such facilities in several ways: drivers may continue to drive without rest and recovery from fatigue, and drivers may run out of time before reaching their driving limit under FMCSA's hours-of-service regulations. As a consequence the failure to rest, and thus, the failure to recover from fatigue, can result in fatigue-related crashes and fatalities.[93]

In addition, many drivers who cannot find legal and safe parking end up parking illegally on the roadside and on ramp shoulders leading to and from truck parking areas, posing hazards to oncoming traffic because of obstructed visibility to oncoming traffic and trucks attempting to accelerate and merge into oncoming traffic.

FMCSA published a white paper on the use of intelligent transportation systems for truck parking and is now carrying out two projects under its Smart Park initiative to demonstrate technologies for providing parking availability information in real-time to truckers on the road.[94]

Security

September 11, 2001 was instrumental in awakening the trucking industry to the importance of cargo security. Although companies had always concerned themselves with cargo theft, the industry as a whole realized that trucks could be used for terrorist attacks and enacted much tighter security procedures.

SECURITY PROGRAMS

As strict security procedures were implemented nationwide, the trucking industry faced many challenges. Security checks at U.S. border-crossings with Mexico and Canada increased dramatically, complicating problems with cross-border trade. Mexico and Canada are the biggest trading partners of the United States. Trucks haul two-thirds (67%) of the value of goods transported between the United States and Canada and more than four-fifths (80%) of the value of goods transported between the United States and Mexico.[94]

Customs–Trade Partnership Against Terrorism (C-TPAT)

To both ensure cargo security and speed the inspection process, the United States worked with Mexico and Canada to develop practical and effective inspection programs. C-TPAT is a voluntary program in which most major motor carriers participate. Participating carriers agree to follow a set of security guidelines outlined in the agreement in return for designated lanes at border crossings which help decrease delays caused by Customs inspections. Enrolling in the C-TPAT program involves a four-step process:

1. Motor carriers agree to participate.
2. A security review is conducted and a carrier profile is submitted.
3. The security profile is validated.
4. An annual security review is conducted and the carrier profile is updated.

Participation by motor carriers in the C-TPAT program allows the government to focus on higher-risk shipments and expedites the movement of approved carriers through security checkpoints.

Free and Secure Trade Program

The Free and Secure Trade (FAST) Program is an effort to streamline the inspection process at U.S.–Canada and U.S.–Mexico border crossings. FAST uses a paperless system to release shipments through border crossings using either electronic data transmission and transponder technologies or barcode technologies. To use FAST lane processing, a shipment must meet the following conditions:

1. The carrier must be C-TPAT approved.
2. The goods being shipped must come from a C-TPAT–approved manufacturer.

3. The goods must be destined for a C-TPAT–approved importer.
4. The driver must possess a valid FAST-Commercial Driver Card.[95]

Container Security Initiative

The Container Security Initiative (CSI) is a voluntary program designed to ensure the security of cargo imported through U.S. ports. Despite 2 years of decline with the global economic downturn, in 2008 U.S. container ports handled 28 million 20-foot unit equivalent maritime containers, approximately half of which were entering the United States.[96] The CSI works by prescreening containers at their points of origins rather than waiting to inspect the containers as they enter U.S. ports. The CSI consists of four main components:

1. Establish security criteria to identify high-risk containers;
2. Prescreen containers before they arrive at U.S. ports;
3. Use technology to prescreen high-risk containers; and
4. Develop and use tamper-evident container technologies.[97]

Prescreening containers will help alleviate security threats and help expedite shipments as they arrive at the U.S. ports.

Highway Watch

Until recently, the Department of Homeland Security (DHS) and ATA cooperated on another freight security project called Highway Watch. This program was funded by DHS and administered by ATA. Through Highway Watch, transportation professionals were trained to recognize and report potential safety and security threats. After an individual was trained, he or she was assigned an identification number and given access to the Highway Watch hotline which was used to report safety and security threats. This program was cancelled in 2008, when TSA's contract to build security awareness among highway professionals was awarded to a private firm.

Transportation Worker Identification Card

Driver identification and verification is an essential security function at freight pickup points, intermediate truck terminals, and even some destinations. To reduce the risks of theft and terrorism, while facilitating gate and reception processes, especially for truck drivers who make frequent pick-ups and drop-offs, TSA has come up with the Transportation Worker Identification Credential (TWIC). The TWIC incorporates biometric identification and will eventually be integrated with online access to manifest, vehicle, and driver databases. Because the TWIC is universal and government-issued, it will relieve the truck driver from having to register for and carry a separate identification tag for entering and exiting every port, terminal, or other secure area.

SECURITY TECHNOLOGIES

Technological advancements have helped the trucking industry develop ways to better protect their cargo. Global Positioning System (GPS) and RFID technologies have some applications for

truck and cargo security by providing vehicle tracking functions. A variety of other security technologies exist as well.

- E-seals: RFID-equipped seals are used in lieu of traditional locks. Inspectors will be able to determine electronically if someone has tampered with the seal, instead of physically having to check each individual seal.[98]
- Trailer security devices: These are RFID devices that can use pressure, magnetic and light sensors to detect entry into a trailer.
- Remote locking and unlocking: Trailers can only be locked and unlocked using a remote device such as electronic contact keys, programmable codes, RFID controls or satellite/cellular communications.
- Emergency call buttons: This security device consists of preprogrammed buttons that are part of an on-board computer or communication system; when activated it will send an emergency message along with the driver and vehicle location.[99]

Trucking and Technology

Advanced technology is important to the trucking industry: it is essential for motor carriers' success in competitive markets; for reliable, on-time delivery of goods; for improved driver safety; to ensure cargo security and to aid in compliance with federal regulations. In essence, the high-level coordination of the transportation system is necessary to move goods safely, securely and efficiently throughout the global marketplace.

VEHICLE TRACKING TECHNOLOGIES

Wireless communications and GPS have emerged as an important technology to both passenger and commercial vehicles. GPS is used in the trucking industry for navigational, logistical, security, and monitoring purposes.

Navigation: Truck drivers use GPS for navigational purposes in much the same way passenger-vehicle drivers do.

Logistics: Dispatchers are able to track vehicle locations using GPS technology. Having this information available allows dispatchers to accurately estimate delivery times and collect information about truck mileage, routes taken and travel times. Dispatchers are also increasingly using GPS technology to track untethered semitrailers. This is important because there are two to three trailers for every truck tractor. By tracking trailers automatically, trucking companies can reduce unused or idle trailer capacity, monitor or minimize charges for idle trailers, thus reducing the need to buy more trailers. In one of the chassis and intermodal container tracking tests, the estimated annual savings per chassis or container was found to be $210 to $400, mostly from increased utilization.[100]

Security: The tracking abilities of GPS technology can also be used to locate stolen trucks or trailers. GPS combined with intrusion detection technology allows for a fixed site, parked truck, or a moving truck to be 'geo-fenced.' Geo-fencing is monitoring of a site or vehicle to determine if the space has been intruded on (Geo-fencing applied to a moving truck is called route adherence monitoring.). Geo-fencing is used most frequently for trucks carrying hazmat or high-value cargo (e.g., electronic goods). The U.S. Departments of Defense and Energy regularly use such technology to track commercial carriers that haul their sensitive freight.

Monitoring: GPS has been used to monitor the flow of trucks along several interstate corridors in order to determine areas and times where there is high congestion or bottlenecks.

Emergency response: GPS combined with an automated alarm system is useful for transmitting a call for help from a truck that automatically includes location of the truck, when an emergency response is needed. For example, the alarm may be as simple as a duress button for the driver or as complex as being tied in with the truck's forward, side, or back collision warning system. An emergency response is desired if the truck is carrying hazardous materials (or high-value cargo) that could be released (or stolen) in event of a collision (or hijacking). Using GPS to automatically transmit truck location in a crisis is valuable to emergency responders if the driver is unable to do so.

RFID: This is another technology that can be used for the purpose of tracking freight. RFID tags containing unique identification numbers are placed on a truck or trailer. The RFID transponder is usually mounted in the cab of a truck to relay vehicle identification to a stationary

electronic reader. This reader can store the identification of a truck at a bridge, tunnel, or toll road to record tolls owed or to deduct toll payments from an established account. For a truck enrolled in electronic toll collection system (e.g., E-ZPass), the truck does not have to queue in line, and its passage through the toll booths is expedited, not just in one but in all states covered by that system.

RFID for roadside weight and inspection: A reader at a roadside weigh and inspection station can immediately identify a truck from its RFID transponder, extract its safety records, and send a signal back to the truck as to whether it may clear the station or pull over for a more thorough weighing and inspecting. Of course, trucks with good safety records will be cleared, and trucks with less than satisfactory safety records will be pulled over. Weigh and inspection stations in more than 30 states deploy technologies that conform to FMCSA's CVISN. Because of the advantages of RFID to increasing the productivity of trucks and commercial vehicle enforcement, the ad hoc Smart Roadside Working CVISN Group to FMCSA has suggested that RFID be adopted as a universal electronic license plate.[101]

RFID transponder-based placards: These are potentially useful for hazardous materials carried as cargo. In the event of an incident, these tools would be useful to emergency responders to identify the commodity and proper procedures.

SECURITY TECHNOLOGIES

As mentioned earlier, GPS and RFID have some applications for truck and cargo security by providing vehicle tracking functions. A variety of other security technologies exists as well, as described above.

SAFETY TECHNOLOGIES

Rapidly evolving technological advancements have great potential for improving the safety of trucking operations and truck drivers. FMCSA offers product guides for a number of safety and security technologies at http://www.fmcsa.dot.gov/facts-research/systems-technology/product-guides/productguides.htm. Included among these technologies are:

- Lane departure warning systems. Monitor the position of a vehicle within a roadway lane and warn a driver if the vehicle deviates or is about to deviate outside the lane.
- Collision warning systems (CWS). In-vehicle electronic systems that monitor the roadway in front of the vehicle and warn a driver when a potential collision risk exists if another vehicle or object is in the same lane.
- Adaptive cruise control (ACC) systems. In-vehicle electronic systems that can be integrated with CWS and automatically maintain a minimum following interval to a lead vehicle in the same lane. When there is no vehicle ahead of the host vehicle, the ACC system operates like conventional cruise control, maintaining the speed set by the driver.
- On-board brake stroke monitoring systems. Relay critical information about air brake adjustment and operational status to drivers, inspectors, and maintenance personnel. These systems can detect major brake problems in real-time. On-board brake stroke monitoring systems use sensors located at each brake actuator to monitor pushrod travel and determine if a brake on

an air-braked vehicle is over-stroking, not releasing, or inoperative. These monitoring systems include driver interfaces that display the existence and location of these problems to drivers, technicians, and inspectors.

- Rear object detection systems. Detect moving and stationary objects located within a specific area behind a commercial motor vehicle while it is backing up. Currently available systems can detect objects within a range of approximately 10 to 20 feet behind a vehicle. They can be integrated with other sensors such as side object detection sensors to cover other blind-spot areas around a vehicle.
- Tire pressure monitoring systems. Automatically detect and relay tire air pressure information with sensors attached to the tire, wheel, or valve stem. Some tire pressure monitoring systems may be integrated with tire pressure equalizer or maintenance systems that monitor and automatically inflate tires to a specific tire pressure. These systems can be valuable aids for proper tire maintenance that will enhance the safe operation of CMVs and reduce the risk to other motorists from thrown tire recaps or tires exploding when they overheat.
- Vehicle stability systems (VSS). Monitor lateral acceleration from on-board sensors to reduce rollovers due to excessive speed in a curve and prevent loss-of-control crashes due to yaw instability. VSSs can be passive systems that warn drivers of potential instability through a visual display or audible warning. They may also be active systems that intervene by reducing the throttle and applying differential brake pressure to correct the instability.

REGULATORY COMPLIANCE TECHNOLOGIES

Technologies have been developed to aid drivers and fleet managers in complying with federal regulations.

- Electronic on-board recorders: These devices help drivers track time spent driving and completing other work-related tasks in compliance with federal hours-of-service rules.
- Fuel tax reporting technologies: These technologies help drivers track where they purchase fuel and the miles spent driving in each state or country for compliance with the International Fuel Tax Agreement.

Trucking and the Environment

The trucking industry's biggest environmental concern is air pollution. As traffic and congestion in major cities continues to increase, the importance of truck emission reduction to overall air quality increases as well.

In 2003, combination truck miles accounted for almost 5% of total VMT and nearly 16% of total fuel consumption. Since 1992, sulfur dioxide, volatile organic compounds, and particulate matter (PM-10) emissions from commercial vehicles all have declined. Nitrogen oxide emissions continued to increase until 2000 and then began to decline as well.[6] However, according to a 2005 report from FHWA, trucks are the source of 66.8% of all freight NO_x emissions and 64.7% of all freight PM-10 emissions in the United States. [102]

REGULATIONS

Government regulations have played a significant role in pollution reduction. Congress passed the Clean Air Act in 1970 and revised it in 1990. Title II of the 1990 Act imposed strict standards on vehicle emissions and fuel content. EPA issued an additional set of emissions standards for passenger vehicles in 1999 known as Tier II Standards. EPA also issued new standards for allowable sulfur in gasoline to be phased in between 2006 and 2009.[54] By 2009, the sulfur content in diesel fuels can be no more than 15 parts per million; the sulfur content was 500 parts per million in 2000.[14]

A related regulation involves the adoption of greener truck engines. Starting in 2007, the emissions standards for trucks became stricter. Low-sulfur diesel fuel and high-efficiency exhaust emission control devices on diesel engines will reduce total sulfur emissions by 97% from 1999 levels. These regulations also will reduce emissions of nitrogen oxides, hydrocarbons and particulate matter.[56]

In addition to these regulator mandates, EPA also operates the Smartway program to recruit firms to undertake voluntary efforts to reduce the environmental impact of freight movements by focusing on ways in which such efforts can be win–win, i.e., both environmentally friendly and either cost neutral, or in many cases, cost-saving for the firms. Smartway involves shippers, carriers, logistics firms, and truck stops, among other types of participants.[103]

TRUCK VOLUME AND CONGESTION

Government regulations are not the only factors affecting truck-generated air pollution. The number of trucks on the road and the duration of truck engine operations also play significant roles. Although emissions are declining, the number of trucks on the road and traffic congestion continues to increase as demand for the movement of goods continues to escalate. In 2002 FHWA predicted that the U.S. economy would transport more than 20 billion tons of freight in 2020; not only would that require more trucks on the road, but the trucks also would be on the road longer, representing a 70% increase over 1996 tonnage levels.[104] By 2008 FHWA was predicting a 92.5% increase in tonnage over the 2002 level.[105] This suggests that congestion-related delays will continue to increase.

ATRI released a study in 2004 suggesting that increasing the amount of cargo each truck carried could reduce the actual number of trucks on the road and improve emissions per ton-mile. Adding an additional axle to a standard truck–semitrailer configuration and increasing the total vehicle weight to 100,000 pounds, for example, effectively reduced the resulting emissions per ton-mile.[73] Opponents claim greater safety risks from the greater discrepancy between shrinking automobile weights and growing large trucks. Many opponents also point out the damage heavy vehicles do to highway infrastructure and claim that trucks do not pay their fair share of highway costs, arguing that more freight should ship by rail.[74] Numerous studies in recent years have attempted to balance benefits and costs both of highway funding and truck size and weight.[75]

IDLING

Truck idling is another factor contributing to air pollution. Trucks may idle for a number of reasons including adverse traffic conditions, waiting to load or unload, and resting in compliance with hours-of-service regulations. Many states have strict regulations limiting the amount of time a truck can sit idle. The times range from 0 to 15 minutes and may allow exemptions allowing trucks to remain idle in adverse weather and traffic conditions.[57] Although good for the environment, idling regulations may be problematic for long-haul drivers who use sleeper berths for their required off-duty hours because the truck has to be running for them to use heating and air-conditioning. Similarly, temperature-controlled vehicles are also challenged. EPA has recently initiated a project to investigate alternative ways of powering auxiliary functions to reduce idling.

BIODIESEL FUELS

High fuel prices, impending oil shortages and concern for the environment have led to the development and use of biodiesel fuels. Biodiesel is attractive as an alternative fuel because it can be used with little or no modification to current engine and fuel systems. The benefits of using biodiesel include reduced emissions of carbon monoxide, hydrocarbons, particulate matter, sulfates and nitrogen oxide.[58] These fuels can be made from soybeans, vegetable oil, animal fat and used cooking oil and can be blended with standard diesel fuel. Yellowstone National Park, the City of Seattle, the U.S. military and the State of Minnesota currently use biodiesel blends.[15] Unlike ethanol produced from corn, the University of Minnesota estimates that the production of biodiesel from soybeans produces a substantial net energy gain. However, the full diversion of soy bean production into biofuels would provide only approximately 6% of current needs, and food prices are likely to be affected at levels well below full diversion. So the long-term role of fuels such as biodiesel is as yet unclear.[16]

APPENDIX A

Results from the Large Truck Crash Causation Study

TABLE 1 Estimated Number of Trucks in All Crashes by Associated Factors

Top 20 Factors	Number of Trucks*	Percent**
Drivers		
Prescription drug use	37,000	26.3
Traveling too fast for conditions	32,000	22.9
Unfamiliar with roadway (less than six times in 6 months)	30,000	21.6
Over-the-counter drug use	24,000	17.3
Inadequate surveillance	19,000	13.2
Fatigue	18,000	13.0
Under work-related pressure	13,000	9.2
Illegal maneuver	13,000	9.1
Inattention	12,000	8.5
External distraction factors	11,000	8.0
Inadequate evasive action	9,000	6.6
Aggressive driving behavior (tailgating, weaving, other)	9,000	6.6
Unfamiliar with vehicle (less than six times in 6 months)	9,000	6.5
Following too closely	7,000	4.9
False assumption of other road users' actions	7,000	4.7
Vehicle		
Brake failure, out of adjustment, etc.	41,000	29.4
Environment		
Traffic flow interruption (previous crash, congestion, other)	39,000	28.0
Roadway related factors	29,000	20.5
Driver required to stop before crash (traffic control device, other)	28,000	19.8
Weather related factors	20,000	14.1
Other Factors		
Cargo shift	6,000	4.0
Driver pressured to operate even though fatigued	5,000	3.2
Cargo securement	4,000	3.0
Illness	4,000	2.8
Illegal drug use	3,000	2.3
Alcohol use	1,000	0.8

* Estimates are rounded to nearest 1,000.
** Percents are calculated on unrounded weighted numbers.

SOURCE: Report to Congress on the Large Truck Crash Causation Study. Washington, D.C: Federal Motor Carrier Safety Administration. http://www.fmcsa.dot.gov/facts-research/research-technology/report/ltccs-2006.htm. LTCCS Database.

TABLE 2 Estimated Number of Trucks in All Crashes by Critical Events Where Truck Was Coded with the Critical Reason

Events	Number*	Percent**
Over the lane line or off the road	25,000	32.1
Loss of control (traveling too fast for conditions, other)	22,000	28.6
Other motor vehicle in travel lane	17,000	21.7
Turning, crossing an intersection	8,000	10.3
Pedestrian/bicyclist/other non-motorist in roadway	2,000	2.5
Other motor vehicle encroaching into travel lane	1,000	1.7
Other	2,000	2.4
Not involved in first harmful event	***	0.6
Total	77,000	100.0
Critical reason not assigned to truck	64,000	

* Estimates are rounded to the nearest 1,000.
** Percents are calculated on unrounded weighted numbers.
*** Weighted numbers lower than 500 are not shown.

SOURCE: Report to Congress on the Large Truck Crash Causation Study. Washington, D.C: Federal Motor Carrier Safety Administration. http://www.fmcsa.dot.gov/facts-research/research-technology/report/ltccs-2006.htm. LTCCS Database.

TABLE 3 Estimated Large Trucks and Passenger Vehicles in Two-Vehicle Crashes by Associated Factor

	Number*		Percent**	
Factor	**Large Trucks**	**Passenger Vehicles**	**Large Trucks**	**Passenger Vehicles**
Drivers				
Prescription drug use	19,000	22,000	28.7	33.9
Over-the-counter drug use	13,000	7,000	19.4	10.3
Unfamiliar with roadway (less than 6 times in 6 months)	13,000	6,000	19.1	9.7
Inadequate surveillance	10,000	9,000	15.8	13.2
Driving too fast for conditions	10,000	7,000	15.2	10.4
Making illegal maneuver	8,000	9,000	11.5	13.1
Felt under work pressure	6,000	2,000	9.9	2.6
Driver inattentive to driving	6,000	6,000	8.5	9.2
External distraction	5,000	4,000	7.7	5.6
Driver fatigue	5,000	10,000	7.5	14.7
Inadequate evasion	4,000	5,000	6.5	6.9
False assumption of other road user's actions	4,000	2,000	5.9	3.1
Unfamiliar with vehicle (less than 6 times in 6 months)	4,000	2,000	5.4	2.4%
Vehicle				
Brake failure, out of adjustment, etc.	18,000	2,000	27.0	2.3
Lights/tape deficiencies	4,000	1,000	6.1	1.1
Environment				
Traffic flow interrupted	16,000	16,000	23.7	24.6
Required to stop before crash (traffic control device, other)	14,000	16,000	21.0	24.5
Roadway problems (missing signs, slick surface, other)	11,000	11,000	16.6	16.2
Weather problems (rain, snow, fog, other)	9,000	9,000	13.3	13.3
Sightline to other vehicle obstructed	5,000	3,000	6.9	4.9
Other Factors				
Driver ill	1,000	5,000	12	7.6
Cargo shift	***	***	0.6	0.0
Illegal drug use	***	4,000	0.4	6.7
Driver used alcohol	***	6,000	0.3	9.0

* Estimates are rounded to nearest 1,000.
** Percents are calculated on unrounded weighted numbers.
*** Weighted numbers lower than 500 are rounded to zero.

SOURCE: Report to Congress on the Large Truck Crash Causation Study. Washington, D.C: Federal Motor Carrier Safety Administration. http://www.fmcsa.dot.gov/facts-research/research-technology/report/ltccs-2006.htm. LTCCS Database.

APPENDIX B

Unpacking MCMIS

The numbers generated by using MCMIS, maintained by FMCSA, aren't quite what one might think from the name of the database, because of the way the registration for motor carriers works. The regulations cast a wide net—every entity operating at least one commercial motor vehicle that is used in connection with interstate commerce, and that meets one of three criteria (a low vehicle size threshold, hauling above a modest number of passengers, or hauling enough hazardous materials at one time to require a warning placard) must register. Registrants also include those who own commercial vehicles but only lease them to others, as well as operators meeting the same three criteria that only engage in intrastate commerce, if their state requires it (34 states do).[106] It is this registration with FMCSA that provides the USDOT number seen on the door of almost every heavy commercial vehicle, and used to uniquely identify its operator. In practice, this provides (approximately[107]) *an upper bound* on what would normally be thought of as the number of actual competitors operating trucks in any particular part of interstate commerce, for four reasons.

First, only since 2001 have motor carriers holding USDOT registration numbers been required to update their registration records biennially, and the compliance with this requirement—which is through the state of registration in some cases and directly with FMCSA in others—is uneven. Since motor carriers must register when they begin operations, the MCMIS does capture all the operations that ever started up. But it includes information on some operations that are no longer in business.[108]

Second, MCMIS generally gives an over count of the firms in any particular part of the business because the regulations encourage applicants to register for all the categories of operation that they might ever undertake, whether they ever do or not, so some significant fraction of MCMIS registrants don't operate in all (or even any), of the categories shown on their registrations.[109]

Third, one large company can have multiple registered "motor carrier operations," so that the true number of distinct companies that operate trucks is smaller than the number of distinct "motor carriers." This would most typically be true of private carriers. One calculation suggests that this over count is modest but measurable, at around 5% of the total.[4]

Fourth, MCMIS may not over-count the carriers involved in interstate commerce, but it does over-count relative to what common sense would call the number of true economic competitors. A firm that competes in a given market for freight services normally is defined by the fact that it has some kind of coherent and centrally-managed freight-hauling operation. However, significant parts of the industry are structured not as integrated freight-hauling firms with employees answering to managers, but as nested sets of contractors and subcontractors. Since it is relatively inexpensive to register as a motor carrier, and doing so preserves the right of the registrant to haul freight on their own should they ever wish to, when a trucking firm operates even partly through contractors and subcontractors, most of these operators also show up in MCMIS as separate firms, whether they are currently operating independently or not. So in this specific, but very real, sense the MCMIS "double counts" motor carriers, especially smaller ones and most especially those that use subcontractors (owner–drivers and small fleets).

The MCMIS data therefore provide an important window on trucking operations, with some key strengths, such as capturing all operations that ever started up, and including both for-

hire and private carriage. But MCMIS also has some key limitations—principally that is in some important ways an over count—that must be kept in mind.

APPENDIX C

List of Acronyms

ACC	adaptive cruise control
AFTC	Agricultural and Food Transporters Conference
ATA	American Trucking Association
ATRI	American Transportation Research Institute
BTS	Bureau of Transportation Statistics
C-TPAT	Customs–Trade Partnership Against Terrorism
CDL	commercial driver's license
CMV	commercial motor vehicle
CVISN	Commercial Vehicle Information Systems and Networks
CWS	collision warning systems
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
FMCSA	Federal Motor Carrier Safety Administration
FASH	Fraternal Association of Steel Haulers
FAST	Free and Secure Trade Program
GAO	Government Accountability Office
GDP	gross domestic product
GPS	global positioning system
GVW	gross vehicle weight
HTF	Highway Trust Fund
ICC	Interstate Commerce Commission
IFTA	International Fuel Tax Agreement
IRP	International Registration Plan
LCV	longer combination vehicles
LTL	less than truckload
LTCCS	Large Truck Crash Causation Study
MCMIS	Motor Carrier Management Information System
NAFTA	North American Free Trade Agreement
OES	Occupational Employment Statistics
PHMSA	Pipeline and Hazardous Materials Safety Administration
RFID	radio frequency identification
SSRS	Single State Registration System
STAA	Surface Transportation Act of 1982
TWIC	Transportation Worker Identification Credential
TL	truckload
TOT	truck-only toll
TSA	Transportation Security Administration
UCR	Unified Carrier Registration Agreement
UMTIP	University of Michigan Trucking Industry Program
UCR	Unified Carrier Registration
VIUS	Vehicle Inventory and Use Survey
VMT	vehicle miles traveled
VSS	vehicle stability systems

Notes and References

1. Rothenberg, L. *Regulation, Organizations, and Politics; Motor Freight Policy at the Interstate Commerce Commission*. Ann Arbor, Mich. University of Michigan Press, 1994. See also William R. Childs, *Trucking and the Public Interest: The Emergence of Federal Regulation 1914–1940*. University of Tennessee Press, Knoxville, 1985.
2. For an account of economic deregulation and its effects, see Belzer, M. H. *Sweatshops on Wheels: Winners and Losers in Trucking Deregulation*. Oxford University Press, New York, 2000.
3. The FMCSA is part of the U.S. Department of Transportation; the ICC ended operations in 1995.
4. The ICC recorded information only about regulated or authorized for-hire trucking companies (see Reference 25 below, for regulated versus exempt), so to be comparable the MCMIS number reported here includes only "authorized" for-hire carriers of freight that reported positive annual miles and positive trucks, and which added or updated their records in 2004 or later. Calculations by Kristen Monaco (California State University–Long Beach) and Stephen Burks (University of Minnesota–Morris) for the present document are based on the MCMIS census file of September, 2007. In general for this document, Monaco and Burks only count carriers with at least one freight-related (i.e., nonpassenger) classification code that reports positive miles and positive trucks, and which either added its registration record or updated it in 2004 or later.
5. The other main modes in 1980 were rail ($27.8 billion, 13%), water ($15.5 billion, 7.4%), pipelines ($7.5 billion, 3.5%), and air ($4 billion, 1.9%). Wilson, R. A. *Transportation in America, 2000,* 18th edition, Eno Transportation Foundation, 2001, pp. 4–5.
6. American Trucking Trends 2004, American Trucking Associations, Alexandria, Va., p. 9.
7. *Increased Trade Spurs Growth in North American Freight Transportation*. BTS Special Report, May 2007, http://www.bts.gov/publications/bts_special_report/2007_05/ , accessed 7/07/07.
8. Federal Highway Statistics, FHWA, 2004.
9. Table 1-32, National Transportation Statistics, Bureau of Transportation Statistics, updated April, 2007. That trucks make up 3.36% of vehicles but account for 7.45% of total miles reflects the fact that commercial vehicles, on average, run more miles than noncommercial ones.
10. American Trucking Associations, p. iv, op. cit. (see Reference 6).
11. Combination trucks include trucks with trailers, and all truck-tractors, whether or not pulling semitrailers. Bureau of Transportation Statistics, op. cit. (see Reference 9).
12. American Trucking Associations, p. iv, op. cit. (see Reference 6). Most Class 8 vehicles are combination trucks, but not all, as some kinds of straight trucks, such as dump trucks and concrete trucks, can be in the heaviest weight classification. Because of the demise of the quinquennial Vehicle Inventory and Use Survey (VIUS) there is no recent publicly available data on the number of Class 8 trucks. The most recent VIUS data is from 2002, which records 2.15 million Class 8 trucks. A simple linear extrapolation suggests about 2.48 million Class 8s in 2005.
13. *U.S. Freight Transportation Forecast to . . . 2017*. American Trucking Associations, 2006.
14. U.S. Environmental Protection Agency. Clean Diesel Trucks and Buses Rule. http://www.epa.gov/otaq/diesel.htm. Accessed January 2006.
15. Minnesota Department of Agriculture. Minnesota's 2% Biodiesel (B2) Program. http://www.mda.state.mn.us/biodiesel/b2/default.htm. Accessed January 2006
16. Hill, J., E. Nelson, D., Tilman, S. Polasky, and D. Tiffany. Environmental, Economic, and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels. In *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 103, No.30, 2006, pp. 11206–11210.
17. A trailer being pulled by a Wal-Mart tractor is an example of private carriage, while a trailer being pulled by another company's tractor is an example of for-hire carriage.

18. *U.S Freight Transportation Forecast to . . . 2017*. American Trucking Associations, 2006, page 9. This publication reports the results of statistical estimates by Global Insight from government and privately collected data. Note that "revenue" figures for private carriers are actually estimates of the cost of their operations, by extrapolation from the pricing of for-hire firms, because private carriers do not generally report revenue figures separately from their parent companies. As a group, private carriers operate many more trucks than for-hire carriers, but on average for-hire carriers operate larger vehicles, and run them many more miles per year, than do private carriers.
19. The coding comes from the North American Industrial Classification System (NAICS), and truck transportation is under code 484, while courier services come under code 492. U.S. Census Bureau, North American Industrial Classification System. http://www.census.gov/epcd/www/naics.html. See also *Sweatshops on Wheels*, Chapter 5, Endnote 4, page 220.
20. Firms like this cannot be identified separately and added back to the total for trucking because the category with which they are grouped includes other companies that primarily handle small shipments by air. Nor does trucking (NAICS 482) count the ground parts of the courier industry, which includes a large number of locally oriented firms that handle urgent shipments within metropolitan areas. These firms have their own breakout code within Couriers (NAICS 492).
21. In addition, while MCMIS includes couriers and parcel carriers among its tally of for-hire carriers, the MCMIS information does not allow these carriers to be separately identified.
22. This is an estimate because actual 2007 Economic Census results were not out until 2008–09. See Reference 32 for details on how it was created.
23. According to the Economic Census website, "Establishments not sent a report form: selected small employers, i.e., single-establishment firms with payroll below a specified cutoff. Although the payroll cutoff varies by kind of business, small employers not sent a report form generally include firms with less than 10 employees and represent about 10% of total sales of establishments covered in the census. Data on sales, payroll, and employment for these small employers were derived or estimated from administrative records of other federal agencies." http://www.census.gov/econ/census02/guide/index.html. Accessed March 14, 2008.
24. The authors count carriers with at least one freight-related classification code whose records were entered or updated since 2004 and who report positive miles and positive numbers of trucks.
25. This distinction is a carryover from the days of economic regulation, 1935–1980, when carriers who hauled only a specific and small set of commodities were exempted from economic regulation. Most of the exempt commodities are unprocessed agricultural products.
26. These data come from the UMTIP Driver Survey data set cleaned under the supervision of and maintained by Michael H. Belzer (Michael.H.Belzer@wayne.edu).
27. Miller, E. Federal Commission Asks Judge to Block Calif. Ports' Drayage Concession Plans. *Transport Topics*, No. 3818, Nov. 10, 2008, p. 3.
28. While they own their own panel trucks, they must buy their trucks from a manufacturer that FedEx specifies, paint the trucks in a specified way to identify them as part of an apparently seamless FedEx brand, buy repair and other services from FedEx, park their trucks overnight and on weekends in FedEx facilities, and work exclusively for FedEx.
29. Anthony Estrada et al., Plaintiffs and Appellants, v. FedEx Ground Package System, Inc., Defendant and Appellant. B189031. Court of Appeal of California, Second Appellate District, Division One. 154 Cal. App. 4th 1; 64 Cal. Rptr. 3d 327; 2007 Cal. App. LEXIS 1302; 154 Lab. Cas. (CCH) P60, 485.
30. See Belzer, M. H. Labor and Human Resources. In *Intermodal Freight Transportation: Moving Freight in a Global Economy*, L. Hoel, G. Giuliano, and M. Meyer (eds.) : Eno Foundation for Transportation, forthcoming.
31. 2002 is the last available full economic census, done every 5 years. http://www.census.gov/econ/census02/.

32. A simple linear extrapolation made by using the average revenue per firm from the 2002 Economic Census (calculating with real dollars derived from BEA Table 1.1.9., Implicit Price Deflators for Gross Domestic Product) suggests that the new Economic Census for 2007 will find (when the data are released) that there were about 124,000 total for-hire carriers in 2007.
33. The VIUS once provided this information every 5 years, but it was cancelled after the 2002 data year. See Reference 12.
34. A five-axle tractor–trailer combination is legal anywhere on the National Highway System (NHS) at 80,000 GVW, as long as its axle weights are also within limits. Some states have higher weight limits, and many restrict weights to less than this off the NHS.
35. The label given here, and in other statistics that categorize things by the primary business of firms is "Truck Transportation."
36. Current Population Survey, household data: annual averages. Table 18. Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity. www.bls.gov/cps/cpsaat18.pdf.
37. Note that this limitation can be important in trucking, because a significant number of independent contractors work as "owner–operators" in some industry segments, and hence are not counted in the OES employment statistics.
38. Standard Occupational Classification (SOC) Code 53-3032: workers who drive a tractor–trailer combination or a truck with a capacity of at least 26,000 GVW for the purpose of transporting and delivering goods, livestock, or materials in liquid, loose, or packaged form. Workers in this occupation may be required to load or unload their truck, and may be required to use automated routing equipment.
39. SOC Code 53-3033: workers who drive a truck or van with a capacity of less than 26,000 GVW, primarily to deliver or pick up merchandise or to deliver packages within a specified area. Workers in this occupation may be required to load or unload their truck, and may be required to use automated routing or location software.
40. In parallel with the distinction between the segments of the trucking industry and courier and parcel service, there is a distinction in the definition of drivers: the occupation "Couriers and Messengers" is not included in either truck driver occupational category. SOC Code 43-5021: workers who pick up and carry messages, documents, packages, and other items between offices or departments within an establishment or to other business concerns, traveling by foot, bicycle, motorcycle, automobile, or public conveyance. Excludes "Truck Drivers, Light or Delivery Services" (53-3033).
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81. The Surface Transportation Board (STB) remained as a small successor, now focused again only on railroads.
82. Prior to 1994, the ICC allowed states to charge interstate motor carriers operating within their borders annual registration fees of up to $10 per vehicle. As proof of registration, participating states issued stamps that were affixed to a card carried in each vehicle. Under this so-called “bingo card” system, some states entered into “reciprocity agreements” whereby, in exchange for reciprocal treatment, they discounted or waived registration fees for carriers from other states.
83. This change was made in that year’s transportation bill, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).
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93. In 1998, Congress directed the National Transportation Safety Board (NTSB) to review causes of truck and bus crashes. In a 2002 report, NTSB recommended identified fatigue-related crashes as a problem. It recommended that FMCSA create a guide to inform truck drivers about locations and availability of parking. Congress further mandated a study on the adequacy of truck parking by FHWA. In response, FHWA produced *Study of the Adequacy of Commercial Truck Parking Facilities–Technical Report* in 2002.
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106. The size threshold is greater than 10,000 lbs. GVW, the passenger threshold is more than 6 if for-hire, or more than 15 if not, and the hazmat threshold is a few hundred pounds. The states that require USDOT numbers are those in the Performance and Registration Information System Management (PRISM) program: Colorado, Indiana , Iowa , Minnesota, Oregon, Alabama, Arizona, Arkansas, Connecticut, Georgia, Kentucky, Louisiana, Maine, Massachusetts, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, and West Virginia. Registrations of brokers and freight forwarders also are recorded in this database.
107. It is only approximately an upper bound because the solely intra-state operators in a few states are not included; see the preceding footnote. Some large states (e.g,. California, Michigan, and Texas) are in this group.
108. About 50% of new businesses fail within 4 years (Amy Knaup, Survival and Longevity in the Business Employment Dynamics Data, Monthly Labor Review, 2005) and the failure rate is higher for small businesses (more than half of MCMIS registrants have only one truck), so it is very likely that a significant fraction of the MCMIS listings which represent separate businesses are for carriers that no longer exist, and which did not update their FMCSA records when they ceased operations. For instance, as of September 2007 there were 648,000 motor carriers of freight whose records show total annual mileage greater than zero. But if carriers who have not updated their records since 2004 are excluded, the number drops to 537,000. Source: unpublished calculations from the MCMIS Census File by Kristen Monaco, California State University–Long Beach, and Stephen V. Burks, University of Minnesota–Morris
109. Many registrants identify themselves as operating in several different parts of the trucking industry. Even though their registrations were active, on top of the 537,000 more-or-less current motor carriers of freight identified in the previous paragraph, there were another 264,000 that had current and active records (by the same standard) that showed zero miles of operation. Most of these had one truck and one driver, so if they are actually in business they are most likely owner–operators who lease themselves to a larger carrier, and who would, in common sense terms, be thought of as part of the labor force of the company holding their lease. Another large subset of carriers in the MCMIS database are primarily passenger operations. In general, the approach taken in identifying carriers in the MCMIS for the current document is this: the authors count only carriers with at least one freight-related (i.e., nonpassenger) classification code that report positive miles and positive trucks, and which either added their registration record or updated it in 2004 or later. Source: see Reference 4.

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