



ANALYSIS BRIEF

Federal Motor Carrier Safety Administration

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FACTORS UNDERLYING THE ADOPTION OF NEW SAFETY TECHNOLOGIES BY U.S. COMMERCIAL MOTOR CARRIERS

Summary

New safety technologies for commercial motor vehicles have drawn increased awareness among carriers, shippers, insurers, and government in terms of the potential benefits of the technologies. In order to identify factors contributing to the adoption of new safety technologies, this survey explored the relationship between motor carrier organizational factors and the rate of safety technology adoption. The results of the survey provide insight into both the levels of adoption of specific types of safety technologies and how they are being adopted by motor carrier organizations of different types. The results indicate that the U.S. motor carrier industry is in the early stages of adopting most of the safety technology management dimensions that were the subject of the survey. The empirical evidence suggests that those firms with the organizational resources to adopt safety management technologies are initiating their adoption. For example, it is apparent that large firms operating over long distances are the leaders in safety technology adoption. Many of the firms surveyed reported that they had adopted at least three different types of safety technology.

Introduction

Commercial motor vehicle (CMV) safety on our Nation's highways, as measured by the large-truck-related fatality rate, has shown a slight but steady improvement in recent years. The Federal Motor Carrier Safety Administration (FMCSA) has a goal to reduce it by an additional 13 percent from the 2005 rate by 2011. Stakeholders in the motor carrier safety

environment recognize that current FMCSA and State commercial motor carrier safety and enforcement programs, though effective, will not in and of themselves be enough to have a significant and sustained impact on further reducing the large-truck-related fatality rate unless new actions are taken. There is general agreement in the transportation safety management community that development and deployment of truck safety technology will be essential to the achievement of permanent reductions in the number and severity of crashes involving CMVs. With this in mind, FMCSA and the University of Maryland (UMD) joined forces to examine technology adoption patterns in the commercial motor carrier industry.

Data collected during a 2005 FMCSA-sponsored national survey of the largest for-hire and private carriers suggest that, to varying degrees, motor carriers have embraced new technologies (such as new safety equipment) and devices (such as vehicle speed regulators and on-board computers). Those technologies are designed to assist the carriers in monitoring and communicating with drivers and their motor vehicles. A new FMCSA report, *Safety Technology Adoption Patterns in the U.S. Motor Carrier Industry*, examines the organizational factors that affect motor carriers' decisions to adopt new technologies. The full report is available on FMCSA's Analysis and Information (A&I) Online Web site at <http://ai.fmcsa.dot.gov>, under the Analysis Results and Reports tab.

Background

This Analysis Brief summarizes the results of a 2005 FMCSA-sponsored national survey of the Nation's largest for-hire and private carriers. This unique and comprehensive survey was developed and administered by researchers at UMD's Robert H. Smith School of Business, with technical assistance provided by FMCSA's Analysis Division and Division Administrators. The survey targeted the largest motor carrier

companies, because those are the firms most likely to have the financial resources needed for the adoption of new safety technologies.

For more than 10 years, FMCSA and UMD have collaborated on in-depth analyses of key aspects of the commercial motor carrier industry. The goal of those analyses has been to produce information that will lead to better, more informed decisionmaking and thereby improve the safety of large trucks and buses. The analyses have provided valuable insights into the financial, operating, and safety performance of the major segments of the motor carrier industry. The most recent have focused on the safety management practices of industry safety leaders.

Data Collection

A mail survey questionnaire was used to collect data for this analysis. It was developed on behalf of FMCSA by UMD researchers and distributed to key senior officials at 1,025 of the largest for-hire trucking companies in 47 of the 50 States. Before the distribution, FMCSA Division Administrators phoned either the Vice President or Director of Safety of each company that was to receive a questionnaire, to request participation in the study. Of the survey questionnaires that were mailed, 14 were undeliverable. In addition, 190 respondents formally declined to participate in the survey. The effective sample size was therefore 821. A total of 415 surveys were completed and returned to FMCSA, for an effective total response rate of 51 percent (415/821).

Firms responding to the survey included 37 with a local geographic scope of operation, 175 with a regional scope, 164 with a national scope, and 32 with a worldwide scope of operation. With respect to firm size (measured in terms of the firm's annual sales), 53 of the respondents had sales of \$10 million or less, 101 had sales of \$10 million to \$50 million, 98 had sales of \$50 million to \$200 million, and 110 had sales of \$200 million

or more. The responding firms included 52 with less-than truckload (LTL) operations, 179 with truckload operations, and 131 with both LTL and truckload operations.

The survey explored the adoption of 26 safety technologies in 5 main categories (Table 1):

(1) driver communication, (2) vehicle

communication, (3) driver performance and driver assistance and regulation, (4) vehicle performance and monitoring, and (5) vehicle maintenance. For each of the 26 safety technologies, respondents were asked to indicate the percentage of their firm's vehicles that were equipped with the technology.

Table 1

Motor Carrier Safety Technologies Explored in the Survey

Driver Communication Technologies	Vehicle Communication Technologies	Driver Performance and Driver Assistance/Regulation Technologies	Vehicle Performance and Monitoring Technologies	Vehicle Maintenance Technologies
<ul style="list-style-type: none"> Cellular telephones (with or without hands-free headsets) Computers with satellite connections (always on) Computers with wireless capabilities Handheld personal digital computers (PDAs) with wireless capabilities Mayday systems 	<ul style="list-style-type: none"> GPS systems Automatic collision notification (ACN) systems Automatic vehicle identification (AVI) systems 	<ul style="list-style-type: none"> On-board closed-circuit television cameras (CCTV) Electronic log books (software) Electronic on-board trip recorders (EOBR) Rear-vision television cameras Real-time traffic and weather notification systems (software) Route-guidance (directions) and dispatching systems (software) Vision enhancement technologies Fatigue management technologies Vehicle speed regulators 	<ul style="list-style-type: none"> Systems that enable management of the carrying and distribution of HAZMAT cargo Adaptive cruise control Obstacle detection systems Lane change or road departure warning systems Vehicle stability systems to prevent rollover crashes 	<ul style="list-style-type: none"> Real-time communication systems that transmit vehicle performance information from the truck to the company's vehicle dispatcher while the vehicle is in use Under-the-hood diagnostic tools, such as digital engine analyzers either in real time or on a scheduled basis On-board electronic vehicle management systems (EVMS) Automatic tire pressure gauges that provide computer readouts and monitoring

Results

Driver Communication Technologies

Driver communication technologies allow drivers to communicate with their dispatch centers in real time. As a result, driver safety can be enhanced, because drivers can report emergency situations and receive assistance in a timely manner. The survey results show that many firms have adopted driver communication technologies: 94 percent of the firms responding to the survey had at least some of their drivers using cellular telephones; 35 percent had computers with satellite connections; and 32 percent had computers with wireless capabilities on at least some of their equipment. Only 16 percent of the firms had mayday systems on at least some of their vehicles; however, 59 percent of those that did have mayday systems had all of their drivers equipped with the systems.

Vehicle Communication Technologies

Vehicle communication technologies, which are installed on the vehicles, are configured to provide real-time geographic and/or physical proximity information automatically to the drivers. They can enhance driver safety by enabling the carrier personnel to know their vehicles' locations in emergency situations. The survey results show that some firms have adopted vehicle communication technologies. More than 53 percent of the firms surveyed had adopted GPS systems in at least some of their vehicles. Only 9 percent of the firms had adopted automatic vehicle identification (AVI) systems, but among those that had, 39 percent had installed the systems on 100 percent of their vehicles. Automatic collision notification systems had been adopted by 4 percent of the firms, with those firms having, on average, 21 percent of their vehicle fleets covered by the systems.

Driver Performance and Driver Assistance/Regulation Technologies

Driver performance monitoring and driver assistance/regulation technologies are installed on vehicles for the purpose of improving driver performance. Some of these safety systems record driver performance, which enables the firms' safety managers to study the driving behavior of each driver. The survey results demonstrate that these technologies are being adopted. Vehicle speed regulators are the most widely adopted technology: 60 percent of the firms responding to the survey indicated that at least some of their vehicles had speed regulators installed. Next in acceptance, with 44 percent of the firms

indicating partial adoption, were on-board trip computers. For the firms reporting at least partial adoption of trip computers, an average of 71 percent of the vehicles in their fleets were equipped with the on-board devices. Third in acceptance were route-guidance and dispatching systems, with 24 percent of the firms having at least partial adoption. Among the sampled firms, 14 percent had at least partially adopted electronic log books, with the average fleet coverage being 47 percent.

Vehicle Performance and Monitoring Technologies

Vehicle performance technologies are installed on vehicles for the purpose of reducing the risk that the trucks will crash into obstacles or lose operational control. Additionally, some of these safety systems record vehicle performance, which then enables the firm to monitor and study the behavior of its physical systems. The survey results provide evidence that the motor carrier industry is in the early stages of adopting vehicle performance and monitoring technologies. Although only 10 percent of the firms had adopted some HAZMAT cargo monitoring systems, among those that had adopted the technology, 53 percent reported 100 percent fleet coverage. Similarly, 10 percent of the firms had adopted adaptive cruise control systems to some extent, and among those firms 24 percent reported full adoption.

Vehicle Maintenance Technologies

Vehicle maintenance technologies are installed on vehicles for the purpose of identifying mechanical problems that occur under normal operating conditions. Some of the systems also record vehicle equipment performance for future maintenance purposes. The results of the survey indicate that vehicle maintenance technologies are being adopted. Based on some adoption by firms in the survey, the electronic

vehicle management system (EVMS) was the most widely adopted technology system in this category, with 60 percent of the firms reporting at least some adoption. The next most widely adopted technologies in this category were under-the-hood diagnostic tools (52 percent) and real-time communication systems (23 percent). Among the firms that had adopted some EVMS safety technologies, more than 49 percent reported full adoption of the systems.

Implications

The 2005 FMCSA-sponsored survey described in this Analysis Brief examined the current levels of adoption of new motor carrier safety technologies by the largest carriers in the United States. The results can assist managers, as well as small and medium-sized carriers, in understanding which motor carrier safety technologies currently are being adopted by the largest carriers. In addition, FMCSA's Office of Research and Analysis has a broader research program that is actively examining the cost-effectiveness of deploying several types of onboard safety technologies.

Additional Information

Additional information on the Office of Research and Analysis and its research program to examine the cost-effectiveness of deploying onboard safety technologies is available on FMCSA's main Web site at <http://www.fmcsa.dot.gov/facts-research/facts-research.htm>.

This Analysis Brief summarizes the major findings of the UMD report, *Safety Technology Adoption Patterns in the U.S. Motor Carrier Industry*, which is available on FMCSA's A&I Online Web site under the Analysis Results and Reports tab, at <http://ai.volpe.dot.gov/CarrierResearchResults/CarrierResearchContent.asp>. The following industry profile reports also are available from the A&I Online site:

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- *Motor Carrier Safety Performance Profile*, FMCSA-RI-04-025 (February 2004), <http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/MCSafPerfProfile.pdf>. Provides a summary of the safety performance of carriers across all the individual segments in the industry. Includes summaries for both for-hire and private carriers in each segment, drawn from measures that are collected as part of FMCSA's SafeStat system.
- *Best Highway Safety Practices: A Survey About Safety Management Practices Among the Safest Motor Carriers* (March 2003), <http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/BestHighwaySafetyPractices.pdf>. Examines the safety management practices of the motor carrier industry's safety leaders. Documents the results of a survey of best highway safety practices that was sent out to motor carriers, with approximately 150 responses received.
- *Motor Carrier Industry Profile: An Update 2004-2005*, FMCSA-RI-06-042 (August 2005), http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/Motor_Carrier_Industry_Profile_Update_2004-2005-final.pdf. Identifies trends and major events in the trucking industry during 2004 and 2005.
- *Motor Carrier Safety Profile Study: Financial and Operating Performance Profiles by Industry Segment, 2001-2002*, FMCSA-RI-04-026 (September 2004), <http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/FMCSA-RI-04-026.pdf>. Profiles the motor carrier industry and its significant operating segments.
- *Motor Carrier Industry Profile: Linkages Between Financial and Safety Performance Among Carriers in Major Industry Segments*, FMCSA-RI-02-009 (October 2002), http://ai.volpe.dot.gov/CarrierResearchResults/PDFs/FMCSA_RI_02_009.pdf. Investigates the relationship between a carrier's safety performance and its financial performance; whether financial performance of a firm has an impact on carrier safety performance; and whether carriers with financial problems have safety performance records that differ significantly from those of carriers without financial problems.

The goal of the Federal Motor Carrier Safety Administration (FMCSA) is to reduce the number and severity of crashes involving large trucks and buses through more commercial motor vehicle and operator inspections and compliance reviews, stronger enforcement measures against violators, expedited completion of rulemaking proceedings, scientifically sound research, and effective CDL testing, recordkeeping, and sanctions.

The Office of Research and Analysis manages agency-wide research, technology, and data analysis programs and studies that will improve safety and security and reduce the number and severity of commercial motor vehicle crashes.

This Analysis Brief was produced by the Analysis Division in FMCSA's Office of Research and Analysis. The division analyzes motor carrier data pertaining to crashes, inspections, compliance reviews, and drug and alcohol testing, and supports research on the effectiveness of FMCSA inspections and compliance review programs.

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