

Safety Impacts of Speed Limiter Device Installations on Commercial Trucks and Buses

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CTBSSP SYNTHESIS 16

**Safety Impacts of Speed
Limiter Device Installations
on Commercial Trucks and Buses**

A Synthesis of Safety Practice

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Operations and Safety and Freight Transportation

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COMMERCIAL TRUCK AND BUS SAFETY SYNTHESIS PROGRAM

Safety is a principal focus of government agencies and private-sector organizations concerned with transportation. The Federal Motor Carrier Safety Administration (FMCSA) was established within the Department of Transportation on January 1, 2000, pursuant to the Motor Carrier Safety Improvement Act of 1999. Formerly a part of the Federal Highway Administration, the FMCSA's primary mission is to prevent commercial motor vehicle-related fatalities and injuries. Administration activities contribute to ensuring safety in motor carrier operations through strong enforcement of safety regulations, targeting high-risk carriers and commercial motor vehicle drivers; improving safety information systems and commercial motor vehicle technologies; strengthening commercial motor vehicle equipment and operating standards; and increasing safety awareness. To accomplish these activities, the Administration works with federal, state, and local enforcement agencies, the motor carrier industry, labor, safety interest groups, and others. In addition to safety, security-related issues are also receiving significant attention in light of the terrorist events of September 11, 2001.

Administrators, commercial truck and bus carriers, government regulators, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and undervalued. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information available on nearly every subject of concern to commercial truck and bus safety. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the commercial truck and bus industry, the Commercial Truck and Bus Safety Synthesis Program (CTBSSP) was established by the FMCSA to undertake a series of studies to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern. Reports from this endeavor constitute the CTBSSP Synthesis series, which collects and assembles the various forms of information into single concise documents pertaining to specific commercial truck and bus safety problems or sets of closely related problems.

The CTBSSP, administered by the Transportation Research Board, began in early 2002 in support of the FMCSA's safety research programs. The program initiates three to four synthesis studies annually that address concerns in the area of commercial truck and bus safety. A synthesis report is a document that summarizes existing practice in a specific technical area based typically on a literature search and a survey of relevant organizations (e.g., state DOTs, enforcement agencies, commercial truck and bus companies, or other organizations appropriate for the specific topic). The primary users of the syntheses are practitioners who work on issues or problems using diverse approaches in their individual settings. The program is modeled after the successful synthesis programs currently operated as part of the National Cooperative Highway Research Program (NCHRP) and the Transit Cooperative Research Program (TCRP).

This synthesis series reports on various practices, making recommendations where appropriate. Each document is a compendium of the best knowledge available on measures found to be successful in resolving specific problems. To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, available information assembled from numerous sources, including a large number of relevant organizations, is analyzed.

For each topic, the project objectives are (1) to locate and assemble documented information; (2) to learn what practice has been used for solving or alleviating problems; (3) to identify all ongoing research; (4) to learn what problems remain largely unsolved; and (5) to organize, evaluate, and document the useful information that is acquired. Each synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation.

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Each year, potential synthesis topics are solicited through a broad industry-wide process. Based on the topics received, the Program Oversight Panel selects new synthesis topics based on the level of funding provided by the FMCSA. In late 2002, the Program Oversight Panel selected two task-order contractor teams through a competitive process to conduct syntheses for Fiscal Years 2003 through 2005.

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FOREWORD

Administrators, commercial truck and bus carriers, government regulators, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and underevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

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The CTBSSP, administered by the Transportation Research Board, was authorized in late 2001 and began in 2002 in support of the FMCSA's safety research programs. The program initiates several synthesis studies annually that address issues in the area of commercial truck and bus safety. A synthesis report is a document that summarizes existing practice in a specific technical area based typically on a literature search and a survey of relevant organizations (e.g., state DOTs, enforcement agencies, commercial truck and bus companies, or other organizations appropriate for the specific topic). The primary users of the syntheses are practitioners who work on issues or problems using diverse approaches in their individual settings.

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For each topic, the project objectives are (1) to locate and assemble documented information; (2) to learn what practices have been used for solving or alleviating problems; (3) to identify relevant, ongoing research; (4) to learn what problems remain largely unsolved; and (5) to organize, evaluate, and document the useful information that is acquired. Each synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation.

PREFACE

*By Donna Vlasak
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This synthesis examines and summarizes literature and industry information relating to speed limiters; exploring questions concerning measurable safety impacts, metrics, and degree of benefit, if any. Speed limiters, also described as speed governors, are devices that interact with a truck engine to only permit the attainment of a pre-programmed speed. The purpose is to synthesize data, research, and analyses performed to date in terms of both methodologies employed to assess speed limiters and the actual results, which may be used to guide policy development in North America. The scope of the project encompassed an assessment of the safety efficacy of speed limiters, for commercial motor vehicles in Aus-

tralia and Europe, as well as in North America and, in addition, for commercial vehicle operations, surveyed truck and intercity and charter bus carriers, that have experience in using speed limiters regarding perceived benefits and/or drawbacks. It is noted that, although this synthesis provides a general understanding of speed limiter use in commercial motor vehicle operations, it does not provide a methodological comparison of before-and-after results applied uniformly across predefined truck and bus fleet operations. An approach to an in-depth empirical study that would gather data from the commercial truck and bus industry with regard to the safety effectiveness of speed limiters is suggested.

A primary (small population convenience) survey that targeted fleet safety managers within specific companies, representing roughly 400 truck and motor coach fleets plus other industry stakeholders, was administered to obtain additional insight from actual users as to speed limiter usage levels and perceived benefits and drawbacks of speed limiters. Fifteen hundred synthesis surveys were distributed and 103 responses were received, for a response rate of approximately 7%.

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SAFETY IMPACTS OF SPEED LIMITER DEVICE INSTALLATIONS ON COMMERCIAL TRUCKS AND BUSES

SUMMARY Speed limiters, also described as speed governors, are devices that interact with a truck engine to only permit the attainment of a pre-programmed maximum speed. For more than a decade they have been used in Europe and Australia to limit the speed of large trucks, and are widely available in the United States on late model and new Class 8 trucks. Many truck fleets use speed limiters both for their safety contribution and to reduce fuel use and tire wear, with the speed set at a level optimum for these factors.

From a safety perspective, the premise is that the slowing down of large trucks may result in lower travel risks for all motorists, reducing collisions and mitigating the severity of collisions that do occur. The counter-argument is that safety can be compromised, in that speed-limited vehicles cannot accelerate to avoid traffic conflicts (for instance, in merging situations) and the slower speed of these vehicles relative to the surrounding traffic creates speed differentials that have been correlated with increased crash risk.

It is desirable, therefore, to synthesize and examine existing literature and industry information relating to speed limiters. Are there measurable safety impacts? If so, what are the metrics? What is the degree of benefit, if any? With these questions in mind, the CTBSSP initiated this project to synthesize data, research, and analyses performed to date in terms of both the methodologies employed to assess speed limiters and the actual results, which may be used to guide policy development in North America.

The scope of the project encompasses data and analyses that assess the safety efficacy of speed limiters for commercial motor vehicles in Australia, Europe, and North America. The objectives of this synthesis are to document current knowledge and state of practice for speed limiters in commercial vehicle operations and to survey truck and intercity and charter bus carriers who have experience in using speed limiters regarding perceived benefits and/or drawbacks.

Note that the response rate of the current survey was approximately 7% (103 out of 1,500 fleet safety managers completed the survey). The survey can best be described as a small population convenience survey of the commercial motor vehicle industry; as such, the results may not be representative and should be interpreted with this in mind.

Almost 56% of respondents indicated speed limiters were either “successful” or “very successful” in reducing crashes. In operational terms, speed limiter users believed that limiters were either “successful” or “very successful” in reducing tire wear (44%) and increasing fuel economy (76%). Almost 96% of respondents indicated speed limiters did not negatively affect safety or productivity.

The survey queried whether speed limiters result in drivers driving faster in speed zones below the speed limiter set speed to “make up time.” Survey results supported this view, with 88% of survey respondents reporting that this was most likely occurring. Generally, respondents saw this as relating more to driver habits than to speed limiters directly. Driver attitudes towards speed limiters were largely neutral (64%), with 23% positive. Recognizing the seriousness of the ongoing driver shortage, it is also noteworthy that 77% see the impact of speed limiters on driver hiring and retention as neutral.

INTRODUCTION

BACKGROUND AND PROBLEM STATEMENT

Speed limiters (also described as speed governors) are devices that interact with a truck engine to only permit the attainment of a pre-programmed maximum speed. They have been used in Europe and Australia for more than a decade to limit the speed of large trucks and are currently widely available in the United States on late model and new Class 8 trucks. Many truck fleets use speed limiters for their safety contribution as well as to reduce fuel use and tire wear, with the speed set at a level optimum for these factors.

From a safety perspective, the premise is that by slowing down large trucks the travel risks for all motorists may be lowered by reducing the number of collisions and mitigating the severity of those that do occur. The counter-argument is that safety can be compromised because speed-limited vehicles cannot accelerate to avoid traffic conflicts (e.g., in merging situations), and the slower speed of these vehicles relative to the surrounding traffic creates speed differentials that have been correlated with increased crash risk.

As described in the body of this report, there is controversy within the trucking industry as to the safety effectiveness of speed limiters. This controversy has been heightened by an initiative to mandate the use of speed limiters in Ontario, as well as the other Canadian provinces, and the active advocacy of a speed limiter mandate in the United States by the ATA and other organizations. The NHTSA is currently evaluating responses to a Request for Comments on such a mandate.

With this in mind, the CTBSSP initiated this project to synthesize data, research, and analyses performed to date in terms of both the methodologies employed to assess speed limiters and the actual results, which may be used to guide policy development in North America. This synthesis can also provide a foundation for further developments in the application of speed limiters to commercial vehicle operations. In addition to synthesizing previous studies, a convenience survey of trucking industry stakeholders was completed within the project to gain a qualitative view of speed limiter use, adverse consequences, and perceived effectiveness in safety, fuel efficiency, and tire wear.

OBJECTIVES AND SCOPE

The project scope encompasses studies assessing the safety effectiveness of speed limiters for commercial motor vehicles

(CMVs) in Australia, Europe, and North America. The objectives of this synthesis are to document current knowledge and state of practice for speed limiters in commercial vehicle operations and to survey truck and intercity and charter bus carriers who have experience in using speed limiters regarding perceived benefits and/or drawbacks. The synthesis also identifies additional research needed to better understand key questions with regard to the safety benefits of speed limiters.

APPROACH

The first step in the study was an extensive literature review to identify previous studies on this topic. The results of the literature review were assimilated to address the core question of what might be learned from such earlier work, as well as the methodology and validity of reported results. This process provided a foundation for designing a survey of trucking industry professionals addressing key speed limiter issues. These tasks led to the formulation of conclusions and potential next steps.

In early 2007, before the beginning of this CTBSSP project, the American Transportation Research Institute (ATRI) independently initiated a review of speed limiters, including a review of related safety studies and a survey of motor carriers. The synthesis team coordinated its efforts with ATRI and incorporated relevant information and survey results to maximize commercial truck carrier response and avoid duplicative efforts (McDonald 2007).

A further source of perspective and insight in the overall process was provided by reviews of the preliminary results by the TRB CTBSSP Program Panel.

Literature Review

The Study Team performed an extensive literature search to identify information available on the safety impacts of speed limiters installed on commercial vehicles and/or buses, emphasizing commercial vehicle operations in North America, Europe, and Australia.

A search process for the literature review was conducted using a variety of online databases and search engines. Major information sources for the literature review included:

- FMCSA research publications
- ATRI and other industry research and information publications

- Traffic safety research literature (e.g., *Accident Analysis & Prevention*)
- Industrial safety management literature (*Journal of Safety Research, Journal of Organizational Behavior Management, Professional Safety, Occupational Health & Safety*)
- Proceedings of the American Society of Safety Engineers
- Proceedings of the Transportation Research Board
- Transportation Research Information System
- Trade publications
- Web pages relating to CMV transportation safety.

In addition to these searches of academic literature and other publications, the synthesis team contacted government agencies (both foreign and domestic), as well as trade associations, state motor carrier organizations, and academic resources, seeking information on unpublished speed limiter studies. Specifically, they were queried as to past and current applications, programs, and studies involving the use of speed limiters; further, these contacts were asked to provide guidance on any other speed limiter safety effectiveness studies. See Appendix A for the full list of organizations contacted.

Commercial Vehicle Industry Survey

A survey targeting fleet safety managers was developed based on issues identified in the literature review with the core objective of gaining additional insight as to usage levels and perceived benefits and drawbacks of speed limiters from actual users. Several outside safety experts were included in the survey to gain additional perspective. The written survey was distributed by e-mail to approximately 1,500 individuals (including multiple safety managers within specific companies), representing roughly 400 truck and motor coach fleets plus other industry stakeholders.

As will be discussed in chapter three, the written survey addressed topics such as fleet size, type of fleet operation, use of speed limiters (number of vehicles, how long, etc.), operational aspects (set top speeds, driver violations or tampering), fleet assessment of safety benefit, operational impacts (speeding citations, fuel savings, slower/fewer deliveries, etc.), driver response, and overall experience with speed limiters.

The written survey was designed to collect core information and provide guidance on follow-up telephone interviews with a small number of select fleet safety personnel with detailed knowledge of speed limiters. The written survey results were analyzed to identify core speed limiter issues, which were the focus of the telephone surveys.

For surveying fleet safety managers, the synthesis team followed the successful model used in prior CTBSSP studies by members of the synthesis team. The initial contacts included past CTBSSP survey respondents, who may be characterized

as safety-conscious fleet safety managers from many CMV transport operations types [e.g., truckload, less-than-truckload (LTL), and private]. Additional safety managers were identified based on collected information and through industry contacts (i.e., trade associations and carrier contact lists provided by ATRI). To enhance the survey process, the respondents were offered a free copy of the project final report. This was seen as critical to obtaining an adequate respondent sample and also served the primary aim of the CTBSSP—to disseminate relevant findings and products and promote program visibility within the CMV industry.

ORGANIZATION OF THE REPORT

Chapter one provides a brief overview of the project, including the problem statement, scope, objectives, and approach. The chapter also discusses a primary survey that targeted fleet safety managers to obtain additional insight as to usage levels and perceived benefits and drawbacks of speed limiters from actual users.

Chapter two describes the findings of the literature review, including the assessment of prior published studies regarding speed limiter use, effectiveness, and legislation. Although several key findings are identified, the literature search revealed a paucity of relevant published research on how speed limiters directly affect safety and driving behavior. The most definitive results on the effectiveness of speed limiters comes from the United Kingdom, which showed that the crash involvement rate for speed-limited heavy trucks fell 26% between 1993 (when mandated) and 2005. U.K. authorities noted that other contributing factors may have influenced the decline, but concluded that speed limiters at least played a significant role. The chapter also proffers the advantages and disadvantages of speed limiters as described in the literature. Positive impacts primarily focus on safety and fuel efficiency. Concerns raised in the literature against using speed limiters include a lack of a consistent set speed across North America and the inability of a speed-limited vehicle to accelerate in risky traffic scenarios.

Chapter two also reviews the current utilization of limiters from multiple-user and non-user perspectives. Industry perspectives on using speed limiters were illuminated by two surveys found in the literature. An OOIDA Foundation (Owner–Operators Independent Drivers Association) survey reported that more than 81% of respondents would rather drive for a company without speed limiters; with the drivers' primary concern with speed limiters being the lack of passing speed. An ATRI survey found overall installation rates of speed limiters at 63% for motor carriers, which are comparable to rates identified in the OOIDA study. ATRI found it difficult to meaningfully compare fleet safety data before and after speed limiter installation owing to the small number of carriers that provided empirical safety data.

Chapter three presents the results of the Study Team's primary survey and interviews with key safety managers. The survey addressed topics such as fleet size, type of fleet operation, use of speed limiters, operational aspects (set top speeds, driver violations or tampering), fleet assessment of safety benefit, operational impacts (speeding citations, fuel savings, slower or fewer deliveries, etc.), driver response, and overall experience with speed limiters. Note the response rate of the current survey was approximately 7% (103 of 1,500 fleet safety managers completed the survey). The survey can best be described as a small population convenience survey of the commercial motor vehicle industry; as such, the results should not be considered definitive and should be interpreted with this in mind. It is not known whether the survey

responses are representative of the overall trucking and motor coach industry.

Chapter four draws conclusions from the results, identifies gaps in our current knowledge, and offers potential steps for future research initiatives. The current synthesis provides a preliminary understanding of speed limiter use in CMV operations; it does not provide, however, a methodological comparison of before and after results applied uniformly across predefined truck and bus fleet operations. This final chapter outlines an approach to an in-depth empirical study that would harvest data from the commercial truck and bus industry with regard to the safety effectiveness of speed limiters.

RESULTS OF LITERATURE REVIEW

The objectives of the literature review include:

- Addressing truck safety with an emphasis on the role of speed,
- Examining the asserted benefits and issues associated with speed limiters,
- Reviewing policy initiatives relating to speed limiters mandates,
- Highlighting key industry policy positions, and
- Analyzing the effectiveness of speed limiters in terms of published studies and industry surveys.

SPEED AND CRASHES

Background

In 2006, 385,000 large trucks (gross vehicle weight greater than 10,000 lb) were involved in traffic crashes in the United States; 4,932 of these crashes involved a fatality. Within this population, a total of 4,995 people died and an additional 106,000 people were injured. Large trucks account for 3% of all registered vehicles, 8% of total vehicle miles traveled, 8% of all vehicles involved in fatal crashes, and 4% of all vehicles involved in injury and property-damage-only crashes. One out of eight traffic fatalities in 2006 resulted from a collision involving a large truck (2006 *Traffic Safety Facts* 2008).

These statistics should be put in perspective, relative to the overall safety performance of truck drivers. Although the statistical data does not provide a definitive answer on the relative safety impact of CMVs and the role of truck driver responsibility in crashes, several analyses concluded that the majority of truck drivers are safe, with a minority of truck drivers being responsible for a disproportionate number of safety violations and crashes (Hickman et al. 2005). Independent of these data, there is a public perception that the trucking industry is not as safe as it should be. The data that can be analyzed indicate that truck drivers have lower crash rates per million vehicle miles traveled than light vehicle drivers (*Traffic Safety Facts 2003 2004*). Nonetheless, light vehicles are extremely vulnerable when they interact with trucks because trucks often weigh 20 to 30 times as much as light vehicles (Insurance Institute for Highway Safety 2002) and trucks require 20% to 40% more stopping distance than do light vehicles (*Heavy Truck Safety Study* 1987). This is best illustrated by the statistic that more than three-fourths of multiple-vehicle fatal crashes

involving large trucks result in the occupant(s) of the other vehicle being killed (*Traffic Safety Facts 2003 2004*). Because of the higher mileage-related crash exposure of trucks and the higher relative crash costs associated with large truck collisions, there is a premium on making trucks, and truck drivers, as safe as possible. Annual average crash costs are more than four times greater for a tractor-trailer (\$88,483 in 2000 dollars) than for a passenger car (Wang et al. 1999; Zaloshnja and Miller 2004).

Speed and Crashes

The relationship between increased speed and crashes has been well documented (Stuster et al. 1998), with the key correlation being speed and crash severity. Excessive speeding by drivers decreases a driver's response time in an event and may increase risk as a result of speed-related increases in crash exposure. As cited by NHTSA in *Traffic Safety Facts 2003*: "Speeding reduces a driver's ability to steer safely around curves or objects in the roadway, extends the distance necessary to stop a vehicle, and increases the distance a vehicle travels while the driver reacts to a dangerous situation" (2005, p. 1). Impact force during a vehicle crash varies with the square of the vehicle speed; therefore, even small increases in speed have large and lethal effects on the force at impact (Roads and Traffic Authority 2005). The FMCSA (2005 *Large Truck Crash Overview* 2007) reported that "speeding" (exceeding the speed limit or driving too fast for conditions) was a factor in 22% of the fatal large truck crashes. The recently completed Large Truck Crash Causation Study estimated that 22.9% of all large truck crashes and 10.4% of large truck/passenger car crashes could be coded as *traveling too fast for conditions* (*Report to Congress . . .* 2006).

The risk associated with vehicle speed is illustrated by the estimated annual savings of 2,000 to 4,000 lives as a result of the nationwide reduction in the highway speed limit to 55 mph in 1974 (Waller 1987). When the national speed limit was later raised to 65 mph, the occurrence of vehicle crashes showed a marked increase (Evans 1991). A recent analysis by Patterson et al. (2002) of the repeal of the National Maximum Speed Limit in 1996 supported Evan's (1991) data. Patterson et al. (2002) found that 23 states had raised their rural Interstate speed limits to 70 or 75 mph and modeled the number of vehicular fatalities on rural Interstates from 1991 to 1999 against the new speed limits in these states (e.g., 75 mph, 70 mph, or no

change). Vehicular fatalities in the group of states that had raised their speed limits to 75 mph and 70 mph were higher than expected as compared with fatalities in the states that did not change their speed limits.

Similarly, a rigorous meta-analysis conducted by Elvik et al. (2004) included 97 different studies with a total of 460 estimates of the relationship between changes in speed and changes in the frequency of crashes or associated injuries and fatalities. Using the Power Model, this study assessed the relationship between speed and road safety. The study concluded there was a relationship between speed and the number of crashes and the severity of crashes. The data suggest that speed is likely to be the single most important determinant in the frequency of traffic fatalities; a 10% reduction in the mean speed of traffic is likely to reduce fatal traffic crashes by 34% and have a greater impact on traffic fatalities than a 10% increase in traffic volume. These data include all vehicles and are not specific to large trucks.

While traveling above the posted speed limit or driving too fast for conditions has been shown to increase crash exposure (i.e., risk), speed variance among vehicles sharing the same road has also been shown to be correlated with vehicular crash risk. Lower speed variance is associated with fewer crashes (Finch et al. 1994; Kallberg and Toivanen 1998). Compliance with speed limits decreases speed variability among vehicles, which is associated with decreases in the frequency of road collisions and the severity of bodily injury (*NCHRP Special Report 204* . . . 1984; Waller 1987). Vehicles traveling the same speed have fewer interactions and make fewer lane changing and decelerating maneuvers in response to other vehicles. This has been shown to decrease interactions between vehicles thereby reducing crash risk.

Speeding Trends by Truck Drivers

Insurance Institute for Highway Safety (IIHS) (“Institute Supports Speed Limiters . . .” 2007) concluded that truck speeds are increasing on rural Interstates (pp. 5, 7):

In New Mexico, where the speed limit for trucks is 75 mph, the proportion of large trucks exceeding 70 mph increased from 27% in 1996 to about 43% in 2006. The percentage exceeding 75 mph more than doubled, rising from 4% to 10%. Truck speeds also increased substantially in Nevada, which has 75 mph speed limits on rural interstates. The proportion of trucks traveling faster than 70 mph increased from 29% in 1996 to 41% in 2006. During the same decade, the proportion of trucks topping 75 mph jumped from 8 to 14%.

The IIHS nationwide survey (“Institute Supports Speed Limiters . . .” 2007) indicated that 64% of drivers favor a speed limiter requirement for large trucks. More than three-quarters of respondents who favored speed limiters supported a maximum speed limit below 70 mph. More than 80% of drivers reported that speeding on Interstate highways and free-

ways was a safety problem, whereas 40% of drivers reported that speeding was a “big” safety problem.

COUNTERMEASURES TO SPEED-RELATED CRASHES

It is evident from the literature that inappropriate speed is a contributor to crashes; however, traditional approaches to reducing drivers’ speed behavior have been somewhat ineffective. Enforcement, education, and training are the traditional and most widely used strategies for speed management. Although these secondary, and in some cases reactive, approaches can be effective to a certain extent, it may be more effective to directly control the vehicle’s speed.

Commercial Vehicle Speed Limitation in Europe

The first European Union (EU) legislation requiring speed limiters was adopted in 1992 for large vehicles and extended to smaller commercial vehicles in 2002. There is now a single standard for all trucks of more than 3.5 tons and a single standard for all coaches of more than nine seats (J.-P. Repussard, Directorate General Energy and Transport, Unit E3—Road Safety, European Commission, personal communication, Dec. 2007).

According to the European Commission (*Report from the Commission* . . . 2001), speed limiters were introduced to improve safety and reduce environmental effects. The regulation was based on the following arguments:

- Heavy commercial vehicles and motor coaches are equipped with large engines to provide them with sufficient power to ascend uphill slopes when loaded; however, when not loaded or descending, the vehicles’ power output capability may be greater than that needed to operate safely and if unrestricted could pose an excessive risk to vehicle performance in braking or tire performance.
- Lower speed results in fewer road crashes and fewer casualties on roads.
- Lower speed means reduced fuel consumption and vehicle emissions.
- Driving at lower speed causes less wear and tear on the engine, brakes, and tires, thereby indirectly improving road safety and environmental performance.

Speed Limiters in Commercial Vehicles

Speed limiter devices have been around for decades. Virtually all Class 8 tractors now come factory-equipped to limit speeds by means of a menu-programmable interface that can be code-protected to resist tampering by drivers. After-market speed limiter devices exist as well. Recent technological advances have allowed for the application of information technology and modern communications to provide greater

flexibility and broader possibilities to manage speed even in changeable situations (e.g., adverse weather conditions and different posted speed limits) (Varhelyi and Makinen 2001).

A 2006 study by Cantor et al. investigated the adoption of safety technologies among the largest trucking firms in the United States. The study targeted the largest for-hire motor carriers as the authors believed these operations had the greatest financial resources to adopt emerging safety technologies. A total of 415 surveys were completed and returned; of these, 60.4% reported adopting vehicle speed limiters in their fleets. The responding firms included 52 LTL operations, 179 with truckload operations, and 131 with both LTL and truckload operations. Thus, the study indicated wide adoption of speed limiters among the largest for-hire trucking fleets.

In 1991, NHTSA's Commercial Motor Vehicle Speed Control Safety Report to Congress discussed devices available to control truck speed and their application in commercial fleet settings. The report was supportive of fleet applications of speed-monitoring and speed-limiting devices, but concluded that "there was not sufficient justification to consider requiring all heavy trucks to be so equipped. Problem size statistics suggested that the number of target crashes was low; for example, approximately 30 fatal crash involvements per year for combination-unit trucks. This small crash problem size, together with uncertainties regarding the potential for crash reduction, suggested that the benefits of mandatory speed limitation were questionable."

Beginning in 1992, heavy vehicles in the United Kingdom were required to use speed limiters. According to Hagggar (R. Hagggar, U.K. Department for Transport, personal communication, Nov. 2007) they found the introduction of speed limiters correlated with a significant reduction in the crash rate, as follows:

When requirements for goods vehicles over 7.5 tons were introduced in the early 1990s the criticism was leveled that more vehicles travelling on motorways at the same maximum speed would reduce not improve safety. In fact this was not the case. The accident involvement rate on motorways (per hundred million vehicle kms) for all heavy goods vehicles (HGVs) increased from 18.5 in 1993 to 18.8 in 2005—a 2% increase. This is significant, because traffic increased by 36% over the same period. These figures include accidents involving HGVs between 3.5 and 7.5 tons which were not (in 2002) required to be fitted with a speed limiter. The reduction in accidents for exclusively speed limited vehicles was significant. All articulated HGVs were speed limited after 1993 and the accident involvement rate for that vehicle class fell from 40 (per hundred million vehicle kms) in 1993 to 30 in 2005—a 26% decrease. Other contributing factors may also have influenced that decline but speed limiters have apparently played a significant part.

Speed Limitation in Passenger Cars

Speed limitation in passenger cars has received significant attention, particularly in Europe. Prior studies were examined to identify areas of relevance to speed limitation in CMVs.

Comte et al. (2000) surveyed passenger car drivers' attitudes with regard to speed limiters and found that respondents believed enforcement was more acceptable than speed limiters because it targeted those who excessively break the speed limit. However, they also indicated that enforcement was costly and ineffective and rated speed limiters as the most effective means for reducing speed.

The concept of intelligent speed adaptation (ISA) for passenger cars has been studied extensively in Europe. These activities are reviewed in *Intelligent Vehicle Technology and Trends* (Bishop 2005), a comprehensive study describing active safety systems activities worldwide, including ISA developments, forming the basis for the following review. The research for the book was based on project publications and discussions with project officials.

ISA calls for vehicles to be "aware" of the prevailing speed limit on roads and (at minimum) provide feedback to the driver when that speed is being exceeded or (at maximum) limit the vehicle's speed to comply with the speed limit. When ISA first entered the intelligent vehicle (IV) scene, it was considered an outrageous idea by those who saw the driver's authority over speed as untouchable. At the same time, road safety experts were convinced that, if speeds were moderated, road fatalities would decrease. The concept that has gradually gained currency in Europe is of an advisory system that provides insistent feedback to the driver when the speed limit is being exceeded. A strong motivator for such a system has come from increased enforcement of speed limits (and stiff speeding fines) over much of Europe (notably France), such that drivers are more likely to welcome a system that helps them avoid severe penalties. A brief review of ISA projects and applications in Europe is provided here.

Sweden

Sweden pioneered the development and testing of systems to electronically assist drivers in maintaining the posted speed limit. The Swedish Road Administration (SRA) has been at the forefront of research aimed at reducing speeding as part of its Vision Zero initiative to completely eliminate road fatalities. SRA conducted a major research initiative from 1999 to 2002 in the cities of Umea, Borlange, Lidkoping, and Lund. Approximately 5,000 ISA-equipped vehicles were driven by 10,000 drivers. The purpose of the research was to study driver attitudes and use of the ISA systems, road safety, and environmental impacts, and define conditions for large-scale deployment of ISA.

Using roadside transponders and global positioning systems (GPS)/digital map techniques, the research team implemented provision of posted speed limit information and over-speed warning functions. An active accelerator pedal was used to communicate speed information to drivers. As a result of the

test deployments, speed violations were reduced. The results suggest that better road safety was achieved without lengthening travel times and ISA had an overall positive effect on the surrounding traffic. The results also showed that if every vehicle was equipped with ISA, a 20% reduction in serious road injuries could be achieved. Although user acceptance was high, most users thought ISA should be mandatory so that ISA-equipped cars did not “stand out” in the traffic stream by traveling at a slower (although speed-limit compliant) speed. SRA is currently developing new measures, such as instituting regulations for ISA, equipping the Swedish government vehicle fleet with ISA and encouraging private fleets to adopt ISA as a component of “Quality Assured Transport.”

According to Svedlund (2007), it is more advantageous when ISA is introduced fleet-wide rather than in individual private cars. The advantages of fleet-wide implementation of ISA include:

- Economic incentives: lower speeds result in less fuel consumption and lower maintenance costs.
- Existing policies: compliant speeds can easily be adopted naturally into company policy.
- Mapmaking: some carriers are route-bound such that it is not necessary to find speed limit maps covering a larger area.
- Easier to integrate technology: this target group already has the equipment to a much larger extent than private drivers, such as a communication infrastructure, positioning, and maps for fleet management.
- Incentives to maintain the equipment: the benefits provided by ISA compel commercial operators to adequately maintain their equipment as compared with personal car owners.
- Greater willingness to pay: early, non-mass production systems are too expensive for private users. Commercial companies can see the system benefits sufficiently to invest in the systems.
- Goodwill: statements of intent by transport companies declaring their non-tolerance toward drugs, alcohol, and reckless driving will, in combination with the use of alcolocks and ISA, clearly improve their image as a reliable business.
- Monitoring: ISA systems can generate statistics useful for driver monitoring.

Since the full-scale trial, Sweden has been working on a strategy for large-scale implementation of ISA. Part of their strategy focuses on the national quality-assured transport project, which helps transport providers and purchasers to provide quality-assured transportation from a road safety and environmental perspective. The initiatives undertaken by the SRA are intended to contribute to creating a market demand for safe and environmentally sound transports. Key focus areas are speed, alcohol and drugs, seat belts, safe vehicles, and harmful emissions. Svedlund (2007) reports that the ISA

market is growing, with more than 1,000 systems installed thus far.

France

The French government conducted ISA experimentation and assessment to better understand driver acceptance and effects on driving behavior in a project called LAVIA: The French Project of Adaptive Speed Limiter. The key objectives of the LAVIA (Limiter Adjusting to the Authorized Speed) project, which was completed in 2006, were:

- Assess user acceptance and usage patterns for ISA with several different functional approaches,
- Assess changes in individual driving behavior,
- Measure the reductions of speed or gaps with regard to the speed limits,
- Measure system impacts on speed limit compliance as well as any detrimental effects (e.g., reduced vigilance), and
- Assess through simulation the global collective impacts on safety using field testing data.

A vehicle equipped with LAVIA identified the posted speed limit at any time within the region designated for the experiments. The authorized speed was encoded in an enhanced digital map for every road within the defined area and location referencing was used to correlate the vehicle’s location with the posted speed limit on the road being traveled. The project made use of manual speed limiter devices already in production by Renault and PSA Peugeot Citroën.

The speed limit information was used by the on-board controller to provide three different types of driver assistance:

- Advisory system: the system was activated at the driver’s option. When enabled, a warning was displayed on the dashboard if the speed limit was exceeded.
- Voluntary active system: the system was activated at the driver’s option. However, when activated, the throttle was under LAVIA control and the speed limit could not be exceeded.
- Mandatory active system: the system was always active, with the throttle under LAVIA control. The speed limit could not be exceeded.

A fleet of 20 vehicles equipped with LAVIA were assigned to 100 drivers in the Paris area for normal usage in a radius of 200 km around their homes. Thus, many different road types and substantial variation in posted speed limits were encountered. Bishop (2005) reported results from the LAVIA project. A questionnaire of 1,000 drivers assessed driver’s opinions toward speed, safety, and speed limiters. Although there was broad agreement with the idea of ISA, only 31% of respondents favored having ISA in their car. However, Bishop (2005) concluded there was a strong potential to increase

driver acceptance of ISA through improved designs, such as consistency of speed limits across the region, maintaining the speed limit database, and addressing the complexities of dynamic speed limits. For large-scale deployment to be effective, Bishop (2005) indicated that factors such as context-appropriate speed limits, up-to-date speed limit databases, and interoperability within Europe would need to be addressed.

ISA–UK

From 1997 to 2000, the British government funded a study to assess acceptance of ISA, implementation technologies, simulation modeling to assess side effects, and user trials both in a driving simulator and on actual roads. The major conclusion from this project was that ISA, in its most compulsory and versatile form (i.e., a mandatory system that is capable of dynamic speed limits based on weather and other conditions), could achieve a 36% reduction in injury crashes across the United Kingdom and a 58% reduction in fatal crashes.

Follow-up work ran from 2001 to 2006 and examined driver behavior with and without speed limiters activated. The project involved 20 ISA-equipped vehicles and 80 drivers. Trials began in early 2003 in four cities that represented both urban and rural driving. The systems relied on GPS/map-based speed information and speed control could be overridden by the driver. As of the writing of the report, results from these follow-up studies have not yet been published.

Other ISA Projects

Smaller-scale ISA projects have been conducted in Belgium, Denmark, Finland, Hungary, the Netherlands, and Spain. Results were similar to those outlined by Bishop (2005) in terms of driver acceptance and effectiveness in reducing speeding and speeding-related crashes.

Relevance to Speed Limiters on Commercial Vehicles

Although the work in passenger car ISA has been quite thorough, its application in CMVs is very different. First, passenger car drivers have different motivations and concerns when driving as compared with CMV drivers; that is, passenger car drivers subjectively assess their perceived costs and benefits relative to speed, whereas CMV operations focus more on quantifiable costs and benefits wherever possible. Second, the ISA work cited by Bishop (2005) was almost entirely focused on reducing speeding on arterials and residential streets, whereas the emphasis for CMV speed limiters is on major highways. Even though local and short-haul CMVs operate on arterials and residential streets as well, the speed limits on those types of roadways are likely to be well below the CMV speed limiters set speed. Furthermore, much

of the challenge in deploying ISA relates to creating and maintaining a map database with accurate information of posted speed limits, an issue that does not relate to commercial vehicle speed limiters.

The ISA studies reviewed by Bishop (2005) echo some of the concerns found with CMV speed limiters in the written survey (such as driver's concern with unequal speeds compared with neighboring vehicles); however, there are significant differences between passenger car and CMV driver concerns regarding speed limiters that the written survey addressed. Therefore, the results of the ISA work are not deemed to be of sufficient magnitude to have a strong bearing on the commercial vehicle speed limiter questions addressed in this study.

ADVANTAGES AND DISADVANTAGES OF SPEED LIMITERS

This section describes the literature's perspective on the advantages and disadvantages of speed limiters, both objective and subjective. The review leads the Study Team to conclude that there is insufficient data to conclusively establish many of the claims, leading to extensive reliance on empirical data and professional judgment of individual fleet safety managers and independent drivers. The resulting lack of "solid ground" fuels the policy debate discussed in the next section.

Advantages

Clearly, speed limiters have several potential safety benefits. They reduce the top speed of vehicles to a pre-set limit. Although this may reduce overall crash risk it is more likely to lessen the severity of a crash (Wilmot and Khanal 1999). Speed limiters also reduce speed variability, thereby reducing lane change and deceleration maneuvers (Varhelyi and Makinen 2001; Toledo et al. 2007). Speed limiters have also been shown to reduce approach speeds at intersections, curves, and roundabouts (Varhelyi and Makinen 2001).

However, there are also potential benefits beyond safety. Higher speeds are less fuel-efficient. Speed limiters have been shown to be fuel-efficient and could lead to substantial fuel savings (Guerrero 2006). Less fuel consumption means a reduction in greenhouse gas emissions ("Slow Speed Ahead?" 2006) and longer tire life ("Institute Supports Speed Limiters . . ." 2007). Industry expert Robert Inderbitzen of REI Safety Services estimates that, overall, speed limiters can produce a 10% to 15% cost reduction when limiting speeds to about 60 mph, with most of the savings coming from fuel, tires, and maintenance (primarily brakes) (R. Inderbitzen, personal communication, Oct. 2007). According to Vermeulen and Klimbie (2002), a field test in the Netherlands involving 177 vans and 30 trucks between 3.5 and 12 tons estimated the fuel savings from speed limiters at an average of 5%.

Disadvantages

Several concerns have been raised against the adoption of mandatory speed limiters in CMVs. One concern is the lack of a consistent set speed across the North American continent. Differences in the set speed in Canada and the United States could lead to a competitive advantage for one country. For example, two different set speeds (63 and 68 mph, respectively) have been proposed in Canada and the United States. Thus, U.S. trucks crossing the border into Canada would have to modify the pre-set limit in their speed limiter to comply with Canadian regulations. This would cost U.S. drivers time and money (Guerrero 2006). Another concern is that the lack of potential income and independence may steer drivers away from trucking. Many drivers choose trucking as a profession because of the independence the job offers (“Slow Speed Ahead?” 2006). This would further compound an industry situation that already has a driver shortage.

Interestingly, one safety concern relates to the inability to accelerate in risky traffic scenarios. Although this might be a legitimate safety concern, fewer than 2% of crashes and conflicts use acceleration as an evasive action (Hyden 1987). Indeed, some have argued that drivers may be more likely to speed on roads that have a posted speed limit below the pre-set speed limit to make-up for lost time (Almqvist et al. 1991). However, there is no research to suggest this compensatory behavior is likely to occur. One respondent in the written survey noted that some companies have a bonus speed program (i.e., 20 min in 8 h of extra speed to pass); this provides the necessary acceleration in critical situations. This would appear to address the concern held by many drivers regarding their inability to accelerate in risky traffic scenarios. Others have suggested that slower truck speeds compared with the surrounding light vehicle traffic will result in more frequent and possibly sudden lane changes, which as noted earlier can be one of many factors increasing crash risk stemming from speed differentials.

Lastly, improvements in fuel efficiency related to speed limiters could have a negative impact on transportation funding vis a vis reduced consumption of taxable fuels (*Understanding Strategies . . .* 2007). In the short- to mid-term, a fuel tax increase would be needed to offset any policy changes that reduce fuel consumption, assuming that transportation funding needs increase at current rates.

POLICY INITIATIVES TO MANDATE SPEED LIMITERS

Europe has been more progressive than the United States in implementing speed limiting technology with its CMV fleets; however, there have been recent legislative proposals to mandate speed limiters in all CMVs in both Canada and the U.S. (Guerrero 2006; “Slow Speed Ahead?” 2006; “Institute Supports Speed Limiters . . .” 2007).

European Situation

When the European Commission required that speed limiter regulations be extended to new medium-size commercial vehicles, the Royal Society for the Prevention of Accidents (RoSPA 2001) objected to these new speed limiter regulations by stating the following:

There is no clear evidence to show how many accidents have been prevented by fitting top-speed limiters to [large commercial] vehicles. Although, it seems likely that this measure has helped to reduce speeds, and so helped to reduce casualties, it is unfortunate that the effectiveness of top speed limiters on large vehicles has not been properly evaluated. This lack of evidence also makes it difficult to assess the likely road safety benefits of the EC’s proposal to extend this requirement to lighter HGVs [heavy goods vehicles], buses, and coaches and to midi-coaches and minibuses. We also note that the fitment of top speed limiters may reduce speeds on trunk roads and motorways, but will have no effect on urban roads, or roads through rural towns and villages, which have lower speed limits, and where driving at inappropriate speed (rather than excessive) speed is the problem. The Regulatory Assessment shows that speeding by large vehicles is still a serious problem. Despite the existing requirement for top-speed limiters on the heaviest vehicles, more than 80% of HGVs and 50% of coaches and buses exceed the speed limits on dual carriageways, and on single carriageways well more than 60% of HGVs and 23% of buses and coaches exceed the limits. Therefore, while RoSPA would support the measures proposed, we do not believe that they will have any significant effect on casualty reduction. RoSPA believes that the ultimate aim should be to have intelligent speed limiters fitted to all road-going vehicles, including cars, although this is clearly a long-term aim that will depend on the results of on-going research and trials (p. 1).

The RoSPA believed the speed limiter legislation would only be effective if it considered all vehicles and was not limited to new vehicles. This would prevent operators from keeping older vehicles on the road as long as possible to avoid regulation and inadvertently undermining safety.

Australian Situation

The current national regulatory framework to address speeding by heavy vehicles includes a requirement that heavy vehicles of more than 12 tons gross vehicle mass and buses of more than 5 tons gross vehicle mass must have a speed limiter fitted and be set to limit the maximum speed by acceleration to 100 km/h. The National Heavy Vehicle Safety Strategy 2003–2010 adopted by the Australian Transport Council (ATC) has a range of strategic objectives, including better speed management and improved heavy vehicle speed compliance. As part of its responsibility under this strategy, ATC reviewed regulatory approaches for improving heavy vehicle speed compliance. A number of options to help address speeding heavy vehicles were explored by the ATC, including an assessment of the costs and benefits of each option. Their selected proposed approach was

to develop a chain of responsibility for speed compliance. Under this approach, each party in the transport chain who can influence whether or not speeding occurs will have a measure of responsibility to ensure that the road transport task is carried out

by a driver in such a manner that does not require speeding. This would oblige all parties in the transport chain to take positive steps to prevent a breach of speed limits. This proposal attempts to deliver an improved culture of compliance with speed limits in the road transport industry (*Heavy Vehicle Speed Compliance* 2006, p. 16).

The report also notes that chain-of-responsibility obligations relating to vehicle mass, dimension, and load restraint have been in place in some jurisdictions since 2005, resulting in increased compliance with road transport law.

Although tampering has been an issue with speed limiters in Australia, it is significant to note that the non-technological chain of compliance approach has been recommended over another layer of technology to improve tamper resistance. Comments received in response to the Commission's proposal were largely positive regarding this new emphasis on chain of compliance.

North American Initiatives

Recent legislative proposals in Canada and the United States may require all heavy trucks to be equipped with a speed limiter pre-set at a top speed. The Ministry of Transportation of Ontario recently reviewed a proposal introduced by the Ontario Trucking Association and Canadian Trucking Alliance (CTA) that seeks to limit the top speed of all heavy trucks in Ontario Province to 105 kph (or about 65 mph) (Guerrero 2006). The Ontario Trucking Association indicated this measure will increase highway safety and air quality (Gillam 2006). This legislation was passed in June 2008; in Ontario 65 mph is now the maximum legal speed for trucks built after 1995.

Further relating to the proposal from the CTA, federal, provincial, and territorial governments are examining the feasibility of requiring the activation of speed limiters on all heavy trucks operating in Canada. Transport Canada, on behalf of the provinces and territories, is currently undertaking a review of the implications of such a requirement from a safety, environmental, economic, and operational perspective. According to Spoerri (A. Spoerri, "Motor Carrier—Road Safety & Motor Vehicle Regulation, Transport Canada," *Truck Speed Limiter Project Workplan Status and Timetable*, personal communication, Dec. 2007), one study is using traffic modeling to investigate the impact of speed differentials and car-truck interactions on highway safety and crash risk, the results of which could be very useful to the safety dialogue going forward. Another study is assessing the experiences of for-hire, private, and owner-operator carriers. Results were due by spring 2008.

According to the CTA ("Canadian Trucking Alliance . . ." 2007), several safety and environmental groups have publicly supported the proposal, including the Canada Safety Council, Pollution Probe, the Traffic Injury Research Foundation, SmartRisk, the Lung Association, the Canadian Transportation Equipment Association, and the Insurance

Bureau of Canada. The Owner-Operators Independent Driver's Association (OOIDA) is a notable dissenter (see *Opposition to Speed Limiters*).

Both NHTSA and FMCSA are reviewing possible rule-making on speed limiters. Two different proposals are under consideration. One proposal, led by Schneider National and a group of other carriers, asked FMCSA to require all Class 7 & 8 trucks to have a speed limiter set at 68 mph (even those currently on the road) (McNally 2006). The second proposal, submitted by the ATA, requests that all *newly manufactured* trucks be equipped with a speed limiter set at no more than 68 mph (McNally 2006; "Institute Supports Speed Limiters . . ." 2007). NHTSA issued a request for comments (Docket No. NHTSA-2007-26851) in January 2007 to collect industry opinions regarding speed limiters. As of the writing of this report, NHTSA received approximately 3,700 responses to the docket. Supporters, including advocacy groups and truck fleets, cited both fuel economy and safety as key reasons to adopt speed limiters. Owner-operators represented a large portion of the opposing view, as outlined in the OOIDA response here.

Opposition to Speed Limiters

OOIDA (Johnston and Shapiro 2007) is perhaps the most vocal opponent of proposals to require certain CMVs to have speed limiters installed and set to 68 mph. OOIDA opposition centers on safety, disputing the reported safety benefits. Key points of OOIDA's position are:

- The 68 mph speed limiter setting is impractical because there are 24 states with speed limits of 70 or 75 mph.
- Trucks traveling slower than regular traffic create turbulence in the traffic flow, leading to increased lane changes and sudden braking, thereby increasing the potential for car-truck crashes.
- Truck maneuverability is compromised in safety-critical situations, as there are times when greater power and speed are necessary, such as one truck passing another, merging onto a highway, or getting out of the way of merging vehicles.
- Speed limiters are too rudimentary a safety tool, as traveling too fast for conditions, which can occur at any speed, is the speed-related behavior most commonly associated with truck crashes. OOIDA asserts that safe speeds in these conditions are far less than 68 mph.
- There is no specific evidence to support the claimed fuel economy improvements of speed limited to 68 mph. Studies have shown that the increase in fuel efficiency would only be in the 0.08 to 0.03 mpg range. Instead, better aerodynamics would result in far greater efficiency.
- Instead of speed limiters, it is more effective to focus on:
 - Improved training, including a graduated Commercial Driver's License course, apprenticeship programs, and/or other forms of expanded driver training;

- More effective enforcement of existing speed laws; and
- Changing the circumstances that induce drivers to speed, namely shipper and receiver scheduling demands and compensation based on the miles driven or loads hauled.

OOIDA asserts the petitioners' real motivation is to reduce competition for the limited pool of qualified drivers. OOIDA notes that many fleets that are members of the ATA use speed limiters and are seeking to remove driver concerns about speed limiters as an issue in the hiring process (i.e., if everyone has to have it, the ATA fleets will better be able to compete).

ASSESSMENTS OF SPEED LIMITER EFFECTIVENESS

Safety Effectiveness of Speed Limiters: Published Results

This section discusses the effectiveness of speed limiters on driver behavior. Unfortunately, there is a paucity of relevant published research on how speed limiters affect driving behavior, particularly in terms of safety. As discussed in Appendix A, the search for published studies in this area was extensive, including searches of journal articles as well as direct contacts with government agencies in Europe and Australia. The studies identified that assessed truck driver behavior while driving a truck equipped with a speed limiter are not of sufficient detail to be helpful in this analysis of safety effectiveness. Other studies focusing on the passenger car population are somewhat relevant and are reviewed here.

The European Commission (*Report from the Commission . . . 2001*) report cites studies (not further referenced in the report) that have been made on the effects of the use of speed limitation devices on heavy commercial vehicles in comparison with vehicles not fitted with them, as follows:

The studies differ slightly in their conclusions but the following overall positive effects are noted: lower fuel consumption (from 3% to 11%), lower maintenance costs (tyres, brakes, engine), increased road safety (fewer casualties), more relaxed driving and lower insurance premiums as a consequence of less accidents. As negative effects the following are noted: decreased road safety when performing an overtaking manoeuvre as overtaking another vehicle takes relatively longer, and increased delivery times as the journey takes longer to make. An indirect effect is that the long overtaking manoeuvres of vehicles fitted with speed limitation devices have the effect of reducing the average speed of other road users. To summarise, it is clear that the known effects of speed limitation devices are generally very positive for drivers, for companies, for society and for the environment. The negative aspects are small and avoidable: if all the speed limitation devices were set accurately to the same speed, there would be less need for overtaking, and as the use of speed limitation devices is accepted, the timetables given to the drivers are more realistic in comparison with the old practice of giving unrealistic timetables which, to be met, required speeding (p. 3).

The Commission report (p. 6) also included statements offered by some member states regarding the road safety effectiveness of speed limiters on commercial vehicles. Danish authorities

noted “the positive effect of speed limiter devices on road safety and the environment” but did not elaborate further on this point. Authorities in the United Kingdom stated that although some problems exist with tampering of the speed limitation device and thus more enforcement is needed, the overall results of the use of speed limitation devices are positive, especially in lowering the average speed of buses and their accident and casualty rates.

Unfortunately, although the Netherlands field test earlier assessed the effects of speed limiters on truck fuel consumption, maintenance costs, damage costs, and speeding tickets, safety was not addressed (Vermeulen and Klimbie 2002).

Regarding passenger cars, Varhelyi and Makinen (2001) conducted field trials in the Netherlands, Spain, and Sweden with an instrumented car equipped with a speed limiting device. Different speed categories, ranging from 30 to 120 kph, were tested across the three countries. The speed limiter reduced driving speeds on roads with speed limits ranging from 30 to 70 kph; however, there were no significant changes on roads where the speed limit was above 70 kph. The authors concluded that heavy congestion and the prevailing speed below the posted speed limit contributed to the lack of significant results on roads where the speed limit was greater than 70 kph. Speed variances decreased significantly and approach speeds at roundabouts, intersections, and curves were slower with the speed limiter. Time gaps increased in the speed interval of 30 to 50 kph, suggesting safer car following behavior. These results suggest that the speed limiter had beneficial effects on driving behavior other than limiting the driver from exceeding the posted speed limit.

Toledo et al. (2007) used a simulation-based evaluation of the impact of speed limiters on traffic flow and safety. In their model they estimated that 10% of the vehicles were equipped with speed limiters. They rationalized that this assumption corresponded to a policy mandating speed limiters in all CMVs. The impact of two pre-set speed limits, 100 kph and 120 kph, at various speed distributions and congestion levels was evaluated. The simulation showed that speed limiters may reduce average traffic speeds by as much as 10% and the variability of traffic speed may also be significantly reduced.

Effectiveness of Speed Limiters: Industry Surveys

Given the lack of controlled studies, information as to speed limiter effectiveness must be gleaned from the experiences of CMV fleet managers and drivers. The results of recent surveys performed by OOIDA and ATRI are reviewed here.

OOIDA Foundation Survey

OOIDA supports its opposition of legislation to mandate speed limiters with the results of a survey conducted by the OOIDA Foundation (*Speed Limiter Survey Results Final*

Report 2007). The survey was sent to 15,382 OOIDA members who were listed in its database as hired drivers. There were a total of 3,422 completed surveys returned, representing a 22.3% return rate.

The respondents drive for 2,080 different trucking companies, of which 60.8% of these companies already had speed limiters installed. The survey asked drivers whether, if all things were equal, they would rather drive for a company that does have speed limiters or one that does not. As many large carriers already have speed limiters installed in their vehicle fleets and often have better pay and benefits, it is often seen as a tradeoff, so the question addressed driver preference of driving with a speed limiter. Of 3,400 drivers, 2,780 (81.7%) reported that they would rather drive for a company without speed limiters, 120 (3.5%) would choose a company with speed limiters, and 500 (14.7%) said the issue was not a factor.

The drivers' primary concern with speed limiters was the lack of passing speed followed by increased congestion. Further, 80.8% of the respondents admitted they "sometimes" exceeded the speed limit on roads or in areas where the speed limit is less than the speed limiter setting to make up for lost time.

Generally speaking, the approach and response rate of the OOIDA study stands up well in comparison to similar studies. The response rate was very high for a mail survey. The study was useful in that it was addressed specifically to the 15,000 company drivers who are OOIDA members, excluding their remaining 141,000 members who are owner-operators. The CTBSSP Study Team did identify one area of concern: although the survey asked if the truck was equipped with a speed limiter (which most Class 8 trucks are), only 1,226 respondents answered the question regarding the top speed setting of the speed limiter, whereas 2,211 respondents indicated that their truck was equipped with a speed limiter. Because it is possible that the speed limiter is not active on an equipped truck, it remains unclear how many respondents were actually using the speed limiter.

ATRI Survey Results

In early 2007, ATRI conducted a web-based survey of motor carriers designed to collect information about speed limiter usage in large trucks (McDonald and Brewster 2007). The

240 respondents provided demographic details along with information on speed limiter installation rates, rationale for use, speed settings, and the impact of speed limiters on personnel. ATRI considers the responses to be both "strong" and "highly representative of the trucking industry." Approximately 13% of responses were from owner-operators. ATRI researchers acknowledged in the report that online "convenience" surveys may favor carriers with a technology-orientation or those that have strong perspectives on the speed limiter issue.

Of the respondents from the privately owned carriers, 79% (of all respondents in that sector) used speed governors compared with 64% of the truckload sector, 54% from the less-than-truckload sector, and 58% from the specialized sector. Overall, 63% of carriers reporting using speed governors. Those carriers that used speed governors accounted for 77% of the trucks represented by carriers who responded to the survey, a testament to the increased likelihood among larger carriers to use speed limiters. These utilization rates are comparable to rates identified in the OOIDA study.

The ATRI results also showed that large carriers are more likely to use lower speed settings than small carriers. Interestingly, whether carriers used speed limiters or not, they identified safety as the primary motivation for either adopting or avoiding the technology. The primary reason for those carriers choosing not to utilize speed limiters was car-truck speed differential. Slightly more than 27% of the respondents reported that driver tampering with speed limiter settings was an issue. Nearly all carriers indicated that the consequence for tampering was immediate termination.

McDonald and Brewster (2007) found it difficult to meaningfully compare fleet safety data before and after speed limiter installation owing to the low number of respondents (56 carriers) that provided objective safety data (in terms of vehicle miles traveled per million miles for pre- and post-limiter installation). Owing to the lack of data for these survey items, it was not possible to make strong claims about safety outcomes for carriers after the implementation of speed governors. Carriers' assessments of the optimal speed to maximize safety, fuel economy, and productivity indicated that optimal safety was achieved at a lower speed than optimal fuel efficiency, which itself was achieved at a lower speed than optimal productivity.

SURVEY RESULTS

Based on the many issues raised in the literature review, and using the ATRI survey as a starting point, the Study Team developed a survey for fleet safety managers and trucking industry experts. The survey can best be described as a small population convenience survey of the CMV industry; as such, the results may not be representative. It is not known whether the survey responses are representative of the overall trucking and motor coach industry.

The survey consisted of 27 multiple-choice questions and was designed to take about 10 min to complete. The initial questions gathered basic data such as fleet size and type of operations. If a fleet did not use speed limiters, the respondent was asked to select one or more reasons for the lack of use and no further questions were asked. If a fleet used speed limiters, the respondent was asked about the effectiveness of speed limiters in terms of perceived fleet safety, driver acceptance, vehicle operations, and related issues. General comments and suggestions were also solicited. The respondents were assured that all information provided would be kept strictly confidential. Approximately 1,500 surveys were distributed by e-mail and 103 responses were received, resulting in a response rate of approximately 7%. The full survey is presented in Appendix B.

DETAILED SURVEY RESULTS

Following are the survey results for each survey question. The actual survey questions are noted in *italics* and the corresponding results are noted beneath each question.

1. *Number of years you have been a safety manager (for commercial vehicle operations):*
 - Mean years experience at current company = 15 years (range 0.5–53 years).
2. *Your approximate number of years experience in commercial vehicle operations.*
 - Overall mean years experience in commercial vehicle operations = 26.8 years (range 4.5–55 years).
3. *Number of power units in your company's fleet: _____ power units.*
 - Mean number of power units at current company = 1,124.8 (range = 5–30,000).

There were a total of 99 responses to this question. The mean number of power units can be somewhat deceiving as the mean suggests the majority of our survey respondents managed large fleets. However, a few very large fleets skew these results. As shown in Table 1 and Figure 1, the majority

of survey respondents reported fleet operations with 21 to 100 power units (33.3%), followed by 101 to 999 units (28.3%), 6 to 20 units (22.2%), more than 1,000 units (14.2%), and 1–5 units (2%). Thus, a median calculation shows that most respondents managed small- to medium-sized fleets.

4. *How would you characterize your fleet's primary operation (select one)?*
 - See Table 2 and Figure 2.

Other fleet types included:

- Government contractor
- Government
- State government
- Local government

5. *Does your organization use speed limiters in any of your trucks?*
 - Percent who use speed limiters = 82.5% ($n = 85/103$).
 - Percent who do not use speed limiters = 17.5% ($n = 18/103$).

If "NO," then why (select all that apply):

- See Table 3 and Figure 3.

Comments provided by respondents for not using speed limiters were:

- Our engine control module (ECM) data do not show we have a problem with drivers speeding.
- All trucks governed; speed maintained by "Is my driving safe" and then drivers receive feedback on driving.
- No cost—all you have to do is set maximum speed for cruise and road speed in the engine ECM. [This is seemingly a comment in support of speed limiters.]
- We have excellent drivers who respect the laws; we run all 48 states and don't see the need to limit our trucks. I believe a truck that is limited to a speed less than the posted speed limit produces a hazard to other vehicles using the highway at posted speed limits.
- Keeping steady speed (use cruise as much as possible).
- Driver frustration and traffic safety.
- With our industry terrain (off road—in forests, etc., the land is hilly, sandy, extremely wet in some seasons, etc.) [speed limiters] will not work. Also, our forestry trucks must be able to resume or decrease to or from a high idle when the trucks are loading as they have loaders

TABLE 1
DISTRIBUTION OF FLEET SIZE (power units)

	1-5 Units	6-20 Units	21-100 Units	101-999 Units	>1,000 Units
%	2.0%	22.2%	33.3%	28.3%	14.2%
N	2	22	33	28	14

Out of 99 responses.

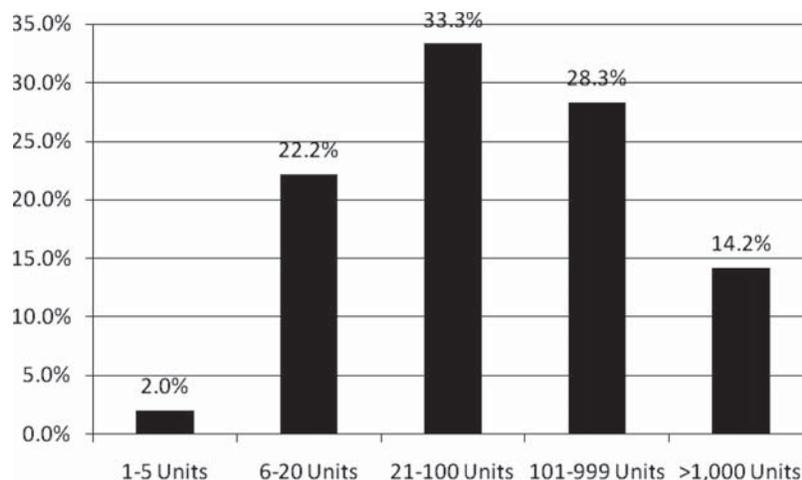


FIGURE 1 Distribution of fleet size (power units).

TABLE 2
FLEET PRIMARY OPERATION

	For Hire: Local Haul	For Hire: Long Haul	Private: Long Haul	Private: Local Haul	Passenger Carrier: Long Haul	Passenger Carrier: Local Haul	Other
%	27.4%	48.1%	6.6%	16.0%	4.7%	0.0%	3.8%
N	29	51	7	17	5	0	4

Note: Respondents could select more than one fleet type, thus percentages will sum to more than 100%.

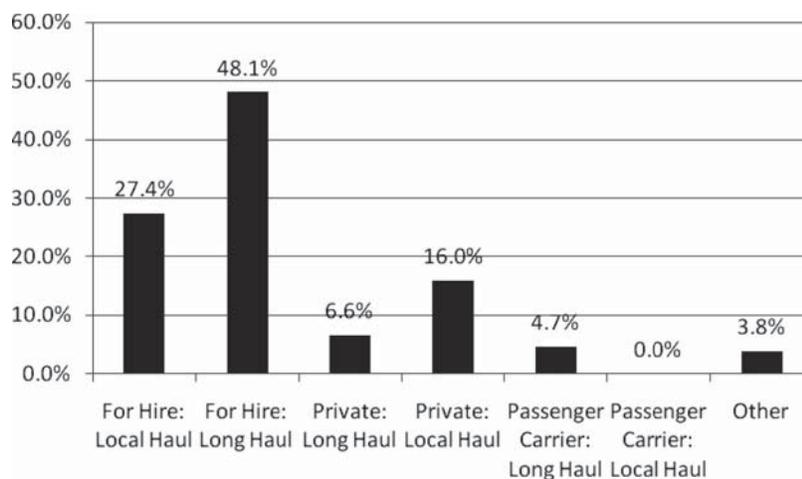


FIGURE 2 Fleet primary operation.

TABLE 3
REASON FOR NOT USING SPEED LIMITER

	Owner– Operator Cost	Delivery Refusal	Avoid Workplace Conflict	Car–Truck Speed Differentials	Inability to Accelerate	All Vehicles Must Have Speed Limiters	Drive Faster
%	33.3%	33.3%	5.6%	61.1%	38.9%	11.1%	11.1%
N	6	6	1	11	7	2	2

Note: Respondents could select more than one fleet type, thus percentages will sum to more than 100%.

with their units and they require a lot of power for a proper operation.

6. Do you use a speed limiting device that was factory installed by the engine or vehicle manufacturer?
 - Percent usage of factory-installed speed limiter = 95.3% (n = 81/85).
 - Percent usage of non-factory-installed speed limiter = 1.2% (n = 1/85).
 - Percent of non-response to question = 3.5% (n = 3/85).
7. Please estimate what percentage of your fleet uses speed limiters: _____%
 - Percent of power units equipped with speed limiter = 90.1% (range = 7%–100%).
8. How many years have speed limiters been installed in your vehicles?
 - Mean years power units equipped with speed limiters = 11.5 years (range = 2–27 years).
9. Does your company set a cruise-control speed limit that is different from a non-cruise-control (on-pedal) speed limit?
 - Percent of respondents who have a separate cruise-control speed = 43.4% (36/83).
 - Percent of respondents who do not have a separate cruise-control speed = 56.6% (47/83).
 - Mean cruise-control speed setting = 65.6 mph (range = 55–75 mph).

What is your cruise-control speed? _____ mph

- See Table 4 and Figure 4.
10. What is your non-cruise-control (on-pedal) speed?
 - Mean non-cruise-control setting = 67.2 mph (range = 57–73 mph) (see Table 5 and Figure 5).
 11. Do you require speed limiters for owner–operators you hire?
 - Percent of respondents who require owner–operators to use speed limiters = 14.5% (12/83).
 - Percent of respondents who do not require owner–operators to use speed limiters = 36.1% (30/83).
 - Percent of respondents who indicated this question was not applicable to their organization = 49.4% (41/83).
 12. How did you determine the governor speed to set in your fleet (mark all that apply)? (See Table 6 and Figure 6.)

Comments provided by respondents were:

- Reduce maintenance cost.
- Original Equipment Manufacturer value and Return of Investment.
- Factory settings.
- Maintenance, tire, time to overhaul cost increases.
- Based on my own driving experience I felt that 10 kph per hour over the limit was realistic.
- Ontario Trucking Association recommendation.
- Economic reasons.

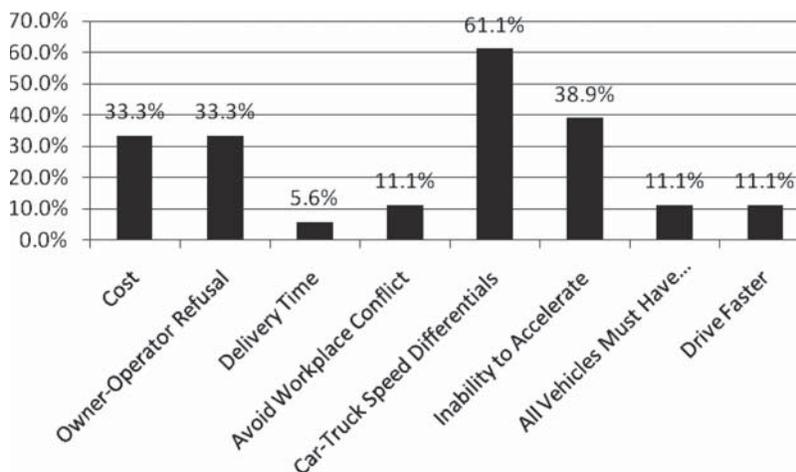


FIGURE 3 Reason for not using speed limiter.

TABLE 4
SPEED BINS FOR CRUISE CONTROL

	55–59 mph	60–64 mph	65–69 mph	>70 mph
%	5.6%	30.6%	50%	13.8%
N	2	11	18	5

Out of 36 responses.

13. What are the TOP 3 intended goal(s) of speed limiters (please write number 1, 2, or 3 to rank order). (See Tables 7 and 8.)

More specific comments provided by respondents were (with number of similar responses in parentheses):

- Fatigue management aid (3).
- Reduce driver fatigue (4).
- Financial liability in crashes.
- Reduce crash severity (3).
- Send message of the importance of speed control (3).
- Improve maintenance cost (3).
- Vehicle wear (3).
- Reduce maintenance, tire, and time to overhaul costs.
- Managing our corporate image. Speeding trucks carry the wrong message to the public. I lobbied for a tighter speed control for years, and was only successful as fuel prices climbed (3).
- Overall safety (3).
- Insurance rates (2).
- Liability issue if involved in a speed-related accident (1).

14. Do you have any variations in the top speed of the speed limiter among your drivers? For example, different speeds for drivers with an excellent or poor safety record.

- Percent of respondents who indicated variations in the top speed of the speed limiter = 11.9% (10/84).
- Percent of respondents who did not indicate variations in the top speed of the speed limiter = 88.1% (74/84).

TABLE 5
SPEED BINS FOR NON-CRUISE CONTROL

	55–59 mph	60–64 mph	65–69 mph	>70 mph
%	3.8%	12.8%	48.7%	34.6%
N	3	10	38	27

Out of 78 responses.

Specific comments were:

- If a driver receives two speeding violations, the speed limiter is reduced to 58.
- Drivers with 2 Million Safe Miles are set at 65 mph.
- Testing the speed on fuel mileage of new 08 engines.
- Based on state law.
- Any driver convicted of a speeding violation has speed reduced by 3 mph for 6 months.
- All students who come to us are set at 65, veteran guys are at 70. If they are put on probation for any safety related reason they are set at 65.
- Why would you take your safest driver and then provide him/her with a higher rate of speed? The goal is safe cost to operate. Giving a higher speed does NOT improve productivity. It only increases costs of operation that ultimately will reduce drivers pay. It has to come from somewhere.
- If accidents occur, speed is reduced further for one year.
- Limit top speed to 65 mph for drivers with safety violations.
- Some higher risk drivers have speed reduced to either 62 mph or 56 mph.

15. Have drivers tampered with the speed limiter settings?

- Percent of respondents who indicated a driver tampered with speed limiter = 22.6% (19/84).
- Percent of respondents who indicated no driver tampering with speed limiter = 77.4% (65/84).
- Percent of respondents who indicated a driver tampering with speed limiter who have a policy (penalties) for tampering with speed limiter = 94.7% (18/19).

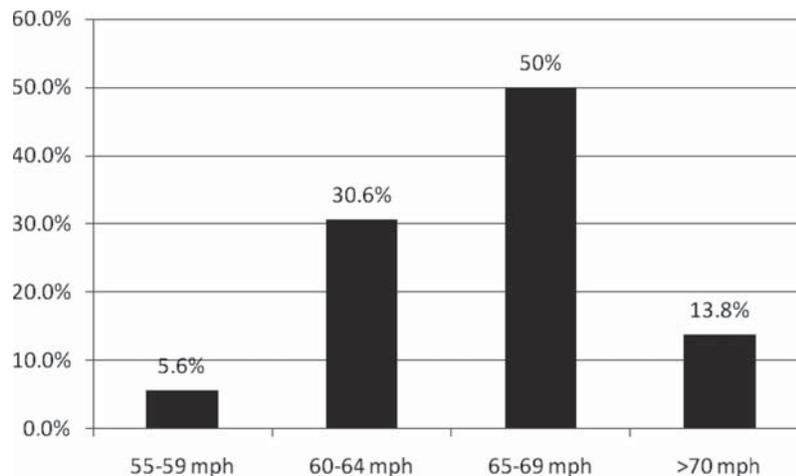


FIGURE 4 Speed bins for cruise control.

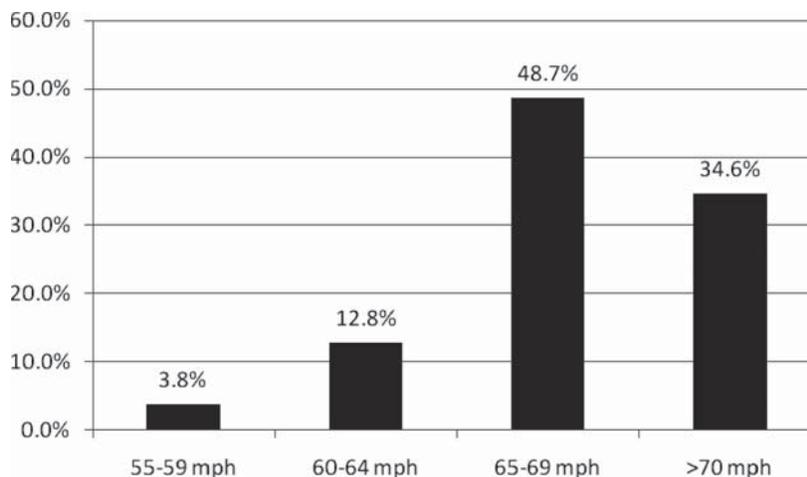


FIGURE 5 Speed bins for non-cruise control.

TABLE 6
HOW SET SPEED FOR SPEED GOVERNOR WAS DETERMINED

	Safety	Posted Speed Limit	Fuel Mileage	Insurance Requirement	Driver Input	Followed Other Trucking Organization	Other
%	90.6%	56.5%	69.4%	16.5%	16.5%	11.8%	9.4%
N	77	48	59	14	14	10	8

Out of 85 respondents.

Note: Respondents could select more than one choice, thus percentages will sum to more than 100%.

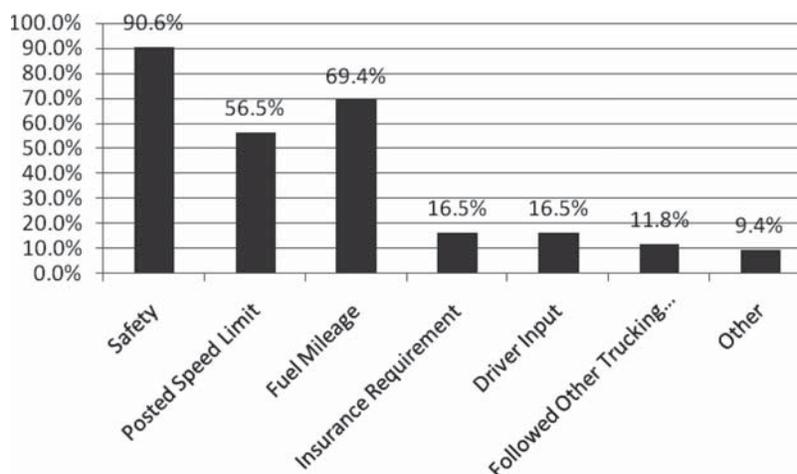


FIGURE 6 How set speed for speed governor was determined.

TABLE 7
TOP THREE INTENDED GOALS OF SPEED LIMITERS (ranked as 1, 2, or 3)

	Reduce Top Speed	Reduce Overall Speeding	Reduce Crashes	Reduce Speed Violations	Reduce Tire Wear	Increase Fuel Economy	Other
Mean	1.61	2.03	1.73	2.33	2.41	1.94	2.55
N	47	31	49	27	17	66	11

Out of 85 respondents.

Note: Not all respondents chose three goals.

TABLE 8
TOP THREE GOALS FOR SPEED LIMITERS, SHOWING RANKING PREFERENCES

Top Three Intended Goals for Using Speed Limiter	Mean Ranking	#1	#2	#3	Total
Reduce Top Speed	1.61	27	11	9	47
Reduce Crashes	1.73	22	18	9	49
Increase Fuel Economy	1.94	24	22	20	66
Reduce Overall Speeding	2.03	9	12	10	31
Reduce Speed Violations	2.33	5	8	14	27
Reduce Tire Wear	2.41	0	10	7	17
Other	2.55	2	1	8	11

Out of 85 respondents.

Responses to tampering were listed as:

- Discipline
- Discipline including termination (2 responses)
- Will be given warning for 1st violation and fired for 2nd violation
- Termination (13 responses)
- None to date, but should it occur it would be considered destruction of company property.

16. *Based on your experience, how successful have the speed limiters been in reducing speeding violations?* (See Table 9 and Figure 7.)

17. *Based on your experience, are you aware of drivers traveling faster than normal in lower speed areas in order to “make up” time “lost” by using a speed limiter on interstate routes?*

- Percent of respondents who indicated that drivers do this behavior = 88% ($n = 73/83$).
- Percent of respondents who indicated that drivers did not do this behavior = 12% ($n = 10/83$).

Specific comments were:

- Get as many miles as possible.
- Our pick-up and delivery appointments are set based on appropriate transit times considering the governed speed and speed limits making it unnecessary for a driver to speed to make up time. If they feel the need to speed to make up time it's because they have wasted time somewhere else.
- Although I don't believe it is a widespread problem, I am not sure that they do it to make up time. I think it is mainly due to habit.

- Simply disobeying the posted speed limits. Nothing to do with making up time.
- Tracking system also provides data on units exceeding speed limits.
- Had one driver that complained max speed was 64 mph “he knew speedometer was correct because radar speed sign told him so while driving through 45 mph construction zone.”
- Based on logged time and miles w/metered time/date stamps (mean speed is very high).
- Regardless of speed limiters, the vehicle operator will often speed through lower speed areas if he or she believes they can get away with it. The excuse of “making up lost time” has long been tried and lost. Chronic speeders will take the opportunity to speed in any speed controlled area they believe they can get away with.

18. *Based on your experience, how successful have the speed limiters been in reducing crashes?* (See Table 10 and Figure 8.)

19. *Based on your experience, how successful have the speed limiters been in reducing tire wear?* (See Table 11 and Figure 9.)

20. *Based on your experience, how successful have the speed limiters been in increasing fuel economy?* (See Table 12 and Figure 10.)

21. *Based on your experience, how often do the speed limiters reduce on-time delivery?* (See Table 13 and Figure 11.)

22. *Based on your experience, what has the driver response been toward the speed limiter?* (See Table 14 and Figure 12.)

TABLE 9
SUCCESS OF SPEED LIMITERS IN REDUCING SPEED VIOLATIONS

	Very Successful	Successful	Neutral	Unsuccessful	Very Unsuccessful	Cannot Determine
%	34.5%	29.8%	23.8%	4.8%	0.0%	7.1%
N	29	25	20	4	0	6

Out of 84 responses.

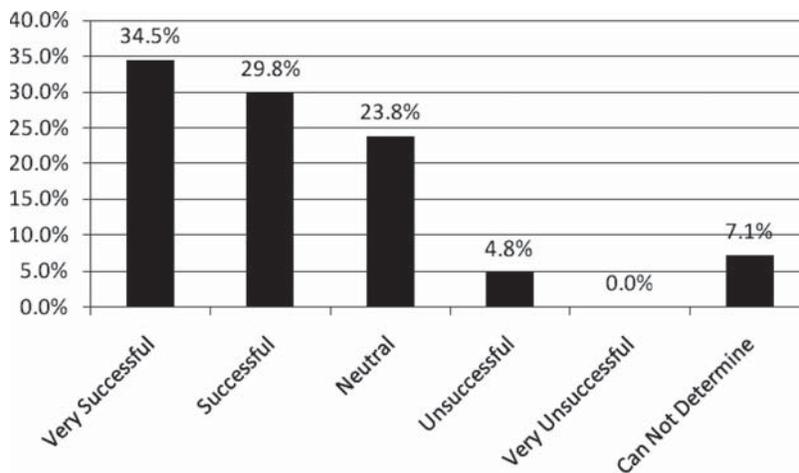


FIGURE 7 Success of speed limiters in reducing speed violations.

TABLE 10
SUCCESS OF SPEED LIMITERS IN REDUCING CRASHES

	Very Successful	Successful	Neutral	Unsuccessful	Very Unsuccessful	Cannot Determine
%	17.9%	38.0%	27.4%	2.4%	0.0%	14.3%
N	15	32	23	2	0	12

Out of 84 responses.

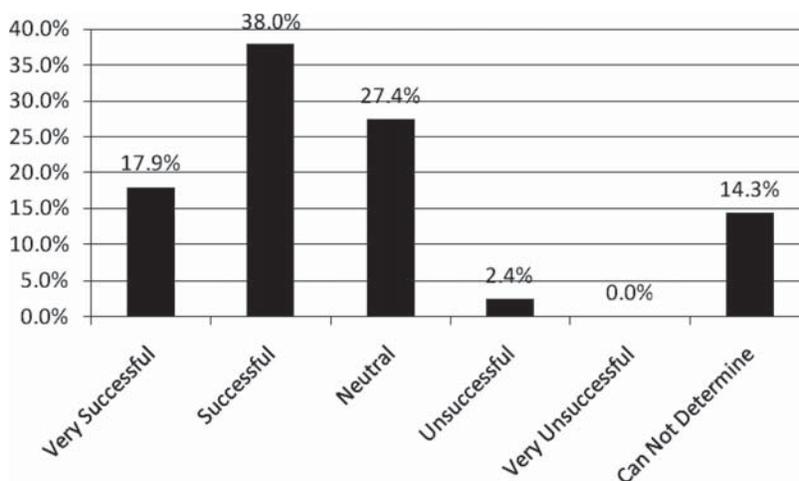


FIGURE 8 Success of speed limiters in reducing crashes.

TABLE 11
SUCCESS OF SPEED LIMITERS IN REDUCING TIRE WEAR

	Very Successful	Successful	Neutral	Unsuccessful	Very Unsuccessful	Cannot Determine
%	14.1%	30.6%	32.9%	2.4%	0.0%	20%
N	12	26	28	2	0	17

Out of 85 responses.

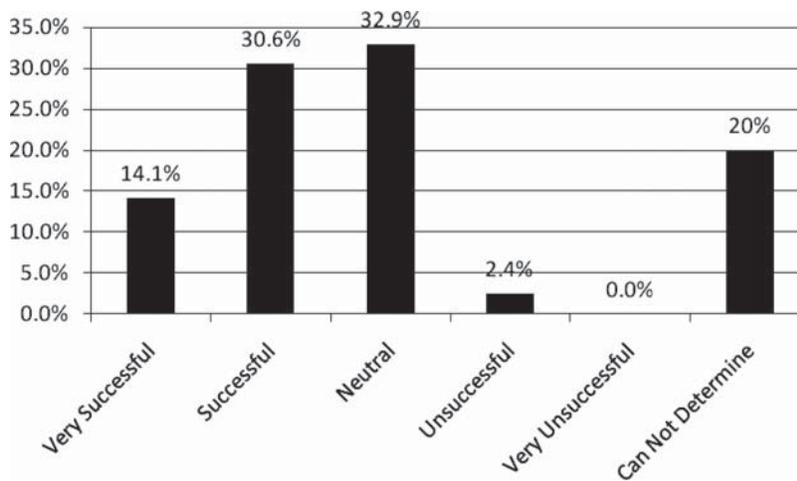


FIGURE 9 Success of speed limiters in reducing tire wear.

TABLE 12
SUCCESS OF SPEED LIMITERS IN INCREASING FUEL ECONOMY

	Very Successful	Successful	Neutral	Unsuccessful	Very Unsuccessful	Cannot Determine
%	35.7%	40.4%	17.9%	2.4%	0.0%	3.6%
N	30	34	15	2	0	3

Out of 84 responses.

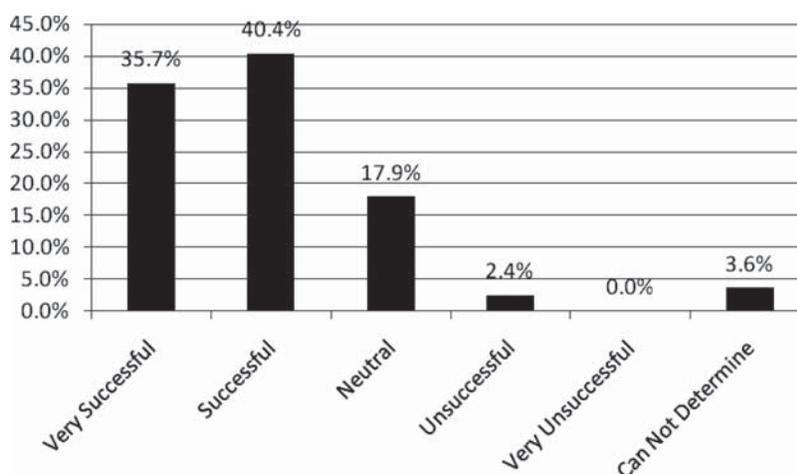


FIGURE 10 Success of speed limiters in increasing fuel economy.

TABLE 13
DO SPEED LIMITERS REDUCE ON-TIME DELIVERY?

	Very Often	Often	Neutral	Seldom	Very Seldom
%	0%	0%	15.9%	32.9%	51.2%
N	0	0	13	27	42

Out of 82 responses.

23. *Based on your experience, in what way does having speed limiters on fleet vehicles impact driver hiring and retention?* (See Table 15 and Figure 13.)

24. *Have speed limiters negatively affected safety in any area of your operations?*

- Percent of respondents who indicated that overall speed limiters negatively affected safety = 3.6% (3/84).
- Percent of respondents who indicated that overall speed limiters did not negatively affected safety = 96.4% (81/84).

Specific comments from respondents indicating negative effects were:

- Increased exposure to being rear-ended, mental stress on drivers as traffic runs around them, occasional road rage events with other motorists mad about our speed on clogged highways; these are all due to our set speed of 60 mph. We would have speed governors on our trucks regardless of the desired set speed we choose, they have wiped out open highway speeding problems for us where the posted speed is above our set speed. In the distant future I expect we will have speed governor settings tailored to the operation, long haul out west may be set to 65 or 70 mph while regional or short haul in more congested areas will remain at 60 mph for us.

- Because we were the only one in our area to have speed limiters.

25. *Have speed limiters negatively affected productivity in any area of your operations?*

- Percent of respondents who indicated that overall speed limiters negatively affected productivity = 3.6% (3/84).
- Percent of respondents who indicated that overall, speed limiters did not negatively affected productivity = 96.4% (81/84).

Specific comments from respondents indicating negative effects were:

- 65 mph is not top speed on interstate reducing long haul productivity.
- Our fleet could cover more miles in a shorter time if our trucks were not governed or governed at a higher speed; however, we do not feel the trade-off of slight improvements in productivity offset the lower accident risk and cost improvements in fuel, maintenance, good will, etc.
- Very slightly though, as drivers complain they can't make appointments sometimes.

26. *Overall, the use of speed governors has improved your fleet operations.* (See Table 16 and Figure 14.)

27. *Please feel free to write any comments, issues, or experiences you've had with speed limiters.*

- Speed limiters and on-board recorders have been part of our fleet strategy for more than 50 years. There is no doubt the combination of the two have helped us identify aggressive drivers and either improve their performance or get rid of them. We fully and totally support the recent initiative to add speed governors to all trucks in the United States; and that the principle should be applied to all vehicles on the road.

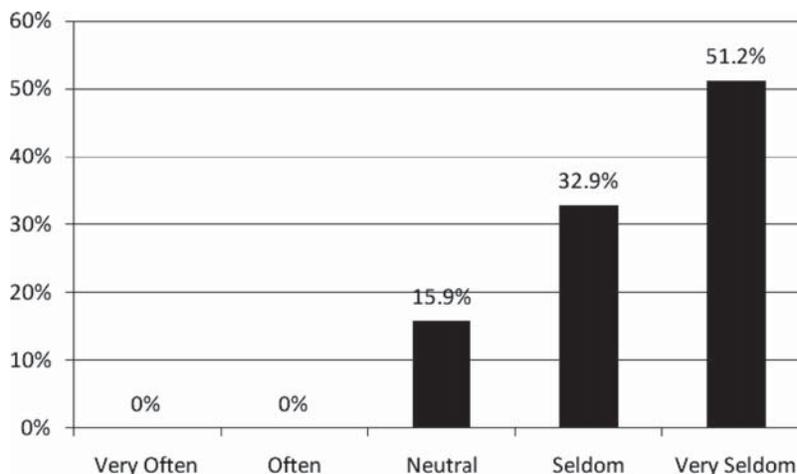


FIGURE 11 Do speed limiters reduce on-time delivery?

TABLE 14
DRIVER RESPONSES TO THE SPEED LIMITER

	Very Positive	Positive	Neutral	Negative	Very Negative	Cannot Determine
%	0%	23.2%	64.6%	8.5%	1.2%	2.4%
N	0	19	53	7	1	2

Out of 82 responses.

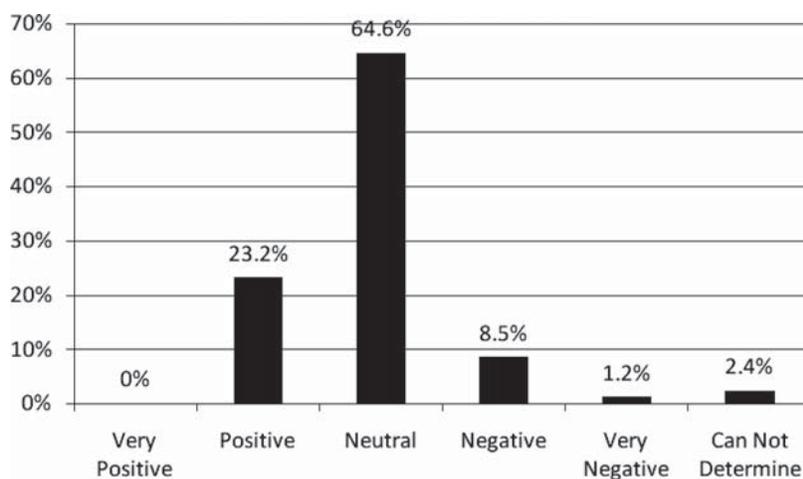


FIGURE 12 Driver responses to the speed limiter.

TABLE 15
AFFECT OF SPEED LIMITERS ON DRIVER HIRING/RETENTION

	Strong Adverse Impact	Adverse Impact	Neutral Impact	Positive Impact	Strong Positive Impact	Cannot Determine
%	0%	6.2%	77.8%	4.9%	2.5%	8.6%
N	0	5	63	4	2	7

Out of 81 responses.

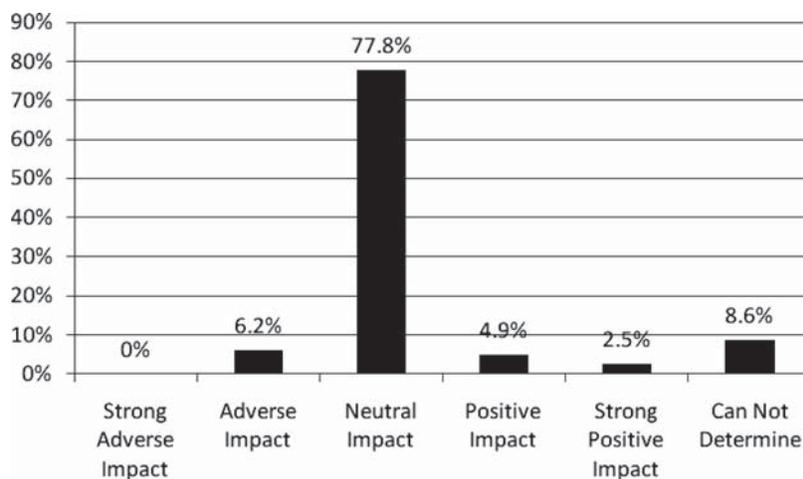


FIGURE 13 Affect of speed limiters on driver hiring/retention.

TABLE 16
OVERALL, HAS USE OF SPEED LIMITERS IMPROVED
FLEET OPERATIONS?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
%	28%	46.3%	24.4%	1.2%	0%
N	23	38	20	1	0

Out of 82 responses.

- No issues with speed limiters except the rare driver that tries to bypass the limiter. There is no impact to our service or driver pay.
- Would only install on current fleet if a federal requirement; if vehicle had it installed would keep it maintained and working. Consideration should be made for this to be a new vehicle requirement versus having to install on older vehicles.
- In the fleets we work with, some are very technology minded, and others (more vocational) are not. For the more progressive, if the device has a positive impact on productivity or efficiency, they might likely adopt such technologies. In fact, one such fleet that we are working with is looking to limit the operating domain of the vehicle’s engine to ensure that it runs (on the average) more closely to its “sweet spot.” It also limits more aggressive drivers. The vocational fleets are really more interested in the bottom line. If there are no major benefits, they are not going to spend any funds on these devices.
- Speed limiters have caused no issues in the charter operations we operate. I strongly believe this to be a good safety tool for all commercial vehicles.
- We had on-board computers for years so the speed limiters only made the supervisor’s job easier by not having speeding violations to deal with after the fact.

- In the Western states drivers will complain about the 70 mph limit; we adhere to our set speed limit. Secondary roads are where speed violations occur.
- Speed limiters have been used very successfully in Europe for a very long time. Their experience should be invaluable to you. Another very good reason for legislating the use of speed limiters to vehicles that “haul stuff” is to allow them to NOT be subject to the most stringent CAFÉ standards. Fuel economy standards should be different for vehicles that are to be used for the mobility of individuals than those for vehicles designed to move goods or large groups of people. Those vehicles necessarily need to be substantially larger than personal vehicles and thus should not need to meet the same stringent fuel economy standards that should be met with personal vehicles. That said, those larger vehicles should also have their speeds restricted for the very reasons that you are studying. Thus, tying together fuel economy standards with speed limiters creates the proper market incentives. If one needs/wants a large vehicle to “haul stuff,” then that vehicle needs to be speed limited. If instead one doesn’t need to “haul stuff” then one can purchase a fuel efficient vehicle that is not speed limited. My view is that way too many people are commuting in fuel inefficient macho trucks. Much of their macho would dissipate if they were speed limited. Also, for those that are really in the business of “hauling stuff,” they really don’t need nor desire to break the speed limit.
- In my opinion, as an investigator of commercial vehicle accidents, I would speculate that most motor carriers utilize speed limiters (which I believe are standard equipment on all large commercial trucks and buses) to save fuel and keep the driver from driving at unreasonably high speeds. The speed limiters are difficult for the driver to tamper with, as they take special software and electronic equipment

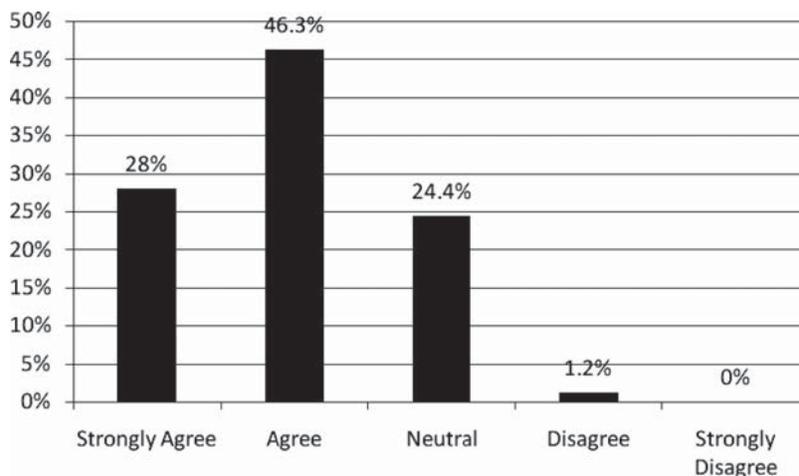


FIGURE 14 Overall, has the use of speed limiters improved fleet operations?

to change. One of the problems of speed limiters is the variation of speed limits in different parts of the country. In states where the maximum truck speed limit is 55 mph, perhaps 60 or 62 mph would be a reasonable setting. However, in the western United States where there are higher speed limits, 70 to 75 mph, and even 80 mph on stretches of I-10 in Texas, a lower setting would be frustrating to the driver and motor carrier.

- The use of speed governors is widely used in the commercial vehicle industry in Europe. It makes no sense at all that we would take an 80,000 lb vehicle that will travel 80 mph off an assembly line and put it out on the highway. The debate should not be on whether speed governors should be used or not—the technology is available and we should use it. The debate should center on what is the correct governed speed. I'm pretty sure we all would agree it's not 100 mph. Is it 90 mph? Most would feel that is still too high, is it 80 mph? 70? 60? Our industry should be using the available technologies to improve highway safety and the reputation of the industry. Additionally, if the speeds were governed then the industry would essentially enforce posted speed limits on Interstates themselves allowing enforcement resources to be shifted to roadways with lower posted speed limits that tend to have higher instances of crashes. The net effect of governed maximum speed and a redeployment of enforcement to higher crash risk locations would be lower serious crashes.
- When passing you can't go any faster than the pre-set speed and tend to spend more time in the oncoming traffic lane. I like how some engine companies have a bonus speed program (i.e., 20 min in 8 h of extra speed to pass). When set at 100 kph (speed limit) most vehicles drive 108 kph and the trucks are always getting passed or create traffic congestion.
- Cost of operating a commercial motor vehicle can be somewhat reduced when you hire, lease, and monitor driver performance prior to and during tenure with company. A bad driver (speed) will shift wrong and go against suggested driving manners. Bad habits cause some good things to sour.
- As long as a truck can go the speed limit and have a little extra speed available to pass if needed speed limiters are not a problem. If the limiter is an attempt to make the truck go slower than traffic or the speed limit, then it will cause more accidents. I think very few accidents are caused by excessive speed of a truck. We are spending too much time and money going after trucks when we should be focusing on the cause of most accidents . . . cars.
- Historically we used "governors" on engines; today, the ECM is easy to set to limit speed.
- The problem that trucking companies still face is the unrealistic expectations of shippers and receivers.

Shippers/receivers do not care about FMCSA regulations (e.g., on hours of service, time allowed to driver, etc.). They want to be able to ship it late and have it delivered early.

- When dealing in the area of passenger safety, you just cannot afford to have even one "loose cannon" amongst your driver force who may jeopardize the safety of his/her passengers by driving excessively fast.
- The fleet has always used driver monitoring devices that included driver logs but most importantly tachographs that record movement, idling, and speed. As technology has advanced other technologies were introduced to ensure driver speed was being monitored. The highest legal speed limit for any units since 1940s was 65 mph. In 1973 speeds were dropped to 55 mph under federal rules. In 1981 due to driver input, speed limit was raised to 60 mph. At the same time the fleet added speed control devices that were basically a cruise control device that would also minimize maximum speeds to 60 mph. In 1994 with the Cummins M-11 engine we began shutting the trucks down through ECM parameters. We began setting the gear down protection at 49 mph to force them into top gear and at same time set maximum cruise and road speed at 60 mph. Idle interruption used to be set at 10 min in the early 1990s and in the late 90s it went to 8 min. Today, if a unit does not have the clutch depressed, is moving, or does not have a Power Take Off engaged, the idle time is 3 min.
- Managing speed is the *most* cost-effective thing a fleet *or* any operator—even owner-operators—can do to reduce costs and improve bottom line (take home \$\$\$\$\$). If every truck on the highway operated at speeds no greater than 65 mph, cost of operations would reduce by as much as 30 cents—15 cents per mile (i.e., cost of fuel when speeds are more than 55 mph, increased maintenance cost, increased tire cost, reduced time to overhaul). A good study that still holds true today is ATA's (TMC) Technical Report, "55 vs. 65 An Equipment Operating Costs Comparison." In the study, TMC illustrates that there is *no* productivity improvement between 55 mph and 65 mph. But there is a cost penalty of 1/2 mile per gallon in fuel + an almost equal cost in additional maintenance, tires, and reduced time to overhaul. At \$3.00 per gallon a truck averaging 6 mpg at 60 mph will have a per mile fuel cost of \$0.50. When increasing the speed to 65 mph (if re-gear to meet the engines sweet spot for fuel economy—\$6,000) the cost per mile for fuel alone is now at \$0.545 per mile with an additional equal cost (SWAG—Sure Wild Assed Guess) of \$0.045 cent per mile in additional maintenance, tire, and reduced time to overhaul costs. The difference of 60 mph verses 65 mph is a conservative \$0.10 (dime) per mile. You would have to run a lot of

miles to try and improve the productivity and you would have to haul an extra load to make up for additional cost—which in turn starts spiral over again—you never catch up.

- Question 17 asked about speeding in lower speed areas to make up time lost by using speed limiters. While I do not feel that our drivers speed in lower speed areas to make up time, they do speed in those areas on occasion and would do so even if their trucks did not have speed limiters. Our drivers are paid by the hour and we constantly reinforce safety first even if it means being late, so there is less incentive for them to speed to “make up time,” whereas a driver paid by the mile has incentive to speed in order to make more money. If I am paid \$0.40 cents a mile and I can travel 60 miles in an hour I will be making the equivalent of \$24.00 an hour. If I travel 50 miles in an hour I am making \$20.00 an hour, etc., at the end of the week that difference can add up. Of course the pressure from dispatch and the customer can drive the “need for speed” as well.
- Most of our drivers are paid by the hour. Before setting the speed limit, we undertook a strong communication program to carefully explain what we were doing, when, and why. Many drivers resisted, but they have come to accept it. Because they are paid by the hour, speed is more a “quality of life issue” than it is a perceived pay issue. For our drivers paid a percentage of revenue, a maximum speed of 65 mph has caused us occasional recruiting issues, because limiting speed is perceived to reduce income (and it may). We’re OK with that.
- I have not made any effort to track the “before and after” affects in terms of fuel economy or accident results, because I knew that regardless, I had no intention of raising the speed once we went through all the trouble of governing it.
- I have always limited the speed on our company fleet. I have felt that our image was more likely to be positive if the trucks were operating at a realistic speed.
- When first installed we experienced a lot of negativity, but after a very short time other issues like wages and benefits became more important to drivers. New drivers were informed of our speed limiter policy and there have been no issues with these employees.
- It is without exception the only safe and economical way to run a trucking operation.
- Our industry is capital intensive/low margin; thus, reducing operating costs is imperative to an organizations financial success. Controlling the largest controllable expense (i.e., fuel) is imperative. The by-product is reduced tire and maintenance costs combined with reduced accident frequency and severity. Managing, planning, and executing our transactional activity in a safe and healthy manner should and must be our mandate for the employees and general public at large.
- This is a safety initiative as well as fuel savings. . . . More importantly it is the right thing to do.
- Success in trucking comes with reducing speed. Reduce accidents, save fuel, reduce maintenance costs. If government introduces a law to make it mandatory everyone wins. Driver complaints will subside when everyone is on a level playing field. Personally, I’m disgusted by speeding; trucks following too close to other vehicles at 75 mph are out of control in an emergency.
- Should not be controlled by government. Speed should be controlled by police and company owners.
- Pulling heavy loads can be tricky at some points. Personally, I would not drive trucks myself anymore with that. Things are getting out of hand in the trucking industry. No more interest in trucking.
- Based on Question 23, if a driver objects to speed limiting you do not want that driver. Also, if you have to make-up time then you are not properly dispatching trucks—the biggest speed limit offenders are truckers that are on a pay per trip basis. Also, shippers that do not give enough advanced notice for deliveries.
- The only detrimental effect of speed limiters is if the limiter is set on unrealistic limits and controlled by a government regulation or agency. Trucks should be allowed to go with the flow of traffic and not have a two-tier speed system to suit the conscience of a group of people that have no vested interest in transportation.
- They are very good tools and should be used by all companies.
- We always have to take into consideration the worst case scenario. We always want to strike a happy medium and we run Midwest and West. That is why we run more than 70 on top speed.
- I’d be happy to see the national speed limit reduced to 55 mph again to reduce accidents and increase fuel economy.
- Speed limiters only serve to ensure a *maximum* vehicle speed, thereby providing comfort in some assurance of public safety (as much as highway speed limitations will allow). Operators must recognize that company fleet drivers are prone to “pushing” the limits in the same fashion as the general driving population. So, the faster the unit *can* go, the faster the unit is *likely* to be driven! Speed limiters are *not* the answer to speeding violations other than in jurisdictions where the maximum posted speed cannot physically be exceeded because of the limiter setting. Lower highway speeds *will* have some impact on vehicle maintenance costs in areas such as tire, brake, and engine wear resulting from lower speed and rpm. The fuel saving benefits are minimal for vehicles traveling more than 60 mph regardless of speed limitation beyond that number; however, there will be some savings for every 5 mph less of top speed

operation without limiter. It is better to have a minimal fuel saving than none at all! I believe the bottom line on this issue is, do not expect any significant economic advantage. Speed limiters will assist in a reduction in severity of highway crashes. In itself, the speed limiter will help to address the industry concern of public safety provided the limiter is not a “stand alone” carrier. This will address this fundamental industry responsibility. Speed limiters have a place in the current and future industry market.

- Speed limiter had a made marginal effect on speeding and a great effect on cost control. Our owner operators do not have speed limiters and there is no difference in the number of accidents between company trucks and owner operators.
- I think they are great idea, but have to get all organizations and transportation companies to go for it.
- Do not agree with all trucks being governed at 105 kph. This will cause more problems on highways because trucks will be unable to pass, which will cause traffic jams.
- We have used speed limiters in our trucks for years and would not operate without them. Having said that, we are not in favor of the proposed 105 kph mandatory speed regulations. We feel that 105 kph does not allow a driver to pass in an efficient and safe manner. Those carriers who are operating in the way that you are trying to target will move their base place of operations out of the province, making the law useless. Companies that want to operate in a responsible manner always will and those that do not will always find a way around it.

SUMMARY OF RESULTS FROM THE WRITTEN SURVEY

The following section is a summary of results obtained from 103 fleet safety manager respondents. Overall, respondents were experienced fleet safety managers, averaging 15 years experience in CMV safety. The fleets represented were fairly balanced across small through large fleets, but with few owner-operators. Operations concentrated on for-hire local and long haul, with emphasis on long haul operations. Five responses were received from passenger carriers.

Use of Speed Limiters

Eighty-two percent of respondents use speed limiters in at least some of their vehicles (averaging 90%). Of the 82% of respondents who indicated using speed limiters, 95% used factory-installed speed limiters and have done so for an average of 11.5 years. A few respondents (14%) required speed limiters when owner-operators were hired, but for most (50%) the question was not relevant as they did not hire owner-operators. To assess respondents' motivation for using speed limiters, they were asked to rank in order three choices

among six choices. The most frequent “number 1” response was “reduce top speed,” which also received the highest score with all responses weighted and aggregated. “Increase fuel economy” received the most votes (66) regardless of rank, followed by “reduce crashes” (47), and “reduce top speed” (49). The lowest score went to “reduce tire wear.” Comments from respondents indicated that fatigue management was noted 7 out of 11 times when “other” was marked. Perhaps this should have been one of the original choices. Other reasons for using speed limiters included reducing overall maintenance costs, maintaining a positive corporate image, and reducing insurance rates.

The 18 respondents who do not use speed limiters noted “car-truck speed differentials” as the primary concern (61%), with “inability to accelerate” when needed the second greatest concern (40%). When combined, “owner-operator refusal” and “avoid workplace conflict” represented 44% of the responses from the non-users. A few comments from respondents indicated their fleets did not have a problem with drivers speeding; therefore, there was no need for speed limiters.

Speed Limit Setting

Most respondents (90%) selected “safety” as the primary consideration for determining the set speed on their speed limiters, followed by “fuel mileage” (69%) and “posted speed limit” (56%). Respondents were evenly split in terms of setting a different cruise-control speed limit from the on-pedal (non-cruise-control) speed limit. The majority (56%) of respondents did not use this practice. The difference in set speed between cruise-control and on-pedal (non-cruise-control) speed limiter was not noteworthy. The mean setting for cruise-control speed limit was 65.6 mph, whereas it was 67.2 mph for on-pedal operations (a difference of only 1.6 mph).

About 12% of respondents operated with variations in top speed of the speed limiter based on driver performance. For drivers considered inexperienced or risky, speed settings are reduced. Comments from respondents included the following:

- If a driver receives two speeding violations, the speed limiter is reduced to 58 mph.
- Any driver convicted of a speeding violation has speed reduced by 3 mph for 6 months.
- All students who come to us are set at 65 mph; veteran drivers are at 70 mph. If they are put on probation for any safety-related reason, they are set at 65 mph.

One fleet allowed drivers with 2 Million Safe Miles to increase their set speed on the speed limiter to 65 mph. But one respondent commented, “Why would you take your safest driver and then provide him/her with a higher rate of speed? The goal is safe cost to operate. [Higher speed] only increases costs of operation that ultimately will reduce drivers' pay. It has to come from somewhere.” Another respondent commented that the debate should move beyond “if” speed

limiters will be mandated and center around selection of the optimum governed speed. He also noted that governed speeds on heavy trucks “would essentially enforce posted speed limits on Interstates themselves, allowing enforcement resources to be shifted to roadways with lower posted speed limits that tend to have higher instances of crashes. The net effect of governed maximum speed and a redeployment of enforcement to higher crash risk locations would be lower serious crashes.”

Tampering with Speed Limiters

Tampering was cited by some respondents as a concern with speed limiters; however, only 22% of respondents reported such tampering. The typical fleet response was immediate termination, although some provided a warning on the first offense.

Do Speed Limiters Cause Speeding?

Anecdotal reports have indicated that speed limiters result in drivers driving faster in speed zones below the speed limiter set speed to “make up time.” Survey results supported this view, with 88% of survey respondents reporting this was most likely occurring. As one respondent noted, “Regardless of speed limiters, the vehicle operator will often speed through lower speed areas if he or she believes they can get away with it. The excuse of ‘making up lost time’ has long been tried and lost. Chronic speeders will take the opportunity to speed in any speed controlled area they believe they can get away with.”

Overall Assessment of Positives and Negatives of Speed Limiter Use

In terms of positive and negative attributes of using speed limiters, the results are as follows:

- Reducing Crashes: 56% of respondents indicated speed limiters were either “successful” or “very successful” for this purpose. Only 2.4% (two respondents) reported they were “unsuccessful.”
- Reducing Speeding Violations: 64% of respondents reported speed limiters were either “successful” or “very successful” for this purpose. Only 4.8% (four respondents) reported they were “unsuccessful.”
- Reducing Tire Wear: 44% of respondents indicated speed limiters were either “successful” or “very successful” for this purpose. More than half (53%) reported they were either “neutral” or marked “cannot determine.”
- Increasing Fuel Economy: 76% of respondents indicated speed limiters were either “successful” or “very successful” for this purpose. Only 2.4% (two respondents) reported they were “unsuccessful.”
- Reducing On-Time Delivery: 84% of respondents indicated either “seldom” or “very seldom” for this issue, with

the remainder “neutral.” No respondents reported that on-time delivery was undermined “often” or “very often.”

- Driver Response: 64% of responses regarding driver response toward speed limiters were “neutral,” whereas 23% indicated drivers were “positive” and 9% were “negative” or “very negative.”
- Driver Hiring/Retention: 77% of responses regarding the impact of speed limiters on driver hiring and retention were neutral, whereas adverse and positive impacts were roughly equal at 6% and 7%, respectively.
- Effect on Safety: 96% of respondents indicated speed limiters did not negatively affect safety, with 3.6% (three respondents) reporting that speed limiters had a negative effect on safety. Specific comments from respondents indicated that these negative influences were increased exposure to being rear-ended and mental stress on drivers as traffic flowed around them.
- Effect on Productivity: 96% of respondents indicated speed limiters did not negatively affect productivity, with 3.6% (three respondents) reporting speed limiters had a negative effect on productivity. One specific comment indicated the negative effects on productivity were overshadowed by the positive effect on safety and fuel economy: “Our fleet could cover more miles in a shorter time if our trucks were not governed or governed at a higher speed; however, we do not feel the trade-off of slight improvements in productivity offset the lower accident risk and cost improvements in fuel, maintenance, good will, etc.”

The final question in the survey asked respondents about the “bottom line” use of speed limiters (i.e., have they improved fleet operations?). Sixty-four percent reported that, overall, speed limiters have improved fleet operations, whereas 24% of respondents chose a neutral stance. Only one respondent did not believe fleet operations were improved.

Therefore, examining the results from the series of questions on safety and other benefits of speed limiters, this group of respondents overwhelmingly (but not unanimously) reported noteworthy benefits with relatively few drawbacks. Clearly, respondents considered speed limiters an important part of their overall fleet management operations. Although the majority of respondents perceived the systems as reducing crashes, no respondents indicated any quantitative data that would support their perceptions (if it did exist, it was not shared with the Study Team). However, as one respondent in the passenger transport sector reported, “. . . you just cannot afford to have even one ‘loose cannon’ amongst your driver force that may jeopardize the safety of his/her passengers by driving excessively fast.”

It appears that cost control issues, such as fuel economy, were a predominate motivator, as reported by survey respondents. However, one comment on the safety effects of speed limiters was interesting: “Speed limiters have [had] a marginal effect on speeding and a great effect on cost control. Our

owner–operators do not have speed limiters and there is no difference in the number of accidents between company trucks and owner–operators.”

Of the 39 general comments, improvements to overall operations, particularly fuel economy, was a major theme. With respect to safety, several spoke in terms of speed limiters as part of a larger safety management strategy, which includes on-board recorders, driver feedback, and performance improvement. Several comments pointed to the unrealistic expectations of shippers and receivers as the root cause of excessive speeding. As one respondent indicated, “if you have to make up time then you are not properly dispatching trucks—the biggest speed limit offenders are truckers that are on a pay per trip basis.”

In terms of driver response, one respondent whose drivers were paid by the hour called speed a “quality of life” issue for their workers. The respondent noted that, “before setting the speed limit, we undertook a strong communication program to carefully explain what we were doing, when, and why. Many drivers resisted, but they have come to accept it.” Alternatively, for other drivers paid a percentage of revenue, “a maximum speed of 65 mph has caused us occasional recruiting issues, because limiting speed is perceived to reduce income (and it may).” Another respondent described their process of implementing speed limiters as follows: “when first installed we experienced a lot of negativity, but after a very short time other issues like wages and benefits became more important to drivers. New drivers were informed of our speed limiter policy and there have been no issues with these employees.” Another summed his perspective up concisely by saying “if a driver objects to speed limiting you do not want that driver.”

RESULTS FROM TELEPHONE INTERVIEWS

In an effort to gather targeted information on specific topics related to speed limiter use among motor carrier populations, the Study Team conducted structured telephone interviews with 12 motor carriers. The specific speed limiter-related topics addressed in the telephone survey included the role of speed limiters in the carrier’s overall safety culture, driver reaction to governor use within the carrier’s fleet, and the collection of data designed to measure the safety effectiveness of speed limiters within the carrier’s fleet. Carriers were selected from a list of ATA’s Safety Policy Council members, Minnesota Motor Trucking Association Safety Council members, and Georgia Motor Trucking Safety Council members. Informally, an attempt was made to collect responses from carriers of varying sizes, geographic locations, and operational models.

Of the 12 interviewed carriers, all used speed limiters within their fleet operations. All of the fleets required that speed limiters be used on all fleet vehicles. However, some carriers employed owner–operators who were not required to use speed limiters on the trucks they drove.

Role of Speed Limiters in Overall Carrier Safety Culture

When queried about the ways that speed limiting devices have been integrated into their overall safety culture and operations, respondents expressed a wide range of viewpoints. At least one carrier indicated that it did not consider speed limiter use a part of their safety culture, but rather as a fuel saving measure. At the other extreme, one carrier reported that they believed speed limiters were at the heart of their safety program—because a driver cannot exhibit safe driving practices and speed simultaneously.

Two survey responses were reported frequently by survey respondents. The first highlighted the “indirect” safety benefits of speed limiters. Five respondents indicated that speed limiter usage was critical to the overall safety of the fleet because limiters allowed drivers to expend mental energy on actual safe driving rather than monitoring speed. One respondent compared the effect of speed limiters with another safety system installed on the truck that does not allow the cruise control to engage while the truck’s lights are turned on. In daylight driving, expending mental energy to manage speed diverts the driver from other safety; although during nighttime driving, requiring a driver to expend mental energy to monitor speed reduces the chance a driver will fall into a “lull” while driving. The second most frequent response noted the “direct” safety benefits of speed limiters. Four respondents reported that reduced speeds are likely to reduce crash severity. One respondent indicated that the operational model (heavy haul) of his fleet was being especially prone to vehicular crashes at high speeds.

Respondents were asked to list the top five components of their safety program and rank the importance of speed limiters within these top five rankings. Three respondents ranked speed limiters “near the bottom” in terms of importance, although four respondents ranked speed limiters “very high” or “near the top of the list.” The remaining respondents were either unable to provide a ranking for the importance of speed limiters or explicitly ranked their importance “near the middle.”

Driver Reaction to Speed Limiter Use

Three respondents reported that drivers were unequivocally unhappy with being forced to use a speed limiter. According to one respondent, “They absolutely hate them. Their feelings toward them haven’t changed at all over time.” However, one respondent reported that, “Drivers do not mind governors at all.” The majority of respondents reported that most drivers do not like speed limiters, but have accepted them and become more accustomed to their use as most carriers require their use. Two respondents indicated that older drivers are generally more accepting of speed limiters and one respondent reported that training greatly reduced driver dissatisfaction with speed limiters.

Carrier Collection of Safety Data Relevant to Speed Governor Use

All but one respondent indicated that they had not attempted to collect and analyze data to determine the effectiveness of speed limiters in improving safety within their operations. The respondent who reported objective evidence of safety improvements noted that the carrier had experienced issues with truck rollovers; however, these incidents were reduced because speed limiters and stability control systems were installed on their trucks. As has been found in previous studies, most carriers did not collect objective data related to speed limiter implementation within fleet operations. The lack of before and after data severely limits the ability of the Study Team to draw objective conclusions regarding the overall safety effectiveness of speed limiters.

COMPARISON WITH AMERICAN TRANSPORTATION RESEARCH INSTITUTE AND OWNER-OPERATORS INDEPENDENT DRIVERS ASSOCIATION SURVEY RESULTS

The OOIDA Foundation (2007) survey was much larger than the one conducted for the current synthesis. However, there was some overlap in content that allows meaningful comparisons. Although the OOIDA results noted a strong driver preference to drive without speed limiters, the responses in the current synthesis indicated that drivers will tolerate them—most fleet safety managers viewed driver response to speed limiters as a neutral factor in driver hiring and retention. Respondents in the OOIDA survey indicated their primary concern with speed limiters was the lack of passing speed followed by increased traffic congestion. Respondents in the current synthesis who reported not using speed limiters had similar concerns.

Both surveys were consistent in finding a high incidence of drivers exceeding the speed limit in areas where the speed

limit is less than the speed limiter setting. Although the OOIDA results indicated that this is done to make up for lost time, survey respondents in the current synthesis indicated that this was likely a matter of overall driver attitudes or habits.

The OOIDA results showed a higher average setting for the speed limiter (69 mph) compared with the results from this synthesis (67 mph for non-cruise control and 65 mph for cruise control).

The OOIDA respondents indicated that 9% of companies required owner-operators to speed limit their trucks, with 41% saying this is not a requirement. This tracks somewhat with the results from the current synthesis, with 14% affirmative answers and 36% negative.

The number of responses to the ATRI survey was twice that received in the current synthesis. The ATRI survey indicated the overall installation rates of speed limiters were 63% for motor carriers, whereas the results from this synthesis survey were much higher. The difference may be the result of the broader coverage of the overall industry that was accomplished with the ATRI survey.

Both surveys illustrate that safety is the primary motivation for either adopting or avoiding speed limiters. As with the OOIDA study, those carriers choosing not to utilize speed limiters cited concerns with the car-truck speed differential created.

The survey in this synthesis reported a 22% rate of driver tampering with speed limiter settings, which is roughly consistent with the 27% rate reported by ATRI. Both surveys found that, in most cases, the consequence for tampering was immediate termination.

CONCLUSIONS

CONCLUSIONS

Speed Limiters and Safety

There is adequate literature on the role of large-truck speed in terms of crash severity, but less empirical data relating to the use of speed limiters to meaningful reductions in total crashes because the percentage of crashes that occur above 65 mph is relatively small. However, the statistical impact could increase over time, as indicated by Insurance Institute for Highway Safety data showing that the number of trucks traveling over the 75 mph speed limit rose from 8% to 14% during the period from 1996 to 2006.

Published studies indicate that both traveling above the posted speed limit and speed variance among vehicles increase crash exposure. Speed limiters, by restricting speed at or near the speed limit, also create such variances in speed relative to other traffic. This is particularly prevalent in truck–car interactions where research shows that car speeds exceed posted speed limits at higher levels than do trucks. Although this situation requires additional objective data, the Study Team found little in the way of published data that addresses the safety impacts of speed limiters on commercial motor vehicles.

The most definitive results on the effectiveness of speed limiters comes from the United Kingdom, which showed that the crash involvement rate for speed-limited heavy trucks fell 26% between 1993 (when mandated) and 2005. U.K. authorities noted that other contributing factors may have influenced the decline, but concluded that speed limiters at least played a significant role. Although extensive objective data exist regarding the use of intelligent speed adoption speed limiters in European field trials, the differences between the application settings (arterials and residential streets versus highway), operational mode (personal versus commercial), and drivers (private citizens versus professionals) are such that these results are not deemed relevant to this study.

Speed Limiter Utilization

Mandated speed limiters are an established component of safety policy in Europe and Australia. In Europe, the requirement for speed limiters has been extended to include not only large trucks, but also medium-sized trucks. This is indicative of European authorities' level of conviction that speed limiters improve safety.

In the United States almost all large trucks (Class 6–8) manufactured in the last 5 to 7 years have the ability to govern speed using the engine control module (ECM). However, the percentage of fleets that use the ECM speed limiter functionality appears to be approximately 65% across the industry. At the sector level, there are more tangible differences, with larger fleets and private fleets being the primary users.

Finally, whereas some survey respondents indicated a desire to receive insurance industry benefits, insurance company interview data conducted by American Transportation Research Institute (ATRI) and FMCSA show hesitancy by insurers to offer “front-end” premium discounts to carriers utilizing speed limiters. The general position of commercial insurers is that users of limiters will benefit “after the fact” from lower crashes and/or crash costs. Although this position presently differs from personal auto insurance, which credits users of seat belts, anti-lock brakes, and other safety devices, there is some informal indication that greater amounts of empirical data on the use of limiters might positively influence commercial insurers.

Qualitative Analyses

Given the paucity of published objective results, the experiences of fleet safety managers and owner–operators are the best available sources of information. Two previous surveys plus a written survey conducted in the current synthesis shed some light on the issues. Note that the current study had a low response rate (approximately 7%). The survey can best be described as a small population convenience survey of the commercial motor vehicle (CMV) industry; as such, the results may not be representative and should be interpreted with this in mind. It is not known whether the survey responses are representative of the overall trucking and motor coach industry.

In the ATRI study, researchers found it difficult to meaningfully compare fleet safety data before and after speed limiter installation owing to the low number of respondents that provided objective safety data. However, qualitatively both the ATRI and Owner–Operators Independent Drivers Association (OOIDA) surveys illustrate that safety is a primary motivation for either adopting or avoiding speed limiters. Those carriers using speed limiters saw benefits in terms of both safety and fuel economy, whereas those choosing not to use speed limiters cited concerns with car–truck speed differential. The OOIDA study focused strongly on driver issues and in particular noted that 81% of drivers reported that they would rather drive for a

company without speed limiters. In the survey conducted for this synthesis, labor concerns were also cited by non-users as a strong reason for not using speed limiters.

In the written survey, a large majority of respondents used speed limiters in at least some of their vehicles. Their primary motivation for using speed limiters was noted as reducing the top speed of the vehicle to improve both safety and fuel economy. In addition to reducing vehicular crashes, several respondents also indicated that they viewed speed limiters as a fatigue management tool.

The surveys indicated that speed limit settings on the speed limiters were within a fairly narrow range of about 4 mph (65 mph to 69 mph). Safety was selected as the primary consideration for determining the set speed, followed by fuel mileage. Tampering has been cited by some as a concern with speed limiters. Depending on the survey, 22%–27% of respondents reported such tampering.

The written survey documented anecdotal evidence of large percentages of truck drivers (with speed-governed trucks) exceeding posted speed limits in zones posted below the speed limiter set speed to “make up time.” Survey results strongly supported the existence of this phenomenon, although respondents disagreed on whether the effect resulted from speed limiters or overall driving habits. Without additional research that cross references speeding with speed limiter/non-speed limiter use, it is difficult to determine the relationship. If the former effect is valid, application of intelligent speed adoption-type methods could be effective; that is, speed limiters that dynamically adjust to changing speed limits as the vehicle traverses its route.

Overall, a positive picture emerges from speed limiter users who participated in the written survey. Fifty-six percent of respondents indicated speed limiters were either “successful” or “very successful” in reducing crashes, and 64% reported speed limiters were either “successful” or “very successful” in reducing speeding violations. In operational terms, speed limiter users believed that limiters were either “successful” or “very successful” in reducing tire wear (44%) and increasing fuel economy (76%), whereas 84% indicated that “seldom” or “very seldom” did on-time delivery get reduced.

Fleet safety managers indicated that driver attitudes toward speed limiters were largely neutral (64%), whereas 23% were positive. Recognizing the seriousness of the ongoing driver shortage, it is also noteworthy that 77% viewed the impact of speed limiters on driver hiring and retention as neutral.

Qualitatively, 96% of respondents indicated speed limiters did not negatively affect safety or productivity. When asked whether fleet operations “overall” have been improved by speed limiters, 64% were positive, whereas 24% chose a neutral stance.

Thus, synthesizing and examining the results from the series of questions on safety and other benefits of speed lim-

iters, this group of respondents overwhelmingly reported noteworthy benefits with relatively few drawbacks. Clearly, speed limiter user respondents considered speed limiters an important part of their overall fleet management operations. Although the majority of respondents perceived the systems as reducing crashes, no respondents indicated any quantitative data that would support their perceptions. However, ATRI’s industry crash data shows that crash severity is highest among large truck crashes where speeds exceeded 45 mph.

In summary, these results provide strong anecdotal evidence that speed limiters were beneficial to fleet operations; however, the results suggest cost reductions associated with fleet operations and high-severity crashes were greater than for a reduction in the frequency of large truck crashes.

POTENTIAL STEPS FOR AN EMPIRICAL STUDY OF SPEED LIMITER USE

Although this synthesis provides a general understanding of speed limiter use in CMV operations, as well as of generalized impacts, it does not provide a methodological comparison of before and after results applied uniformly across predefined truck and bus fleet operations. An in-depth, empirical study is needed to collect objective and subjective data in the commercial truck and bus industry with regard to the safety effectiveness of speed limiters. Such a project might consist of the following steps.

- Detailed Survey of Implementation Programs

A detailed survey of the commercial truck and bus industries, working with industry associations and manufacturers of speed limiter devices, to discover and classify technologies and techniques used in past application of speed limitation in commercial trucks and buses. In addition, more detailed information is needed on the active use of (versus simply the existence of) speed limiters by fleet sector, size, driver experience, carrier policies and enforcement, and other key variables. These data can then be used to extrapolate benefits to the larger fleet and CMV driver populations once additional empirical research data are obtained.

- Selection of In-Depth Survey Population

Development of a detailed survey population, based on a stratification of fleet size classes (e.g., large, medium, and small), operational types (long haul, short haul, less-than-truckload, private, and for hire), or by commodity types, driver categories, and overall safety performance classifications.

- Development of Evaluation Schema

Development of a set of quantitative and qualitative evaluation criteria and factors for analysis, including both safety performance and economic factors as a minimum, to serve as a basis for before and after comparisons, so that results of speed limiter technology application can be determined. Formal

partnerships with industry would be useful to ensure that sensitive internal safety data can be collected and analyzed.

- Development of Survey Analysis Schema

Development of an attitudinal and perception survey for use with the population of drivers and fleets, which would then be evaluated in the expanded study effort, would be useful. Content could include views on program success, perspectives on safety benefits and economic impacts, and evolution of attitudes of management and drivers over implementation period. These qualitative data could be compared and corroborated with industry/fleet data as a validation tool.

- Selection of Populations of Survey and Control Fleets

A selection of appropriate fleets would be an important part of the evaluation. Possible categories could be (1) fleets that have implemented speed limiters in the past 5 years, (2) fleets that are planning implementation, and (3) control fleets.

- Conduct Analysis of Survey and Control Fleets

An essential step would be to conduct analyses of the survey and control fleets, including evaluation of impacts, and atti-

tudinal and perception surveys. If feasible, identification of promising targets for fleets that have not yet implemented speed limiter application, but are willing to work in a pre-application and post-application evaluation of results in a one-year time frame, would be ideal.

- Development of Best Practices Recommendations

One outcome could be the development of a set of best practices for implementing a speed reduction program, to include detailing key factors that could lead to success of such a program. This effort could also identify the relationships of speed limiters to an overall fleet safety management culture and best practice use and commitments.

- Consultation with Insurers of Truck and Bus Fleets

As an additional component to this investigation, selected insurers of truck and bus fleets could be involved to (1) develop an understanding of insurance company views of speed limiter use and implementation and how this technology, with adequate empirical data, may influence a priori risk evaluation and loss-pick ratings, and (2) develop and design aggregated data sets relating to safety efficacy results of speed limiter technologies.

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ACRONYMS

ATC	Australian Transport Council	IIHS	Insurance Institute for Highway Safety
ATRI	American Transportation Research Institute	ISA	Intelligent speed adaptation
CMV	Commercial motor vehicle	LTL	Less-than-Truckload
ECM	Engine control module	mpg	Miles per gallon
GPS	Global positioning system	OOIDA	Owner-Operators Independent Drivers Association
HGV	Heavy goods vehicles	SRA	Swedish Road Administration

SI (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS					APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol	Symbol	When You Know	Multiply By	To Find	Symbol
<u>LENGTH</u>					<u>LENGTH</u>				
in	inches	25.4	millimeters	mm	mm	millimeters	0.039	inches	in
ft	feet	0.305	meters	m	m	meters	3.28	feet	ft
yd	yards	0.914	meters	m	m	meters	1.09	yards	yd
mi	miles	1.61	kilometers	km	km	kilometers	0.621	miles	mi
<u>AREA</u>					<u>AREA</u>				
in ²	square inches	645.2	square millimeters	mm ²	mm ²	square millimeters	0.0016	square inches	in ²
ft ²	square feet	0.093	square meters	m ²	m ²	square meters	10.764	square feet	ft ²
yd ²	square yards	0.836	square meters	m ²	m ²	square meters	1.195	square yards	yd ²
ac	acres	0.405	Hectares	ha	ha	hectares	2.47	acres	ac
mi ²	square miles	2.59	square kilometers	km ²	km ²	square kilometers	0.386	square miles	mi ²
<u>VOLUME</u>					<u>VOLUME</u>				
fl oz	fluid ounces	29.57	milliliters	ml	ml	milliliters	0.034	fluid ounces	fl oz
gal	gallons	3.785	liters	l	l	liters	0.264	gallons	gal
ft ³	cubic feet	0.028	cubic meters	m ³	m ³	cubic meters	35.71	cubic feet	ft ³
yd ³	cubic yards	0.765	cubic meters	m ³	m ³	cubic meters	1.307	cubic yards	yd ³
<u>MASS</u>					<u>MASS</u>				
oz	ounces	28.35	grams	g	g	grams	0.035	ounces	oz
lb	pounds	0.454	kilograms	kg	kg	kilograms	2.202	pounds	lb
T	short tons (2000 lbs)	0.907	megagrams	Mg	Mg	megagrams	1.103	short tons (2000 lbs)	T
<u>TEMPERATURE (exact)</u>					<u>TEMPERATURE (exact)</u>				
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C	°C	Celsius temperature	1.8 C + 32	Fahrenheit temperature	°F
<u>ILLUMINATION</u>					<u>ILLUMINATION</u>				
fc	foot-candles	10.76	lux	lx	lx	lux	0.0929	foot-candles	fc
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²	cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
<u>FORCE and PRESSURE or STRESS</u>					<u>FORCE and PRESSURE or STRESS</u>				
lbf	pound-force	4.45	Newtons	N	N	Newtons	0.225	pound-force	lbf
psi	pound-force per square inch	6.89	Kilopascals	kPa	kPa	kilopascals	0.145	pound-force per square inch	psi

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with section 4 of ASTM E380

APPENDIX A

Contributing Organizations

To identify any prior studies on the safety effectiveness of speed limiters in commercial vehicles, both international and industry organizations were contacted, as listed below.

INTERNATIONAL ORGANIZATIONS

Australia

- National Transport Commission
- Police South Australia
- Queensland Transport
- New South Wales Transport
- Vic Roads

Austria

- Federal Ministry of Transport, Innovation, and Technology

Canada

- Transport Canada, Motor Carrier Division
- Ontario Ministry of Transportation, Carrier Safety Policy Office

European Commission

- Directorate General for Transportation and Energy: Road Safety Division

France

- Laboratory for the Interaction Between Vehicle, Infrastructure, and Driver (LIVIC)
- National Institute for Transportation and Safety (INRETS)

Germany

- Federal Highway Research Institute

Netherlands

- The Netherlands Organization for Scientific Research (TNO)
- Technical University Delft

Norway

- Norwegian Public Roads Administration

South Africa

- University of Capetown, Urban Transport Research Group

Spain

- Spanish Road Association

Sweden

- Swedish Road Administration

Switzerland

- Federal Roads Office

United Kingdom

- Department for Transport, Freight and Logistics Division

INDUSTRY ORGANIZATIONS

All state motor truck associations

American Bus Association

American Trucking Associations (ATA)

- Safety Department

- Highway Policy Committee

- Technology & Maintenance Council

- Safety and Loss Prevention Management Council

Commercial Vehicle Safety Alliance

Motor Freight Carriers Association

National Tank Truck Carriers Association

National Private Truck Council

Owner–Operator Independent Drivers Association

APPENDIX B

Survey Questionnaire

Under sponsorship of the Transportation Research Board, Bishop Consulting along with the Virginia Tech Transportation Institute (VTTI) is conducting a study focused on the safety impacts of speed limiting devices in commercial trucks and buses. As a trucking industry professional your knowledge and opinions are important to this study. This survey seeks your input on various speed limiter issues. The survey, which will take about 10 minutes to complete, asks you about the effectiveness of speed limiters, in terms of perceived fleet safety, driver acceptance, vehicle operations, and related issues. There is also a space for your comments and suggestions. Final research results will be provided to interested parties and stakeholders, but **all information provided by you will be kept strictly confidential! The information collected from this survey will not be used for any other purposes.**

Thank you for your participation and support!

Please send me a copy of the final report (must complete information below) YES

Name: _____
 Phone: _____
 Company: _____
 E-mail: _____
 Job title: _____

1. Number of years you have been a safety manager (for commercial vehicle operations):
 _____ years
2. Your approximate number of years experience in commercial vehicle operations:
 _____ years
3. Number of power units in your company's fleet: _____ power units
4. How would you characterize your fleets primary operation (select one)?
 - For hire: local/short-haul (less than 100 miles from home base)
 - For hire: long-haul (more than 500 miles from home base)
 - Private fleet: long-haul
 - Private fleet: local/short-haul
 - Passenger carrier: long-haul
 - Passenger carrier: local transit
 - Other (please specify): _____
5. Does your organization use speed limiters in any of your trucks? NO YES
 - a. If "NO," then why (select all that apply)? If "YES," skip to Question #6.
 - Cost of installing and/or maintaining devices
 - Owner-operator refusal
 - Impact on delivery time
 - Avoid workplace conflict
 - Car-truck speed differential safety concerns
 - Inability to accelerate during safety event
 - All vehicles (cars and trucks) must have speed limiters
 - Fear that drivers will drive faster in lower posted speed zones
 - Other (please specify): _____

If you answered NO on Question #5, please do not complete the questions beyond this point. Please e-mail your responses to richardbishop@mindspring.com or fax your responses to Jeff Hickman @ 540-231-1555. Thank you for your time.

6. Do you use a speed limiting device that was factory installed by the engine or vehicle manufacturer? NO YES
 a. If "NO," what type of speed limiter does your company use?

7. Please estimate what percentage of your fleet uses speed limiters? _____%

8. How many years have speed limiters been installed in your vehicles? _____ years

9. Does your company set a cruise-control speed limit that is different from a non-cruise control (on-pedal) speed limit?
 NO YES, the cruise control speed is _____ MPH

10. What is your non cruise-control (on-pedal) speed? _____ MPH

11. Do you require speed limiters for owner-operators you hire?
 NO
 YES
 Not applicable

12. How did you determine the governor speed to set in your fleet (mark all that apply)?
 Safety
 Posted speed limit
 Fuel mileage
 Insurance requirements
 Driver input
 Followed other trucking organization
 Other (please list): _____

13. What are the TOP three intended goal(s) of speed limiters (please write number)?
 ___ Reduce top speed
 ___ Reduce overall speeding above posted speed limits
 ___ Reduce crashes
 ___ Reduce speeding-related violations
 ___ Reduce tire wear
 ___ Increase fuel economy
 ___ Other (please list): _____

14. Do you have any variations in the top speed of the speed limiter among your drivers? For example, different speeds for drivers with an excellent or poor safety record.
 NO
 YES, please explain:

15. Have drivers tampered with the speed limiter settings? NO YES
 a. If "YES," are there penalties for drivers who tamper with the speed limiter settings?
 NO
 YES, please explain:

16. Based on your experience, how successful have the speed limiters been in reducing speeding violations?
 Very successful
 Successful
 Neutral
 Unsuccessful
 Very unsuccessful
 Cannot determine

17. Based on your experience, are you aware of drivers traveling faster than normal in lower speed areas in order to “make up” time “lost” by using a speed limiter on interstate routes?

- NO
- YES, please explain (anecdotal information is acceptable):

18. Based on your experience, how successful have the speed limiters been in reducing crashes?

- Very successful
- Successful
- Neutral
- Unsuccessful
- Very unsuccessful
- Cannot determine

19. Based on your experience, how successful have the speed limiters been in reducing tire wear?

- Very successful
- Successful
- Neutral
- Unsuccessful
- Very unsuccessful
- Cannot determine

20. Based on your experience, how successful have the speed limiters been in increasing fuel economy?

- Very successful
- Successful
- Neutral
- Unsuccessful
- Very unsuccessful
- Cannot determine

21. Based on your experience, how often do the speed limiters reduce on-time delivery?

- Very often
- Often
- Neutral
- Seldom
- Very seldom
- Cannot determine

22. Based on your experience, what has the driver response been toward the speed limiter?

- Very positive
- Positive
- Neutral
- Negative
- Very negative
- Cannot determine

23. Based on your experience, in what way does having speed limiters on fleet vehicles impact driver hiring and retention?

- Strong adverse impact
- Adverse impact
- No impact
- Positive impact
- Strong positive impact
- Cannot determine

24. Have speed limiters negatively affected safety in any area of your operations?

- NO
- YES, please indicate how:

25. Have speed limiters negatively affected productivity in any area of your operations?

- NO
- YES, please indicate how:

26. Overall, the use of speed governors has improved your fleet operations.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

27. Please feel free to write any comments, issues, or experiences you've had with speed limiters.

Thank you for your time. Please submit you survey in one of the following ways.

E-mail: richardbishop@mindspring.com

Fax: Jeff Hickman @ 540-231-1555

Mail: Jeff Hickman, Virginia Tech Transportation Institute, Blacksburg, Va., 24061

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International-North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation