Commercial Truck and Bus Safety

Synthesis 5

Training of Commercial Motor Vehicle Drivers

A Synthesis of Safety Practice

Sponsored by the
Federal Motor Carrier
Safety Administration

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COMMERCIAL TRUCK AND BUS SAFETY SYNTHESIS PROGRAM

Synthesis 5

Training of Commercial Motor Vehicle Drivers

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SUBJECT AREAS
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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 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.

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

By Christopher W. Jenks
CTBSSP Manager
Transportation Research Board

This synthesis will be useful to commercial truck and bus carriers, state agencies, and others interested in improving commercial vehicle safety. The synthesis identifies and documents training strategies and curricula from existing commercial driver training programs, with the goal of identifying those commercial motor vehicle driver training tools and techniques that hold the greatest potential to improve commercial motor vehicle safety. Information for this synthesis was obtained through surveys of commercial motor vehicle training schools and carriers; a review of relevant literature; and a review of comments received on the U.S. DOT Federal Motor Carrier Safety Administration (FMCSA)-issued Advance Notice of Proposed Rulemaking (ANPRM) and Notice of Proposed Rulemaking (NPRM).

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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This synthesis series reports on various practices; each document is a compendium of the best knowledge available on measures found to be successful in resolving spe-

cific problems. To develop these syntheses in a comprehensive manner and to ensure inclusion of significant knowledge, available information assembled from numerous sources is analyzed.

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.

CONTENTS

TRAINING OF COMMERCIAL MOTOR VEHICLE DRIVERS

SUMMARY

This synthesis focuses upon similarities and differences in training strategies and curricula among existing driver training programs, with a goal of identifying those commercial motor vehicle (CMV) driver training tools and techniques that hold the greatest potential to improve CMV safety. In particular, the need to ensure adequate knowledge and skills for entry-level drivers guided this research effort. The summary and recommendations that follow reflect an exhaustive review of technical information sources, as well as inputs from the trucking and motorcoach industries derived through survey responses solicited in this project, supplemented by comments to the FMCSA's 1993 Advanced Notice of Proposed Rulemaking (ANPRM), which was published in the *Federal Register* on June 21, 1993, and its 2003 Notice of Proposed Rulemaking (NPRM), published in the *Federal Register* in August 2003.

Although this research synthesis identified specific tools and techniques that, if broadly implemented, appear likely to yield safety benefits, there are overarching needs and requirements to promote the effectiveness of driver training programs that cannot be overlooked. As emphasized in the recommendations of the 2002 International Truck and Bus Safety Research and Policy Symposium, there is an urgent need for standardized curricula for entry-level driver training and remedial training for problem drivers (Zacharia and Richards, 2002). And, it is equally critical—whether it comes about through regulation, through initiatives by motor carriers and insurers, or through a combination of actions—that it is not possible for a driver whose qualifications are limited to completion of a course designed solely to coach the student to pass the commercial driver's license (CDL) exam, to assume sole responsibility for a heavy vehicle.

One sometimes overlooked factor is the extent to which training program effectiveness depends upon the qualifications and commitment of the trainer, regardless of the particular tools available to support training program activities. These individuals, whether employed by schools or carriers, must instill in entry-level drivers not only the requisite knowledge and skills that make them able to perform everyday driving tasks but also a 'safety culture' that they will take with them when they have sole responsibility as a heavy vehicle operator. Certainly, the trainer must know everything that the trainee is expected to know and have the skills—oral and written communications, listening,

platform skills, and patience—to impart this knowledge effectively. Trainers who are highly motivated, with 2 or more years of hands-on driving experience, who are provided with proper certification and recertification as needed to meet a given carrier's training goals, and are compensated in proportion to their essential contributions are paramount to meeting future demands for a safe, stable, and productive workforce in the trucking and motorcoach industries.

Finally, the overall commitment of an organization to finishing training for entry-level drivers and refresher training for experienced drivers will dictate how training programs are structured and what resources are allocated to them. As noted by a regional less-than-truckload (LTL) company participating in the present industry survey, "There is no substitute for selection of the right individual, one-on-one training, evaluation, and observation. The organization needs a strong safety culture at all levels of the spectrum and continual emphasis on highway safety." Recognition of drivers' skills, through rodeos and similar events, and tangible rewards for their accomplishments in meeting safe performance milestones similarly reinforce a new driver's understanding that the company is serious about its training programs.

With these thoughts in mind, a number of recommended practices for improving training effectiveness for entry-level CMV drivers are supported by this synthesis:

- *Industry-wide acceptance of, and adherence to, standards put forward by the Professional Truck Driving Institute (PTDI) as a minimum requirement for entry-level (2nd seat) drivers and for the certification of driver trainers.* As a practical matter, this will depend on the adoption of hiring policies by carriers that require graduation from a PTDI-certified institution.
- *Finishing training for 1st seat (solo) drivers.* This may be accomplished through partnerships between schools and industry to provide the PTDI-recommended externship experience or by carriers who provide over-the-road, one-on-one training using certified company driver-finishing trainers for a number of miles or hours that are specified in advance and tied to performance-based criteria.
- *Substitution of multimedia instructional materials, delivered via CD/DVD-ROM, for traditional classroom presentations relying on printed materials.* These resources can better engage students' interest, more clearly explain or display certain procedures, and reduce training costs, while allowing more time to be devoted to instruction in and around the vehicle instead of in the classroom. Distance learning and e-learning possibilities may also be greatly expanded. Training program elements that are good candidates for instruction using multimedia resources include familiarization with vehicle control systems; how to perform pretrip, en route, and post-trip vehicle inspections; identifying and maintaining vehicle systems; preparing the vehicle for driving in adverse weather; procedures for securing cargo; proper lifting techniques; and effective communication skills. The explanation of defensive driving techniques can also be enhanced through dynamic examples illustrated via CD/DVD-ROM technology.
- *Introduction or expansion of appropriate uses of affordable simulation options.* A key in this area is to properly match the training target with the capabilities of a particular simulator platform. Safe driving strategies and tactics can be taught and evaluated using a dynamic presentation of realistic traffic situations on a low-end, noninteractive simulator with forward view only, providing that it offers a sufficiently high-resolution display to permit detection and recognition of safety hazards at meaningful preview times and distances. Certain maneuvers in a fixed (noninteractive) environment, such as docking, can be effectively practiced using model-board simulators that are relatively modest in cost. For other maneuvers,

however, such as effective scanning practices, it is desirable to simulate a visual environment that is nearly or fully immersive (360 degrees), which requires a more expensive system. Training operators to drive in hazardous weather and make emergency maneuvers requires still higher fidelity simulation, including top-end computer graphics and a sophisticated motion platform. Schools and companies should design simulation into their training programs in a way that makes sense in terms of their particular instructional goals and available resources. Drawing on the concept of a regional training center, an attractive solution would be for multiple organizations to share access to simulators.

- *Expansion of the use of skid pads to train beginning drivers about stopping distances under different load configurations; to use different brake systems (including all ABS, mixed ABS, and non-ABS); and to experience the consequences of driving on a wet surface for handling and stopping the vehicle, including skid control.* As in the case of simulators, a consortium of training providers that share a common facility may be the most practical means of increasing access to skid pad training.
- *Employment of videos, in concert with testimonials by experienced drivers, to give entry-level trainees a realistic orientation to health, wellness, and lifestyle issues and to provide fitness-to-drive instruction.* Increased cost-effectiveness for training programs and better driver retention will be served by using this approach to train recruits in the management of work schedules and family time, management of finances while on the road, and general health maintenance. Teaching novice drivers to recognize signs of fatigue and to employ fatigue-reducing strategies also will be enhanced by including these methods as mandatory components of a training program.

CHAPTER 1

INTRODUCTION

BACKGROUND

Large trucks are overrepresented in fatal crashes. In 2000, large trucks accounted for 4% of the nation's registered vehicles, 7% of traffic volume, and 13% of all fatal crashes (Federal Highway Administration, 2002). To reduce the incidence of preventable crashes, training programs are offered as a countermeasure to improve fleet safety by improving the skills and knowledge of commercial drivers.

The FHWA has advised caution in selecting a driver training program. There are many schools—some operated commercially, and some operated privately by large carriers—with differing objectives, facilities, and staff orientation. FHWA provides a list of discriminating factors in its *Commercial Vehicle Preventable Accident Manual: A Guide to Countermeasures* (Uzgiris et al., 1991): curriculum content, adequacy of facilities, compatibility of training vehicles with company fleet, staff qualifications and experience, certification, referrals, and hours of actual driving instruction and practice.

There are three primary sources of trained drivers: private schools that charge tuition and receive some funding through government programs; public junior colleges and community colleges that offer transportation programs that include truck driver training; and the carriers themselves, who provide training either in place of, or to augment, what is provided by schools. Traditionally, formal training programs include three components—classroom instruction, skills training in a restricted (off-road) area, and on-the-road instruction.

No federal standards for commercial driver training exist with the exception of the recently passed minimum requirements (*Federal Register,* 2004) for training in four topics, estimated to require 10 hours of training for heavy truck and motorcoach drivers as discussed later in this report. However, a de facto curriculum standard for the training of new truck drivers is that published by PTDI. There also are no standards for the instructors who deliver training materials (outside of those published by PTDI for instructors who teach at PTDI-certified institutions), a significant omission considering the observations by those with lengthy industry experience that instructor knowledge and skill are at least as important to the instructional process and a student's subsequent safety record as curriculum content.

Once drivers have obtained a CDL, any additional training they receive will most likely be provided by their employers and is typically reactive rather than proactive. That is, aside from an orientation to company policies and procedures, only drivers identified as "high risk" will receive supplemental vehicular training over the minimum needed to qualify for the CDL. Most drivers do not drive for major carriers that conduct this level of training, and those who do may not stay long enough to complete supplemental programs.

Unfortunately, as the need for trained drivers has increased, recent trends show a decline in the number of formal programs offering commercial driving instruction. Ultimately, this need must be addressed. But first it is essential to identify and document best practices for commercial driver training to ensure that the most effective methods are applied, for the health of the industry and for the safety of the driving public.

OBJECTIVES AND SCOPE

The objectives of this research were to identify and document CMV driver training programs and practices, with a focus on large trucks and buses, resulting in a synthesis of practices that will be useful to truck and bus carriers as well as state departments of transportation (DOTs) and departments of motor vehicles (DMVs). The scope of the study included a comprehensive literature review, complemented by a survey of selected truck and bus companies, industry associations, and public and private driving schools. The information sought in the literature review and survey permitted the research team to identify and examine (1) similarities and differences in training strategies among existing driver training programs, (2) similarities and differences in the curricula applied in selected training programs, and (3) the extent to which simulator- and computer-based technologies can be used to enhance the effectiveness of commercial driver training programs.

RESEARCH METHODS

An exhaustive technical information search was conducted to pinpoint knowledge domains used in driver training programs delivered by truck driving schools and the commercial vehicle industry. Journal articles, government research

publications and study reports, and trade papers were identified and acquired to meet this need from the following sources: electronic information and abstracting database services; state DOT library and information centers; and professional organizations devoted to driver training and education, highway safety, and commercial driver issues (e.g., the American Driver and Traffic Safety Education Association, the American Association of Motor Vehicle Administrators, the Insurance Institute for Highway Safety, and the AAA Foundation for Traffic Safety). The electronic index and abstract databases on transportation and highway safety topics that were searched included TRIS online; SilverPlatter's TRANSPORT CD-ROM (database includes bibliographic information from TRIS, the Organization for Economic Cooperation and Development, and the European Conference of Ministers of Transport); other transportation and education databases from DIALOG (e.g., Compendex, ERIC, and NTIS); and the internet (using various search engines, such as Yahoo, Google, and Lycos). Search terms included commercial motor vehicles, CMV, bus, truck, training, driver education, skills programs, driving performance, commercial driver license requirements, and operator needs and deficiencies. Based on the project team's review of abstracts for all candidates, 28 technical documents were prioritized for review and synthesis.

A key element in the project was to gain the perspective of experts regarding what works (and what does not work) in training entry-level CMV drivers to perform safely under a full range of operating conditions. To this end, lists of potential survey contacts were drafted, reviewed by project consultants with close ties to the trucking industry,[1] and augmented to reflect the consultants' input. A preliminary list of truck driving schools consequently was narrowed to focus on vocational/technical school and community college programs that have received PTDI certification, highlighting those that have been recognized as an "Editor's Pick" by the *All American Truck Driving School Guide.* A total of 24 schools were thus selected to receive surveys in this research. Similarly, a list of 42 truck and bus companies that received a safety-related reward or recognition in 2002—such as a National Industrial Safety Contest winner or National Truck Safety Contest winner—or that were identified by project consultants as having exemplary training practices were selected as candidate information sources. Finally, 23 organizations were identified as potentially useful survey respondents in this project, including government safety organizations, professional and trade associations, and insurers of commercial carriers. Bus, as well as truck, and Canadian, as well as U.S., interests were represented in the final list of survey recipients.

A 12-question survey was developed based on the information gleaned from the literature review, then revised in accordance with suggestions by the project consultants.[1] The resulting survey form, presented in Appendix A, was mailed to the 24 schools, 42 truck and bus companies, and 23 organizations described above.

A period of 1 month was allowed for survey recipients to complete and return their responses. When a smaller-than-anticipated level of response was obtained, the project was extended to accommodate the supplemental efforts described below:

- Telephone contacts were made with every survey recipient 1 month after the survey mailing date. The recipients were provided with additional background on the purpose of the research and on its sponsor (TRB); the importance of industry input to advancing safety through better training of CMV drivers was emphasized; and the recipients were asked to complete and return the surveys within a 2-week timeframe. Individuals who indicated that no survey had been received during the prior mailing were provided with a faxed copy following the telephone conversation.
- A project consultant made in-person requests for survey responses to participants at the National Private Truck Council conference approximately 2 months following the survey mailing date.
- Follow-up telephone contacts were conducted 3 months after the survey mailing date. During these contacts, many survey recipients indicated that the survey content did not apply to them. Another subset of respondents refused to participate, indicating that their companies do not participate in surveys as a rule or stating that no one in the company could spend the time required to complete the survey.

Surveys were returned by five schools, three trucking companies, and one bus company. Interestingly, over one-quarter of the truck and bus companies that were contacted but did not complete the survey advised that they neither hire entry-level drivers nor provide finishing training; instead these companies require new hires to have a minimum of 2 years (or 100,000 hours) of verifiable experience and a clean record.

Information obtained from the survey respondents was used to (1) augment the results of the literature review in characterizing current training practices, and (2) support inferences about the effectiveness of specific, enhanced training practices and approaches for entry-level CMV drivers. In the chapters that follow, a review of the literature describing what is currently considered adequate training for entry-level CMV drivers is presented, along with methods used to deliver training programs and their effectiveness. The input received from driving school instructors and truck and bus

[1]Mr. John Brock, Milestone Group, Arlington, VA; Mr. Robert Inderbitzen, CTP, REI Safety Services, LLC, Southbury, CT, Director of Safety and Compliance, National Private Truck Council; Mr. John McFann, J. McFann Consulting, Fort Wayne, IN.

company trainers that describes their current teaching methods and their ratings of the effectiveness of various training techniques is presented next.

Because respondents were assured that their individual responses would remain anonymous, schools and companies that participated in the data collection activity are not identified in the summary. While the survey return rate in this project was disappointing, many comments about training needs for entry-level CMV drivers were generated by schools, associations, and carriers in response to the NPRM by the FMCSA, posted in the *Federal Register* on August 4, 2003, and earlier in an ANPRM posted on June 21, 1993. The industry perspectives provided by these comments are incorporated into the following chapter.

CHAPTER 2

CONTENT AND QUALITY OF ENTRY-LEVEL DRIVER TRAINING PROGRAMS

As noted by Batts (1999), many truckload carriers rely on entry-level drivers. This author cites a Gallop study commissioned by the American Trucking Associations Foundation indicating that more than 80,000 new drivers per year will be needed by the trucking industry over the next decade. Bates further states that the quality of training received by entry-level drivers from three sources—public schools (most often community colleges), for-profit training programs, and carrier-based schools—is inconsistent. While some schools offer quality programs, others, designed solely to help someone acquire a CDL, put drivers on the road with as little as 1 week of training.

TRUCK CRASHES AND TRAINING

Beilock et al. (1989) analyzed data compiled by the Office of Technology Assessment and the 1987 Regular Common Carrier Conference's Motor Carrier Safety Survey. They concluded that the most common factors associated with heavy vehicle crashes were driving too fast for conditions (cited as a factor in 20% of all heavy truck crashes and the single highest factor cited) and the level of driver training (the second most-frequently cited factor). Driver education and training was offered as a solution to reduce the incidence of crashes associated with speed. A decade later, Horn and Tardif (1999) expressed a somewhat modified point of view, i.e., that adequate training is a necessary but not a sufficient condition for the reduction of heavy vehicle crashes; they recommended an approach combining regulations that specify the content requirements for training with an industry-based strategy for its delivery. The present research aims are consistent with this viewpoint.

In an evaluation of crashes between 1981 and 1985 using the National Analysis Sampling System (NASS), it was found that only 42% of truck drivers involved in crashes had received any training (Beilock et al., 1989). In the aforementioned 1987 survey, only 23% of 1,762 drivers of combination trucks had formal training before becoming professional drivers. The Office of Technology Assessment also found that untrained drivers are overinvolved in fatal crashes, as shown by the finding that 42% of large-truck drivers who were involved in all truck crashes had received training, compared with only 26% of the drivers involved in fatal crashes. These results indicate that, without regard to the quality of training, formal schooling prior to beginning trucking appears to have little effect on crash probabilities. The authors suggest that this result may be explained by the wide variation in course content across schools, underscoring the importance of developing and enforcing standards for training.

Beilock et al. (1989) also concluded that training programs that include periodic reexaminations and refresher courses are effective in reducing crash rates. They cite UPS's practice of periodic retraining. UPS trainers accompany drivers four times each year, using a 120-item checklist to determine if a driver has developed bad habits. Retraining is provided for drivers based on the checklist. Retraining is also mandatory if a driver is involved in an avoidable crash. In 1986, the UPS crash rate was barely one-tenth that for the motor carrier industry as a whole. Horn and Tardif (1999) state that continuous driver training through driver improvement courses that focus on safety and driver behavior—thinking ahead before dangerous situations develop, driving under slippery road conditions, etc.—must be supported by senior management, who must view training as useful rather than just as an additional cost or annoyance.

The FHWA, in its *Commercial Vehicle Preventable Accident Manual: A Guide to Countermeasures* (Uzgiris et al., 1991), states, "the great majority of preventable crashes can be shown to be directly related to the performance of the driver; and, therefore, it is extremely productive to any fleet safety program to have careful new driver selection and adequate monitoring procedures for existing drivers." It recommends that management address the following question when there is an excessive incidence of preventable crashes by individual drivers: "When hiring new drivers, are recruiting efforts sufficient to attract an adequate number of qualified applicants for effective selection?" (Uzgiris et al., 1991.) The *Manual* offers truck driving school as a countermeasure for excessive incidents of preventable crashes, explicitly linking fleet safety to driver skills and knowledge.

THE CONTENT AND QUALITY OF TRUCK DRIVER TRAINING

The following discussion focuses on the current state of the knowledge regarding the content and quality of training provided by truck driving schools, as well as training content and procedures delivered by carriers in so far as this could be

identified in the literature. As noted by Horn and Tardif (1999), the availability of reliable data in the area of truck driver training and evaluation is poor relative to highway safety research and development in general.

While the CDL is a federally mandated licensing standard, there is no federally mandated standard for the training of entry-level commercial truck drivers. And while the FMCSA believes that the FHWA Model Curriculum, the PTDI Curriculum, the Model Curriculum for Training Motorcoach Drivers, and the NHTSA School Bus Driver Instructional Program represent the basis for training adequacy, such training is not mandated. At the same time, the FMCSA does not agree that training adequacy is ensured simply by having the knowledge to pass the CDL test (Federal Motor Carrier Safety Administration, 2003).

PTDI-Certified Courses

PTDI was established in 1986 to assist carriers and students in the identification of courses that provide quality-level training. The Institute's curriculum and other course certification criteria are an adaptation of the 1984 FHWA Model Curriculum. The PTDI is the only organization, either public or private, that has established a standard for the training of entry-level truck drivers. PTDI certifies courses at truck driving schools; it is not a school and does not offer courses. The Truckload Carriers Association assumed management of PTDI in 1997; and, since then, PTDI has undergone restructuring that includes the identification of skill standards, a revision in the curriculum, and modification of certification standards.

PTDI-certified courses are currently offered at 61 schools in 28 states and Canada, according to PTDI's Web site.[2] PTDI-certified driver-finishing programs are currently offered by two carriers at two locations. Only graduates of a PTDI-certified entry-level course are eligible to enroll in a PTDI-certified driver-finishing program. These standards assure the continuity and consistency of training after a driver leaves the school and finishes training at the trucking company.

PTDI-certified courses generally offer at least 148 curriculum hours, including 44 hours of behind-the-wheel training during which the student actually drives the vehicle. PTDI recommends an additional 21 hours beyond the minimum requirements of 148 hours, with the additional time in the classroom distributed across at least five subjects: additional DOT regulations, first aid, CPR, CDL written preparation, defensive driving, and the job search. PTDI-certified courses range from 240 to 600 hours, with many of the longer programs placing students in an externship program with an over-the-road trainer. PTDI states that an externship of 140 to 240 hours of instruction can provide the additional training and experience necessary for an entry-level driver to progress to a solo driver. To be PTDI-certified, programs must include topics in basic vehicle operation, safe operation practices for basic operation (visual search, vehicle communication, speed and space management), advanced operating practices (night operation, extreme driving conditions, hazard perception, emergency maneuvers and skid avoidance, skid control and recovery, passive railroad crossings), vehicle systems and reporting malfunctions, and nonvehicle activities (handling and documenting cargo, environmental issues, hours of service requirements, accident procedures, managing life on the road, trip planning, and communication). PTDI is concerned with more than just the curriculum and quality of instruction; PTDI-certified courses undergo evaluation by on-site teams that look at areas such as instructional personnel, classrooms, quality of training equipment, accuracy of student records, and employer and student satisfaction (Batts, 1999).

The value of training that meets PTDI standards was a consensus opinion at a national forum of the Driver Training and Development Alliance, which asserted that "a carrier's greatest asset is a driver with good driving skills, a solid knowledge of regulations and proper vehicle inspection techniques, and customer service savvy" (Abry, 1998). This group of 185 individuals from business, industry, and government highlighted the need for truck safety through voluntary, industry-wide driver training and development standards; it emphasized that driver training is an investment rather than a cost because training reduces turnover, results in increased driver pride, and reduces wear and tear on the vehicle. The alliance encourages potential drivers to attend schools that deliver a curriculum certified by the PTDI.

Current Practices

Horn and Tardif's (1999) review of practices in the European Union and North America found that private schools most commonly offer a 150-hour curriculum that includes classroom, range, and on-road training. The vehicle used for on-road training is usually equipped with extra seats behind the driver so that 3 to 4 students can be in the vehicle at the same time and participate in training through observation. During the in-truck training, the instructor uses a commentary technique so that the student driver and observers can learn from the on-road exposure. Horn and Tardif found that nonprofit schools tend to offer a more extensive curriculum, with some countries providing 700 hours of training. In France, the curriculum can cover up to 2 years, depending on the student's experience and knowledge.

Perhaps the single most important component of an effective training program is a qualified trainer (Wiggins, 1990; Horn and Tardif, 1999). The International Road Transport Union moved in 1998 to create a vocational training academy at the European level to comply with a European community directive governing admission to the occupation for future transport operators. Wiggins (1990) states that the character-

[2] "Schools with PTDI-Certified Courses Listed by State as of March 20, 2004," available online at www.PTDI.org/schools.schools.htm. The most current list is available at www.PTDI.org/schools/schools.htm. Last accessed September 20, 2004.

istics of a good trainer include confidence, a thorough knowledge and understanding of the trucking industry, excellent communication skills, and the ability to think on one's feet. She describes the Interstate Truckload Carriers Conference (ITCC) program for trainers called "Developing a Company Training Program," which is a 1-week program designed for trainers working with driver graduates or experienced drivers. Trainers are taught how to identify weak spots in drivers' skills, how to address them, and how to use objective scoring measures to grade drivers.

Occupational and safety professionals recommend that trucking firms adopt training programs that are delivered by qualified driver trainers to ensure driver competence that is above the minimum standards set by law (Smith, 1996). The driver training program should include defensive driving, transportation of dangerous goods (if applicable), the Workplace Hazardous Materials Information System, workplace hazard recognition, load security procedures, vehicle operation, safety equipment, pretrip inspections, road skills, relevant legislation, hours of work legislation, first aid, and any other safety-related subjects. Further, the program must have a recall and evaluation system for both the driver and the training program and must have provisions for the identification of drivers who require further training and retraining. The FHWA has recommended that the management of carrier companies periodically have a qualified person ride along with drivers to evaluate their defensive driving habits and to ensure that the drivers are aware of the concept of "preventable crashes" (Uzgiris et al., 1991).

The FHWA's *Commercial Vehicle Preventable Accident Manual: A Guide to Countermeasures* (Uzgiris et al., 1991) highlights the following areas in which managers of carrier companies should ensure that their drivers have received training:

- Ways in which drinking and substance abuse affect driving performance.
- Defensive driving.
- Safe curve negotiating techniques, conditions that make rollover more likely, and the meaning of posted advisory speeds on curves (they are for automobile drivers).
- Performance of safe passing maneuvers.
- Performance of safe turning procedures.
- Safe procedures for crossing intersections.
- Safe lane usage and lane changing.
- Safe parking procedures.
- Controlling their vehicles on downgrades.
- Checking the condition of braking systems.
- Safe maneuvering on slippery surfaces, including knowledge of how to judge safe speed on a slippery surface and causes and prevention of jackknifing.
- Emergency equipment requirements and emergency procedures.
- How to maneuver safely around pedestrians.
- Safe passenger management procedures.
- How and why rollovers occur.
- How to deal with sealed cargoes, top heavy or offset cargoes, or improper axle weight distribution.
- What to do regarding improperly loaded or secured cargoes.
- Proper use of hitching equipment, proper coupling procedures, and proper methods for blocking and bracing.
- Avoidance of high-hazard locations.
- Troubleshooting vehicle deficiencies (worn, failed, or incorrectly adjusted components that can cause or contribute to crashes).
- Inspection of safety-critical components to determine the adequacy of their condition.
- How to detect deteriorating conditions during brake, tire, and wheel inspections.
- Consequences of improper tire inflation and how to check tire inflation.

Commercial Motor Vehicle Driver Training

Dueker (1995) conducted a study to determine the effectiveness of the private sector in ensuring adequate training of entry-level CMV drivers. This study focused on training for CMV drivers of heavy trucks, motorcoaches, and school buses. Operational definitions created for each of the terms included in the study objectives are presented below.

"Entry-level training" was defined as all training received during the first 3 years of the driver's experience, including preservice training, on-the-job training, and in-service training. Included in the definition of "private sector" were driving schools (i.e., public, private, and company-operated); certification and accreditation groups; carriers and fleet operators; associations; insurance companies; and drivers. Programs were considered as "formal training" only if they provided some number of class or lab hours, to discriminate between programs that just provided on-the-job training. Further, it was determined that on-street hours must be provided in addition to classroom hours for a program to be considered "adequate."

"Adequate training" for heavy trucks and motor coaches was defined by Dueker as shown in Table 1, using the FHWA model tractor-trailer driver curriculum (Federal Highway Administration, 1985) as a starting point and the consensus of a panel of 36 experts on the minimum acceptable requirements for each of the listed curriculum characteristics. The recommended curriculum topics for "adequate" truck or bus training are presented in Table 2. Data are not provided in the summary tables below for school buses, as they are not a focus of this research.

Data regarding the adequacy of heavy truck and motorcoach training were provided by a total of 640 respondents from industry, schools, and individual drivers who were surveyed in the Dueker (1995) study. The study concluded that the private sector is not effective in providing adequate training for drivers of heavy trucks, motorcoaches, or school

TABLE 1 Training criteria employed by Dueker (1995) for heavy trucks and motorcoaches

Curriculum Characteristics	Minimum Criteria for Adequate Training
Hours:	
Class/Lab	89
Range	85
Street	116
Total	290
Per Student Hours:	
Street only	38.7
Range and Street	52.9
Student-Teacher Ratios:	
Class/Lab	12
Range	6
Street	3
Behind the Wheel:	
Hours	38.5
Miles	1,000
Content Topics (see Table 2)	49-50 topics

buses. Data were provided to describe percentages of motor carriers that provide adequate training as well as percentages of drivers receiving adequate training. Of the heavy truck carriers who were surveyed, only 22% indicated that they provide formal training to the entry-level drivers they hire. This compares with 63% of motorcoach carriers surveyed who provide formal training to their entry-level drivers. In terms of the adequacy of the formal training provided, approximately one-third of the heavy truck carriers and motorcoach carriers provided training that was considered "adequate," as defined by project criteria. For heavy truck carriers, 38% provided training defined as "adequate;" and, for motorcoach carriers, 30% provided training that was defined as "adequate." Combining the prevalence of formal training and the adequacy of formal training, the findings indicated that only 8.1% of heavy truck carriers who hire entry-level drivers provide adequate training for them, and only 18.5% of the motorcoach carriers who hire entry-level drivers provide adequate training for them. These results are presented in Table 3.

Dueker (1995) also reports data provided by 141 heavy truck drivers and 22 motorcoach drivers to describe the number of drivers who are being adequately trained and the extent to which schools (publicly funded and proprietary) add to the percentage of adequately trained truck drivers. The drivers in the sample were limited to those with 5 or fewer years of experience (i.e., "new" drivers). The findings of the driver survey, presented in Table 4, show that both publicly and privately funded schools contribute substantially to the number of CMV drivers who receive adequate training.

Responses to the ANPRM

As part of the study performed by Dueker (1995), responses to FHWA's ANPRM, "Training for All Entry-Level Drivers of Commercial Motor Vehicles," were analyzed. The 104 respondents included 65 individuals from the trucking industry, 16 from the school bus industry, 1 from a motorcoach association, and individuals associated with the government. The most frequently mentioned standard was the FHWA Model curriculum, as embodied by the PTDI Standards and the CDL Standards. The PTDI standard includes classroom instruction, range practice, and on-street practice that totals 148 per-student hour, which is equivalent to the 320 hours required by the FHWA Model Curriculum when accounting for the higher student-teacher ratios in the FHWA Model (Dueker, 1995). The CDL tests comprise a general knowledge test, specialized knowledge tests, a vehicle component inspection, and a road test.

When asked what an adequate training program should include, the most frequent response from the truck group (22 of 38 respondents) was that the program should conform to the FHWA Model Curriculum/PTDI Standard for both content and hours; 5 truck-group respondents indicated that the program should conform to the FHWA/PTDI standard, but additional topics should be included or the curriculum should be updated. Additional topics recommended by truck- and motorcoach-group respondents included the following: defensive driving; vehicle safety inspections; handling CMV on all types of roadways; night driving; responding to hazards and emergencies; mountain driving; freight handling procedures and equipment; cargo stacking, securing, and weight distribution; map reading and planning; hours of service/log preparation; state-specific DMV and Public Utilities Commission (PUC) regulations; and brakes. The most frequent suggestion for improving training methods was to place greater emphasis on behind-the-wheel instruction.

The need to enhance inclement weather driving skills is emphasized by Kostor and Summerfield (2001). Although driving schools may have modules on driving in inclement weather, there is a need for advanced training to test classroom

TABLE 2 Curriculum topics recommended by Dueker (1995) for "adequate" training

Curriculum Topic	Heavy Trucks	Motorcoaches
Basic Operation		
Function, location, and proper use of all primary vehicle control systems (e.g., brakes, accelerator, shifters, clutch, and internal transmission retarders).	√	√
Function, location, and proper use of all secondary vehicle control systems and instruments (e.g., light switches, wipers, ignition controls, seat belt, gauges, and warning devices)	√	√
Door controls		√
How air brakes operate	√	
How hydraulic brakes operate	√	
Proper use and adjustment of mirrors for maximum visibility		√
Equipment-specific engine stop and/or start controls (e.g., emergency, engine compartment switch, and master switch)		√
Air/electric horns		√
Basic control and maneuvering (e.g., starting, acceleration, braking, steering, shifting, backing)	√	√
Turning—understanding location of bus pivot point		√
Parking		√
Overhead clearance		√
Railroad crossing procedures		√
Different multirange transmission shift patterns	√	
Use of retarders and speed controls		√
Special Handling of Articulated Vehicles		
How the center of gravity of your load affects handling and about unstable loads (e.g., tankers and live cargo)	√	
Special things you should know about handling tractor trailers	√	
Special things you should know about handling multiple articulated vehicles (twins, doubles, triples)	√	
Special things you should know about handling tractors alone (bobtail)	√	
Special things you should know about handling other special rigs (e.g., oversized or low-clearance vehicles and pole trailers)	√	
Safe Operating Procedures		
Visual search	√	√
Communication with other road users (e.g., signaling, flashers, headlights, backup lights)	√	√
Adjust speed to traffic, traction, visibility, road conditions	√	√
Monitor space around the vehicle	√	√
Understand and use the defensive driving 4-sec following distance technique		√
Special Conditions		
Nighttime operations	√	√
Extreme temperature (hot, cold)	√	√
Mountainous terrain	√	√
Transporting handicapped and exceptional passengers		√
Advanced Driving Skills		
Hazard recognition (e.g., road conditions, driving situations, driver and pedestrian characteristics)	√	√
Collision avoidance (e.g., quick stops, evasive maneuvers, making judgments)	√	√
Prevention of and recovery from skids		√
Prevention of and recovery from skids and/or jackknife	√	
Equipment-related emergencies (e.g., blow-outs and brake failure)	√	√

(*continued on next page*)

TABLE 2 (Continued)

Curriculum Topic	Heavy Trucks	Motorcoaches
Vehicle-Related, Nondriving Activities		
Coupling and uncoupling articulated vehicles	√	
Safety inspections, i.e., using systematic procedures for pretrip, en route, or posttrip inspections	√	√
Securing vehicle and contents	√	√
Basic familiarization with the location, function, operation, and common failures of vehicle systems	√	√
Recognizing vehicle malfunctions	√	√
Diagnosing vehicle malfunctions		√
Coordinate with maintenance to effect repair of vehicle components		√
Safe work methods (e.g., lifting)	√	√
Preventive Maintenance and Servicing		
Check and service engine fuel, oil, coolant, battery, and filters	√	
Check tire air pressure	√	
Check tires and check for proper wheel mounting	√	
Drain moisture from air brake supply reservoirs	√	
Check brakes	√	
Clean and repair lights	√	
Change fuses and reset circuit breakers	√	
Nonvehicle Activities		
Handling baggage and package express		√
Recognizing hazardous materials and proper refusal to transport these materials		√
Hours of service requirements	√	√
Keeping a log	√	√
General accident procedures	√	√
First aid procedures	√	√
Fire-fighting techniques	√	√
Trip and route planning		√
Basic geography and map reading		√
How to handle cargo (safe loading, weight distribution, securing the load)	√	
Hazardous materials paperwork and placard requirements	√	
Handling special types of nonhazardous cargo (e.g., unstable cargo)	√	
Inspect cargo (pretrip and en route)	√	
Special accident procedures for hazardous materials	√	
Occupational awareness (i.e., instruction regarding the change in lifestyle once becoming a truck driver; promotion of truck driving as a career)	√	
Loading and Transportation of Passengers		
Safe boarding and alighting of passengers		√
Approaching and leaving a stop		√
Rules of the road governing vehicles that transport passengers		√
Emergency evacuation procedures		√
Stow baggage or equipment inside bus to make aisles and emergency exits accessible		√
Passenger Management		
Understanding government regulations and company procedures regarding alcohol, tobacco, and drug use by passengers		√
Communication techniques for handling difficult passengers		√
Maintaining Fitness		
Alcohol and drugs	√	√
Personal health and fitness	√	√
Cargo handling health and safety (avoiding lifting injuries, falls, proper clothing, safety equipment)	√	

TABLE 3 Summary of training adequacy findings for motor carriers (Dueker, 1995)

	Heavy Trucks	Motorcoaches
Percent of motor carriers who provide formal training for their hired entry-level drivers	21.6	62.5
Percent of sampled motor carriers whose formal training was judged as "adequate"	37.5	29.6
Estimate of the percent of motor carriers who provide adequate training for the entry-level drivers they hire	8.1	18.5

TABLE 4 Summary of training adequacy findings for drivers (Dueker, 1995)

Formal Training Methods	Percent of Drivers Trained	Percent of Programs Adequate	Percent of Drivers Adequately Trained
Heavy Trucks			
Proprietary	47.5	44.8	21.3
Public Funded	7.8	54.5	4.2
Company/Military	6.4	87.5	5.6
Total	61.7	50.0	31.1
(Sample Size)	(141)		
Motorcoaches			
Company	50.0	36.4	18.2

theory and skills in controlled settings (e.g., through the use of a skid pad). The authors assert that, by preventing heavy truck crashes at a per-crash-cost of $100,000, the wider use of such facilities would be very cost-effective. Kostor and Summerfield support their conclusions through analyses of heavy truck crashes that occurred in Manitoba, Canada, between 1994 and 1999. They found that for heavy trucks, higher proportions of crashes occurred under poor weather conditions and under higher wind speeds than for passenger vehicles. Approximately 41% of heavy truck crashes occurred under winter (i.e., icy or snow covered) and spring/fall (i.e., mud, wet, and slush) road surface conditions, compared with 23% of passenger vehicle crashes. Also, more crashes occurred on poor roads under higher wind speeds for heavy trucks than for passenger vehicles. For passenger vehicles, 71% of icy/snow-covered road crashes occurred with low winds (i.e., wind speeds below 25 km/h [15 mi/h]) and 29% occurred with moderate winds. In comparison, 63% of heavy truck crashes on icy/snow-covered roads occurred under low winds, and 37% occurred under moderate winds. Though high-sided vehicles do not perform as well as passenger vehicles in inclement weather, truck drivers should be able to compensate for this, given significant training.

Kostor and Summerfield (2001) also looked at the crash experience of Longer Combination Vehicles (LCVs) under inclement weather conditions. They found that the LCVs crash experience was not disproportionate to singles under low wind and icy road conditions and, in fact, the number of crashes under moderate wind/icy road conditions for these vehicles was less than those under low wind/icy road conditions. In theory, LCVs would be more unstable under icy road and windy conditions than single heavy vehicles and should be overrepresented in crashes under these conditions. The authors explain this finding by noting that most carriers use more experienced drivers on LCVs and instruct all drivers to adjust for conditions or cease operation until the adverse weather has passed.

Responses to the NPRM

Comments on FMCSA's proposed training requirements were due to the agency by October 11, 2003. Thirty-eight comments were received. The response from industry and other interested parties relevant to the topic of best practices for training entry-level drivers, as summarized in the following paragraphs, is informative.[3]

Over one-third of the comments—most of which came from schools—focused on the proposal "falling short of a minimum standard for the training of entry-level drivers." The majority of these respondents suggested that the four proposed topics be incorporated into the Model Truck Driver and Model Motorcoach Driver curricula, which should then be identified as the minimum standards for training entry-level drivers. A few of these commenters further stated that the delivery of the PTDI curriculum should be more flexible and performance-based, to make the training more effective.

[3]See the U.S. DOT's Document Management System at http://dms.dot.gov. To retrieve the comments, search under Old Docket No. MC-93-12; along with some other material, the comments are Document Numbers FMCSA-1997-2199-170 to FMCSA-1997-2199-215. Direct quotations in the following paragraphs are taken from these documents.

In addition to the incorporation of the proposed topics into the model curricula, one respondent suggested the inclusion of training in the proper use of antilock brake systems and proper use of inline or engine retarders. This commenter offered that the PTDI curriculum should be updated every 5 to 10 years to include new technologies.

Of the respondents who stated that the proposed requirements fell short of a minimum standard but did not specify use of the Model/PTDI curricula, one proposed that as a minimum, the Professional Truck Driver 8-hour Defensive Driving course be required and that training should be renewed every 2 years. Another stated that regardless of how many hours a graduate from a training program receives, he or she is still an entry-level driver. He continued with the following comments: "No person should be allowed to test for CDL without being able to verify formal training or an adequate amount of on-the-job training. Minimum standards should be established to establish consistency among states. Filling hours with classroom material or student observation cannot take the place of BTW. Adequate training requires a focus on safety sensitive issues including actual driving, backing, and hours of service. Enough emphasis is not put on the carrier segment regarding finishing programs that ensure an entry-level driver continues to receive training."

Another commenter not specifying the model curriculum but stating that the proposal fell short of a minimum requirement, offered the following: "Specifying a minimum time requirement for training is unnecessary. Final rule should emphasize specific training content including basic defensive driving topics, including space management, proper lane changes and merging, vehicle dynamics, adverse weather, etc., and should require the carrier to be able to provide documentation that all of the elements of the training have been met."

A fourth commenter stated the following: "The Secretary is required by Section 4007(a) to issue a rule to improve entry-level driver training unless the Secretary has determined that it is not in the public interest to require training for all entry-level drivers. Since there has been no Secretarial determination that entry-level training is not in the public interest, the statute requires the Secretary to proceed to issue a rule requiring such universal training. The proposed novice driver training is a legally insufficient response to the statutory mandate and clearly violates legislative intent. When the agency's own contracted research showed that basic knowledge and skills transmission through the private sector was inadequate, the result of that finding must be decisive agency action to ensure that basic driver training is provided."

One commenter stated that the FMCSA should do as much as possible to encourage driver training schools to participate in PTDI's program, with the addition of the four new areas, but that the training should not be mandated. Several other respondents objected to mandated training, with one stating that the motorcoach industry should be exempted. He provided the following comment: "The motorcoach industry should be exempted from the proposed rulemaking, as the safety record of motorcoaches is even safer than that of transit operators, who are exempted."

Approximately one-third of the respondents suggested that instead of requiring that carriers provide training in the four proposed areas, the topics should be included in the CDL program materials and testing. This would ensure that drivers received the information and would remove the burden for industry to document the training and maintain records.

Several comments were focused on the proposed whistleblower protection training. One respondent objected to whistleblower protection training, stating that it has the effect of "using the regulations to intimidate and retaliate against the employer while building a protective cocoon around the poor or unsafe worker or driver." Another commenter who was opposed to this training stated that the whistleblower provision does not address a driver's ability to safely operate a motor vehicle, so it should be removed. Three others indicated that whistleblower protection training would be redundant, as it is already covered by statute and is provided in many carrier training programs. If not already part of a carrier training program, the training could be easily accomplished with a poster or a statement signed and read during orientation, as opposed to formal training.

Over a quarter of the respondents took issue with the proposed definition of an entry-level driver. The majority of these respondents stated that it should apply to drivers with 1 year of experience or less, instead of the proposed 2 years or less.[4] Several respondents said that the definition of an entry-level driver should depend on the number of miles driven rather than the amount of time on the job.

With respect to the driver wellness component, a few respondents acknowledged that while diet and exercise are important, wellness is an individual's responsibility addressed through successful completion of a periodic exam; it is not within the purview of the FMCSA. In the same vein, an additional respondent provided the following comments: "The proposal falls short of being an instrument to achieve the goal of improving overall highway safety, given the four training areas cited, and the fact that 75% of all crashes are caused by passenger cars. The four training areas are already addressed by federal statute, and the agency is overstepping its bounds with respect to individual privacy in the driver qualification and driver wellness areas."

Wellness

As evidence for including wellness issues as an area in which entry-level drivers should receive additional training, FMCSA sites a study by Roberts and York (2000) indicating that obesity, high blood pressure, alcohol and drug abuse, and

[4]The definition of an "entry-level driver" was changed in the Final Rule (May 21, 2004) to "a driver with less than one year experience operating a CMV with a CDL" from the original language in the proposed rule (August 15, 2003), which defined an "entry-level driver" as a "driver with less than 2 years experience operating a CMV with a CDL."

stress are major health issues among truck and bus drivers (Federal Motor Carrier Safety Administration, 2003). Roberts and York (2000) in turn cite a study by Stoohs et al. (1993) indicating that 71% of 125 studied drivers were defined as "obese" because they had a Body Mass Index (BMI) greater than 28. They also cite Korelitz et al. (1993), who found that in a survey of 2,945 truck drivers attending a trade show, 40% were overweight (BMI between 25 and 30) and 33% were obese (BMI greater than 30). In this survey, 33% of the truck drivers had blood pressure measurements greater than 140/90 mm Hg and 11% had blood pressure measurements greater than 160/95 mm Hg. In a related finding, Roberts and York (2000) cite data from Orris et al. (1997) showing that 303 partial delivery truck drivers had higher stress levels than 91% of the U.S. population. Regarding alcohol, Roberts and York (2000) cited data from Korelitz et al. (1993) indicating that 23% of the 2,945 truck drivers surveyed could have a drinking problem as defined by responses to questions regarding personal drinking perceptions.

In Roberts and York's (2000) review of the literature on wellness programs in the trucking industry, only one evaluation of program effectiveness was uncovered. Holmes et al. (1996) designed a wellness program that emphasized driver nutrition, then conducted a before-and-after study with 30 truck drivers to determine whether such training could produce benefits with respect to health risk factors, including weight, body fat, blood pressure, blood sugar, cholesterol, smoking, and general physical fitness. This study was conducted in response to a company's increase in health care claims for heart problems/heart disease. Participants underwent a health screening conducted at their job site and were made aware of their results and health status based on standard guidelines. A nutrition intervention program was developed in which study participants received nutrition publications and daily healthy snacks (e.g., cheese sticks, fresh fruit, juices, raisins, pretzels, and other low-fat items). Tips were provided for eating a healthy diet when dining out, at home, or on the road. Study participants also received an exercise chart showing calories burned for various activities and a slide chart showing calories and grams of fat for specific foods.

At the end of a 6-month period, as reported by Holmes et al. (1996), significant improvements were shown for weight, body fat, cholesterol, and smoking. The authors note that a drop of 25 mg of cholesterol may reduce the risk of heart attack by 50% or more. Half of the study group had cholesterol levels exceeding 200 mg at the beginning of the study; and, by the end of the 6 months, only one driver had a cholesterol reading over 200 mg. Subjective data from driver interviews suggests that the nutrition treatments also were a positive influence on driver attitudes. The program generated positive feelings about the company, employee ratings of the program and the value of health screenings and discussions were very high, and employees thought the healthy snacks should be continued. The cost of the program was $100 per driver screening and $13,000 in snacks over a 7-month period for 30 drivers. Cost containment for heart problems over the 7-month period could not be ascertained, but the program was considered to be a quantitative as well as a qualitative success. In the authors' opinion, wellness programs can contribute to fewer health claims, lower employee turnover, and higher employee satisfaction.

Roberts and York (2000) conducted on-site and telephone surveys of 26 companies to discuss their wellness programs; only 6 companies indicated that they had wellness programs or were willing to discuss their programs, however. In four of the six companies, programs were reaching corporate office workers but not drivers. In the programs that reached drivers, one company experienced a 40% reduction in crashes after the implementation of classroom training addressing fatigue and other health issues and the dissemination of a manual providing information on exercise, diet, health, and fatigue. However, the program is no longer supported because the individual who developed, implemented, and championed the program left the company. In the sixth company, a wellness program has been initiated that offers health fairs; weight maintenance programs; exercise incentive programs; "lunch and learns" covering topics including diabetes, healthy food choices, and fitness; and promoting activities such as golf, basketball, and volleyball tournaments and aerobics. Truck drivers are advised of the program during their orientation and are given nutrition packets with information about healthy snacking and calories, plus a manual with information about stress management, healthy eating, and exercise. The company's participation rate after 6 months was 20 to 25% of the office staff and 10% of the driver staff. A company spokesperson indicated that there are not enough resources available to reach the target population, nor are hard data available to measure program effectiveness. Notwithstanding these limitations, health costs are believed to have been reduced as a result of the program; otherwise, the company would have discarded it.

The following elements are required for successful wellness programming according to Roberts and York (2000): (1) commitment from senior management (including monetary and personnel support, philosophical support, and participation in programs); (2) a clear statement of philosophy, purpose, and goals; (3) a needs assessment; (4) strong program leadership; (5) use of effective and qualified professionals; (6) accurate, up-to-date, research-based information made available to participants; (7) effective communication (high visibility, successful marketing, motivating to employees); (8) accessibility and convenience to employees; (9) realistic budget; (10) a fun, motivating, and challenging program philosophy; (11) a supportive work/cultural environment (company policies, company attitude toward employee); (12) a supportive physical environment (cafeteria and vending with healthy options, available fitness facility, windows, lighting, and truck cab); (13) individualization to meet the needs of each employee; (14) a defined system evaluation; and (15) positive results. The wellness plan they developed is called

"Gettin' in Gear" and includes the following four core topics, based on focus groups and surveys indicating that these are drivers' greatest concerns: (1) Refueling (diet and weight); (2) Relating (family); (3) Relaxing (fatigue and stress); and (4) Rejuvenating (exercise). The approach is holistic, in recognition that driver health issues are not one dimensional but part of a larger dynamic system.

Included in the "Getting' in Gear" program were information presentation (brochures, videos, audios, and a notebook), written lifestyle questionnaires, physical risk factor assessment (cholesterol, glucose, body mass index, blood pressure, pulse, aerobic fitness via step test, strength fitness via push ups, and flexibility via sit and reach), goal setting and coaching, snack packs, exercise membership with the "Rolling Strong" gyms found in several truck stops across the country or subsidized YMCA memberships, and an evaluation. A pilot study was conducted over a 6-month period to determine program effectiveness, determined by before-and-after lifestyle habits questionnaires and before-and-after physical measurements. Results for 54 individuals indicated that program participants improved significantly in 7 of the 15 areas with respect to eating habits, in all 6 areas relating to exercise, and in 2 of 13 areas relating to Relaxing; no improvement was found in area 2, Relating. It should be noted that participants scored well initially in this area, however. Significant improvements were also found in 6 of 10 physical risk areas: BMI, pulse, diastolic blood pressure, aerobic fitness level, strength fitness level, and flexibility fitness level.

This review concludes by noting an initiative by FMCSA and its partners—the American Trucking Associations Foundation, the National Private Truck Council, and other industry participants—in 1996 to develop a driver/operator fatigue education and outreach program. A major goal of this initiative is to educate all 7 million CDL holders in the U.S. about how to master driver alertness (Krueger et al., 2002). Program elements include "Awake at the Wheel" public service announcements; the printing of 1 million "Awake at the Wheel" brochures and their distribution to truck and bus drivers, carriers, motorcoach companies, and other organizations interested in motor carrier safety; the production of a 19-minute video called "The Alert Driver: A Trucker's Guide to Sleep, Fatigue, and Rest in Our 24-Hour Society" and a 75-page booklet to accompany the video; a series of educational courses on driver fatigue, including a 1.5-hour course for truck drivers, a 1.5-hour course for dispatchers and trucking managers, a 4-hour train-the-trainer instructional program, and a 1- to 3-hour course for trucking executives and corporate officials to help them decide whether to implement an employee fatigue countermeasure program. Krueger et al. (2002) indicate that the 4-hour train-the-trainer course on operator/driver fatigue has been conducted over 55 times around the country between 1996 and 2002, and 30,000 copies of the "Alert Driver" video and booklet have been produced and distributed to educate truckers and their families about fatigue. As of the date of this report, no evaluation studies of the effectiveness of this program could be located.

FMCSA's Final Rule

Based on the study by Dueker (1995), FMCSA proposed and recently issued minimum training standards for operators of double- and triple-tractor trailer LCVs, requirements for instructors who train LCV drivers, and standards for entry-level drivers (Schulz, 2003; Federal Motor Carrier Safety Administration, 2003, 2004). According to Schulz, the government's proposal to train entry-level drivers does not require lengthy hands-on driver training. FMCSA's new rule does not specify a required number of hours for the new training, but estimates that training will require approximately 10 hours.

FMCSA's final rule applies to truck and motorcoach drivers who (1) hold a CDL (and school bus drivers employed by nongovernmental entities who hold a CDL), (2) operate in interstate commerce, and (3) have less than 1 year of experience operating CMVs. FMCSA is not requiring entry-level drivers to receive additional training in the areas covered by the CDL test, stating that such training would be redundant. The new requirement is for these entry-level drivers to receive training in four areas that are not covered in the CDL licensing exams but are areas that FMCSA believes driver knowledge is vital to large truck and bus safety: (1) driver qualification (multiple medical conditions); (2) hours-of-service (including fatigue prevention strategies and causes of fatigue); (3) driver wellness (diet, exercise, stress); and (4) whistleblower protection (Federal Motor Carrier Safety Administration, 2004). FMCSA estimates that the new training for entry-level drivers will need to prevent 201 truck-related crashes (combining fatal, injury-related, and property-damage-only crashes) per year by the 32,400 entry-level drivers affected by its provisions in order to be cost beneficial.

Under the FMCSA rule, employers will have 90 days to ensure that all currently employed entry-level drivers receive the required training. Training could be provided by the motor carrier, a training school, or a class conducted by a consortium or association of motor carriers, but documentation that drivers have fulfilled the training requirement must be filed with the drivers' personnel files and documentation of the curriculum content must be maintained for safety investigation purposes.

CHAPTER 3

STRATEGIES AND TECHNIQUES TO ENHANCE TRAINING EFFECTIVENESS

SIMULATORS

As discussed by Vance et al. (2002), one of the greatest advantages of simulator training is the ability to recreate dangerous situations without putting drivers and equipment at risk. Simulation can expose drivers to high-risk situations such as blowouts, brake failures, and hazardous road and weather conditions, allowing sufficient practice with infrequently encountered events so that an automatic behavioral response can be learned. Vance et al. (2002) state that beginning drivers benefit most from part-task training, where each situation is separated into components that can be taught incrementally, starting with basic skills such as baking up, steering, maneuvering through traffic, or parking. They indicate that experts who need refresher training benefit more from a full-task simulator, where greater interactivity (i.e., system response to a driver's control inputs) is afforded, permitting better transfer of existing skills into new environments, such as poor road and weather conditions, or when learning how to deal with equipment failures. The development of training scenarios and the platforms used to deliver training are considerably more expensive for full-task than for part-task simulation.

Data regarding the effectiveness of simulator training for truck drivers is sparse. In their review of practices in the European Union and North America, Horn and Tardif (1999) state that truck driver training has generally remained low tech, with the majority of training done using traditional methods of teaching. Although training simulators are appearing in some schools, they will remain the exception for years to come because the trucking industry and the private training schools do not have the money to pay for these tools. However, Horn and Tardif embrace the continuation of research and development on simulation technologies to identify areas where transfer of training and acquisition of additional experience can be gained through the use of these technologies at a cost that the trucking industry can afford. A potential solution is offered by Brock et al. (2001). Based on their findings that simulator training in the motorcoach industry has safety and efficiency payoffs, these authors have proposed regional training centers as a means of offering simulator training to numerous small- and midsized transit agencies that would otherwise not be able to afford them. Using this approach, a consortium of agencies would manage and fund the regional training center. Alternatively, simulators could be installed in trailers and taken to each agency in the consortium on a set schedule.

Pierowicz et al. (2002) evaluated the adequacy of six simulators for use in a three-part study to determine whether simulator-based training can enhance training effectiveness and improve the performance of tractor-trailer drivers, compared with conventional training methods. The bulk of the Pierowicz et al. (2002) report describes the functionality of the six simulators and their adequacy for use in three upcoming validation studies. The simulators were evaluated on 183 factors to determine their adequacy in supporting the research design of the three study phases. No procurement for the three study phases had been released at the time of this report, however. The results of this study, when completed, will provide valuable data to fill the gaps in the knowledge regarding the effectiveness of simulation in training truck drivers.

Regarding the use of simulators for training motorcoach drivers, Brock et al. (2001) conducted a literature review, surveys, and site visits. They concluded that transit bus operator training can be improved with selective use of transit bus simulators. They also noted that a critical feature in the success of simulator training programs is the competence and enthusiasm of the instructional staff.

The Brock et al. (2001) report discussed three current applications of simulator technology: (1) An open-loop video simulator—Doron L-300; (2) a low-end simulator—Doron L-301 VMT-Vehicle Maneuvering Trainer; and (3) a midrange simulator—FAAC MB 2000. All three simulators are used to train new drivers; they are also often used to retrain more experienced drivers. However, each device trains a subset of the skills required by drivers of transit buses, but none trains them all. The open-loop system is the least expensive of the three systems and is the most frequently used. It uses a video display of traffic, and several students may be trained simultaneously at different stations, each with steering wheels, brake and accelerator pedals, and other rudimentary controls. It is not interactive, i.e., student inputs do not affect the playback of the training videos. The utility of this tool lies in its ability to train and test reaction time and visual recognition. The fundamentals of stopping distances, driving under different road conditions, and the relationship of speed and reaction time can be demonstrated and practiced.

Both the low-end and midrange simulators discussed by Brock et al. are limited to training one user at a time; however, this provides one-on-one time with an instructor. The low-end simulator is designed to train students to maneuver a transit bus in relatively tight, unforgiving situations. It is a model-board system that replicates the visual, auditory, and vibratory effects of driving a bus in an urban, crowded environment. Skills that may be taught with the system include approaching a bus stop, parking, tight turns, and backing. Brock et al. state that students and trainers are convinced that use of this simulator allows new operators to get into actual buses more quickly and results in safer drivers. The midrange simulator is the newest and most expensive, and few are currently in use. Its visual (graphics-based) and auditory systems are much more realistic, and it uses a rear-projection screen allowing drivers to adjust their mirrors to experience the full extent of the driving environment beside and behind the vehicle. A student drives in a 50-square-mile virtual world where the instructor regulates other traffic flow and can insert vehicle malfunctions into the scenarios.

Brock et al. (2001) note that the use of simulation decreased trainee drop-out rates by 35% for an agency using the mid-level simulator, decreased student failure rates by 50% in an agency that uses the open loop and the low-end simulators, and decreased the collision rate by 10% in an agency using a combination of open-loop and low-end simulators. In addition, the use of simulation reduced training time in one agency from 19 days to 17 days, by replacing classroom bus training with simulator training. In another agency using just the open-loop system, training time was reduced by 5 days when simulation was employed. The only agency surveyed that used the midrange simulator reported that 90 days after training, 32% of their conventionally trained drivers had experienced a crash, compared with 18% of their simulator-trained drivers. In this agency, simulator training in tasks related to overtaking and being overtaken by vehicles on the left and right sides of the bus resulted in fewer crashes by the students performing these maneuvers in the real world (17 crashes by the simulator-trained students compared with 154 crashes for the nonsimulator-trained students).

The transit agencies surveyed by Brock et al. reported that simulators are also able to replace some of the hours spent in the actual vehicle. This can have a significant impact on training costs, as simulator costs can run as low as $3 per hour per student versus $40 per hour per student for in-vehicle training.

Results of a survey of bus operator trainers conducted by Brock et al. (2001) indicate a high level of satisfaction with their training simulators. Fifty-eight percent of the respondents indicated that simulator training is more effective than traditional training for teaching certain types of knowledge, skills, or attitudes. In particular, simulator training validates defensive driving techniques taught in the classroom, provides an opportunity to experience hazardous situations without putting the students or the bus at risk, reinforces proper driving habits and defensive driving principles, and allows instructors to check reaction time, eye-hand coordination, and driving skills. Instructors indicated that trainees with little or no experience were better prepared for their initial driving assignment. Seventy-five percent of the drivers surveyed reported that their bus simulation training enhanced their learning experience, although 6 of the 51 respondents reported motion sickness, dizziness, and disorientation after bus simulation training.

Guidelines for what type of simulator should be acquired by agencies wishing to integrate training into their curriculum were provided by Brock et al. (2001). An open loop simulator provides skills-based training opportunities. It can be used to train perceptual skills in a noninteractive environment, including stopping distances, role of reaction time, and visual recognition. It costs approximately $40,000 to $80,000. A low-end simulator provides rules-based training opportunities and some skills-based learning. It can be used to train vehicle maneuvers in a static environment, including parking, backing, turns, and tight maneuvers. It costs approximately $100,000. A midrange simulator provides skills-based, rules-based, and knowledge-based training opportunities. It can be used to train skill integration in a dynamic environment, including forward planning, observation skills, push-pull steering, directional signal use, proper mirror use, and driving in traffic. It costs approximately $300,000. When deciding to use simulation, companies (or schools) must adjust their current training program to utilize the particular technology appropriately; otherwise, just adding simulation to an existing program could add to program cost without increasing effectiveness.

Vance et al. (2002) similarly offer that reasoning or cognitive ability tasks do not require high physical fidelity simulators, whereas training that involves learning perceptual-motor skills or the interaction of the trainee with the layout of the equipment does require high physical fidelity. Also, a close correspondence between equipment in a simulator and the actual equipment in the vehicle is desirable to enhance the transfer of training to the real-world situation.

At the high end of simulator applications for CMV driver training, a $1-million system recently purchased by the Texas Motor Transportation Association deserves mention. This system is used to allow experienced truck drivers to safely experience dangerous situations such as a veering car, a tire blowout, or dense fog. The full-motion simulator is built into a 53-ft trailer and uses an authentic truck cab that moves in response to a driver's inputs when viewing driving scenarios on a large screen. The trailer also contains a small classroom with six computers that provide interactive lessons on topics such as space management and securing loads. The association will rent the unit to carriers for $1,000 per day. No data regarding the effectiveness of this training tool was found in this review.

COMPUTER-BASED TRAINING

Computer-based training is a means of providing company-wide job consistency and reducing training costs (Kahaner, 2001). UPS, which has been using CD- and web-based programs since 1998, states that they are much more efficient and yield better results than paper manuals. A computer-based

training program that has been implemented by Smithway Motor Xpress (Ft. Dodge, IA) to teach load securement procedures has reduced training costs from $1,000 per driver to $150 per driver. It has been associated with a reduction of claims in that area of 87%. Most of the cost saving results from a reduction in the time it takes drivers to learn the material when presented using computers compared with classroom lecture and on-the-job training. Drivers learn at their own pace and can take laptops with them on the road and study the coursework in their down-time. Also, the statistics that computer-based programs keep (topics trained, length of time to train, and areas of difficulty) can pinpoint areas where additional help is needed. Kahaner (2001) further states that computer-based training is more attractive to younger drivers who were brought up playing computer games and are used to the faster pace of TV and the Internet; these individuals would be bored with training that is limited to classroom lecture.

Ryder (2000) describes a computer-program developed by Instructional Technologies, Inc., that delivers 32 1-hour lessons on trucking fundamentals based on the PTDI curriculum. This vendor provides schools and fleets with computers at no cost and delivers the lessons via a high-speed Internet connection, so that schools and fleets pay only for what they use. The lessons are presented using video, high-quality graphics, and animation to explain concepts and demonstrate driving practices. Students log onto the program with a code, and must answer questions about the instructional material roughly every 3 minutes, which ensures that they are paying attention. A benefit of this program is that it standardizes training and provides documentation that a student has received training.

Thompson (1996) describes a CD-ROM training program implemented by Frito Lay to train drivers about DOT regulations, focusing on alcohol and drug requirements. CD-ROMS and PCs have been placed in 40 company locations throughout the United States. The program takes 2 hours to complete, and drivers are given 90 days to finish the training. The Safety Director believes that the delivery of training using the CD-ROM is more entertaining than reading text or watching plain voice-over videos, and the methodology allows the training to be delivered in a flexible manner, which eliminates scheduling difficulties common with conventional classroom training. A computer tracks driver status in training, time spent in training, and the driver's scores, producing proof of compliance with training for the DOT. Additional programs on defensive driving, proper use of the onboard computer, and pretrip and posttrip inspections are planned using similar computer-based training technology.

VIDEOTAPES AND SLIDE PRESENTATIONS TO SUPPLEMENT CLASSROOM INSTRUCTION

Videotape presentations are available today that address virtually any subject a company wishes a driver to know concerning product delivery and safety. More than a decade ago, the FHWA stated that the number of training aids was so great that the problem was how to locate, select, and evaluate the most appropriate ones for the company (Uzgiris et al., 1991). While audiovisual aids are offered as a countermeasure for preventable crashes and to improve fleet safety, it is important to determine what mix of audiovisual aids, posters, manuals, pamphlets, and other literature is most effective in improving a company's training program. Sources of driver training aids mentioned by the FHWA include national and state truck and bus associations, safety organizations, insurance companies, company in-house productions, and private-sector providers and consultants.

Historical examples include a videotape series to standardize training for drivers who haul bulk liquid and gaseous products, the majority of which are hazardous (Snyder, 1983). Drivers progress from classroom instruction that includes personal and videotape training, to hands-on training, and then back into the classroom several times before being certified for over-the-road work. Another example is a video developed by the American Trucking Associations and FLI Learning Systems; it was designed to improve drivers' attitudes and skills and help them realize how their behavior on the road shapes the public's perception of the trucking agency (Dandrea, 1986). As part of a 4-hour program, the multimedia components include a 12-minute film addressing attitude and image and a 6-part audio-narrated slide series designed to improve driver techniques for handling high-frequency crash situations.

More recent experience with such tools includes the use by in-house instructors at PST Vans (Salt Lake City, UT) of the product noted at the end of Chapter 2, "The Alert Driver: A Trucker's Guide to Sleep, Fatigue, and Rest in Our 24-Hour Society," during orientation for new drivers and at safety meetings for their experienced drivers. This company employs 1,500 drivers who are on the road for 2 to 3 weeks at a time. They train their new drivers in topics relating to how to deal with fatigue, how to eat and sleep properly, and how to maintain positive relationships while away from home for long periods of time. Discussions include sleep and rest needs, diet, stress, lifestyle, and how these relate to driving, and leads nicely to discussions about DOT regulations and hours of service rules.

Another program employed by PST Vans for all new hires (entry-level as well as experienced drivers) is a video test developed to measure a driver's traffic-related knowledge and skill level. This can be used by the company for decisions relating to driver training needs and assignments. Drivers watch a 60-minute video, using paper answer sheets to indicate whether they agree or disagree with actions portrayed in different traffic scenes, making split-second decisions as they would in real-life driving. Different parts of the video measure driving and traffic knowledge (e.g., traffic laws, road rules, driver readiness, driving in traffic, and vehicle readiness); traffic perception skills (e.g., searching the driving environment, identifying and classifying hazards, predicting what other drivers will do, and deciding which maneuver is most appropriate given the situation); traffic risk recognition and acceptance (e.g., yielding to other roadway users, vehicle

positioning, vehicle speed control, passing other roadway users, and environmental risks); and driving procedure skills (e.g., observing, communicating, speed adjustment, vehicle positioning, and time and space judgment). Results categorize a driver's skill level as low, medium, average, highly skilled, and expert, and estimate the statistical probability that driver training will improve driving performance. They also influence where the company places their newly hired drivers in training. Driving school graduates who score high on the video test and also score high on PST's on-road test may be placed in the accelerated fleet training program, which pays drivers 2 cents more per mile and puts them on a fast track for a first-seat driver position. The company reports a reduction in crash frequency since program implementation for all crash types, including in-traffic and single-vehicle crashes. In addition, scores improved for entry-level drivers on post-training testing (after 90 days). Within one 6-month period, PST reported a reduction in incidents from 225 to 125, where incidents are defined as anything requiring an incident report, from a DOT-reportable crash to a worker compensation accident (Cleaves, 1997).

A search of the Internet identified a number of instructional products, including instructors' kits and driver workbooks for self-paced courses, as well as a self-paced defensive driving course. The latter course concentrates on critical commercial driver's license and National Safety Council (NSC) defensive driving principles, including pretrip inspection, cushion of safety (following distance, stopping distances, blind spots, and tailgaters) and effective scanning procedures applied to city, highway, and rural driving situations. It also zeroes in on safe backing procedures, night driving, impaired drivers, adverse weather conditions, triangle placement, and the importance of adequate sleep, exercise, and proper nutrition.

The NSC's Defensive Driving Courses (DDCs) are in many ways the pre-eminent example of how video is used to supplement classroom instruction. Some companies use DDC-4 (4 hours), DDC-6 (6 hours), or DDC-8 (8 hours) as a foundation for their fleet programs for their new recruits and as a refresher, while others use its 8-hour professional truck driver course (DDC-PTD). Some companies also require employees who have been involved in a preventable crash to complete a DDC before they are permitted to return to the road. Companies commonly use the DDCs as the core of their classroom training and add a film on a particular topic or use in-vehicle training to reinforce the concepts taught in the classroom. Training effectiveness statistics provided by Kiell (1989) indicate safety improvements as a result of such training for a wide range of users. ChemLawn reported a 50% reduction in costs from crashes over a 4-year period (1985 to 1989); it also reported its insurance costs decreased, whereas the rates of most other companies increased over the same time period. The Indiana Department of Highways reported a 40% reduction in crashes over a 5-year period (1984 to 1989), while Houston Lighting and Power reported reductions in costs associated with vehicle damage (32%), property damage, third-party claims, and lawsuits (8%), and crashes per million miles of vehicle travel in primarily urban driving areas (23.5%). The cycle under which these companies and agencies require their drivers to undergo defensive driving refresher training averages 2 to 3 years.

HANDS-ON, ON-THE-ROAD

Beginning drivers who complete formal training—including the PTDI curriculum standard—cannot be considered fully trained drivers without additional road experience and vocational-type training (such as loading tankers, chaining on loads, etc.), under the guidance and supervision of an experienced, professional driver. As noted earlier, PTDI not only calls for each student to receive a minimum of 44 hours of actual behind-the-wheel time to complete the basic, or core, curriculum, but also stresses the need for an externship of 140 to 240 hours of additional (on-duty) instruction to provide the training and experience needed for an entry-level driver to progress from a second-seat to a solo driver (Professional Truck Driving Institute, 1999). The procedures and requirements for finishing training as implemented by a cross-section of schools and carriers are discussed below.

Wiggins (1990) describes the requirements for trainers at Contract Freighters, Inc. (CFI) and the training that the company provides to newly hired drivers. CFI's trainers are company drivers who undergo a 36-hour in-house course that includes methods of motivation, constructive criticism, and mental aspects of the job (teaching drivers why they should do something in addition to what they should do). Prospective trainers observe each others' driving performance and provide constructive criticism before they begin training new hires. Once a trainer begins working with new hires, he or she undergoes a management review every 6 months. Before they go on the road, new drivers undergo a week-long orientation which includes meeting department managers, attending presentations on equipment maintenance and safety, and federally mandated physical and road testing. Then, a trainer-finisher travels 14,000 miles with the new driver, to supervise regular demands of the driving task, provide practice in backing, and provide training in skills such as brake adjustment. The finisher and driver may act as a sleeper team only after 7,000 miles of training have been completed, and only if there have been no preventable crashes. After the new hire completes the 14,000 miles, the driver undergoes a road analysis test including a written questionnaire to determine how much was learned and to rate how well the finisher performed in providing training. After the finishing training, the new driver is placed with another driver with similar experience for 25,000 miles as a sleeper team. If a crash occurs, an additional 10,000 crash-free miles must be completed.

The drop out rate of the finishing program at CFI is 32%, most of which occurs during the finishing training. According to the company's director of training, once a new driver has completed the finishing program and sleeper team driving,

there is an 85% likelihood that the driver will stay with the company. Periodic retraining is also important to correct bad habits, reinforce driver safety, and reduce crashes. Refresher training can be accomplished by a range of programs: short courses covering topics most important to the company's operation, such as braking and brake adjustments, speed and space management, etc.; group simulator training; and individual training in a full motion cab simulator.

Certification of training instructors is paramount for PST Vans, which employs a proprietary, hands-on, defensive-driving system for its finishing training (Cleaves, 1997). The PST instructors present the course to drivers in groups of four. Drivers first spend classroom time learning about crash statistics and common factors that cause collisions. The training is organized around the concepts of total awareness, emphasizing perceptive anticipation, accurate forecasting, early detection, and deliberate reaction. Drivers also learn the importance of attitude and emotions and how they affect driving. Practical instruction on how to avoid low-speed collisions when backing and parking and how to avoid rear-end and intersection collisions is not overlooked. Drivers then go on the road with the instructor for 3 to 4 hours, so the instructor can point out and correct any poor driving habits and poor driving decisions in traffic. The training instructors must be recertified every 2 years in refresher training provided by the vendor of the training course.

Browning-Ferris Industries (BFI) developed its own training program for entry-level drivers because of the unique characteristics of its garbage trucks, which are 10-wheel vehicles that do not bend in the middle (straight trucks). The requirements for driving these trucks are different from the requirements of driving tractor trailers and van-rig type trucks. The training had to suit the requirements of drivers who drive in low traffic, in residential areas, in low light, and with constant mounting and dismounting by crew members to remove trash. In addition, company employees must back their trucks at least 100 times a day, often for relatively long distances. The program includes training videos showing company vehicles in situations that BFI drivers typically encounter and booklets that prepare drivers for the CDL written test, pretrip inspection, road test, and special endorsement exams. The training was considered effective, based on in the fact that the first 300 drivers who attempted the CDL had a first-time pass rate of 97%, compared with the first-time pass rate of 50% experienced by other companies who did not train their drivers for the CDL.

BFI's CDL program became a standard part of the company's operating procedures. It only hires drivers who have passed the CDL, and these new hires must undergo classroom training, followed by hands-on training with the specific vehicle they will operate. They then ride as a passenger in the vehicle to learn from an experienced driver or supervisor. After that phase, the new hire may go on-the-road under supervision by an experienced driver. Some new hires complete the program in 2 weeks, while others require 6 weeks to become proficient. BFI estimates that its driver-training program, including refresher training using the NSC's DDC, reduced the number of collisions about 33% between the years 1988 and 1993.

While the success of the BFI training program can be attributed in part to the use of vehicle- and location-specific training and reliance on experienced drivers, the company asserts that its single most effective motivating and training tool is its annual truck and equipment rodeo. In this event, the top drivers, operators, and mechanics (and their families) from company operations all over the world are treated to an all-expenses-paid trip to compete and demonstrate their skills. More broadly, Horn and Tardif (1999) testify to the use of motivational and incentive/recognition programs, beyond the use of company training programs, in offering significant potential for safety improvement and driver retention. Horn and Tardif cite research Tardif conducted in Canada, finding that over 70% of the 40 trucking fleets interviewed had a safety incentive or recognition program in place. The effectiveness of these programs in reducing crashes is "remarkably high" and the benefit–cost ratios are usually greater than 2 to 1. According to Horn and Tardif (1999), results of validation research indicate that such programs also improve driver retention.

Much of the industry input addressing the question of what constitutes adequate training and the specific nature and extent of requirements to finish training was gleaned from responses by schools and trucking companies to FMCSA's ANPRM in 1993. The relevant material is available on the Internet through the U.S. DOT's Document Management System.[5] Information from these responses is summarized below. In some cases, the FMCSA information about training methods employed has been supplemented with more detailed or updated material from an organization's web site.

The Wisconsin Decision Driving Center at Fox Valley Technical College, a PTDI-certified school, offers a 1-day workshop to give drivers hands-on experience in learning how to avoid crashes. An off-street driving range simulates emergency situations that test a driver's limitations and a vehicle's capabilities. Drivers learn controlled braking techniques, off-road recovery techniques, evasive maneuvers, how to handle dry and slippery curves, skid control, jackknife recovery, the antilock brake system, reaction time and vehicle braking distance, and vehicle dynamics and control. The center features computer-controlled evasive devices and a 200 ft × 500 ft skid pad. The curriculum offered by this facility provides 1,500 miles of behind-the-wheel training experience by the time a student graduates from the 12- to 15-week program. Training is provided on flat beds, twin trailers, and tanker trucks up to 48 feet long and 102 inches wide. A cooperative unit of instruction between the college and Wisconsin trucking companies is offered to students who graduate from the program, allowing over-the-road driving experience with a veteran driver.

[5]See the U.S. DOT's Document Management System at http://dms.dot.gov; search under Old Docket No. MC-93-12 to retrieve Document Numbers FMCSA-1997-2199-1 to FMCSA-1997-2199-215.

Reiterating the need for finishing training for entry-level drivers, the Becker Driver Training Facility has expressed the view that, "after a few hours of instruction, most students can pass the (CDL) driving test in a controlled circumstance. Unless minimum programs with hands-on training under the direct guidance of a veteran 10-year licensed instructor are established, unskilled heavy duty operators will continue to operate on the highways." This Minnesota facility offers a 6-month, 1,200-hour interstate course that is 75% hands-on training under the guidance of a veteran driver instructor. In the over-the-road training, there is a 1-to-1 student–teacher ratio. The course includes 338 classroom hours, 366 hours in the yard and on the range, 100 hours of observation and road driving that includes preparation for the CDL, and 400 hours of observation, commercial type driving, and hauling of cargo; these last 400 hours of training involve actual driving and hauling of interstate freight. In addition to basic truck-driving techniques, students learn the following skills: map reading and trip planning, hours of service, preparation of the daily log, vehicle safety inspections; understanding the bill of lading instructions; building personal stamina, proper diet, and how to help the body adjust to different wake/sleep, work hour patterns; and mechanical aptitude.

Another school, C1 Professional Training Center in Indiana, indicated in its response to the FMCSA ANPRM that the crucial factor in determining the effectiveness of a training program is the amount of time the student spends in and around the cab of a truck. This school spends over 75% of the training time in and around the cab of the truck, has a student-instructor and student-truck ratio of 2:1, and uses an instructor force that averages over 20 years of truck driving experience. The Director of Training at this school, in concert with other commenters to this ANPRM, stated that it is not how many hours of training that determines whether a student is adequately trained but the skill level that the student demonstrates.

One comment with multiple signatures stated that truck driving schools do not have students load, unload, and properly secure a load. Drivers are learning how to properly load their trailers by trial and error, and error may cause an accident.

One company, Baraboo Sysco, said training for entry-level drivers consisted of a 4-week program, including 32 hours of night driving, 145 hours of day driving, and 32 hours of yard driving (backing and cornering maneuvers). This is followed up by supervisor "ride-withs" twice each month. Similarly, Virginia Power comments indicate the use of on-the-job entry-level driver training procedures. Entry-level drivers are shown films about safe driving and a film on pre- and post-trip inspections specific to company utility service vehicles. They then obtain their CDL learner's permit and are assigned to a crew with an experienced utility service vehicle operator who trains the entry-level driver to operate the specialized company utility service vehicles. The on-the-job training period lasts from 3 to 6 months.

Another company, John Christner Trucking, Inc. (Sapulpa, OK), requires entry-level drivers, who must have graduated from a PTDI-certified school, to undergo over-the-road training under the supervision of an experienced trainer/finisher driver until they reach a suitable level of experience to operate alone. Similarly, EPES Carriers, of Greensboro, North Carolina, provides entry-level drivers, who have graduated from an approved truck driver training school with PTDI or similar standards, with finishing training through a driving school (the Carolina Training Center). This includes DDC-PTD (the 8-hour training for professional drivers developed by the NSC) and supplemental training in handling hazardous materials.

At J. B. Hunt, entry-level drivers who have satisfactorily completed a driver training program that meets or exceeds PTDI standards and have obtained their CDL must complete a "preimprovement" interview, road test, and company orientation. These drivers are then assigned to a J. B. Hunt Certified Trainer for a supervised Advanced Driver Training Program. Upon completion of the Advanced Driver Training Program, drivers are evaluated with written tests and exams and given an additional Road Skill Evaluation before being upgraded to a lead (first-seat) driver.

Federal Express requires entry-level CMV drivers to complete a 3-week classroom training program that includes the subjects listed in the PTDI Model Curriculum. Following classroom training, prospective drivers are required to complete 1-week of on-the-job training with an experienced driver trainer. Entry-level drivers must successfully complete both phases of Federal Express' training program before operating a CMV on public highways.

Drivers employed by the Wisconsin-based Schneider National trucking organization who have not yet logged 30,000 miles are divided into two categories. The first group consists of drivers who have attended a driving school and have a CDL. They are trained for 1 week (3 days classroom and 4 days over the road). Upon passing the company road test, they spend a minimum of 2 weeks with a training engineer. The training engineer does not sleep while the student drives and limits his or her own driving for demonstration purposes to less than 25% of the miles driven during training. The second group of drivers consists of drivers with no experience or CDL. They attend a basic course for a minimum of 2 weeks and must pass both CDL tests and the company road test before moving on to the training engineer stage. Trainees are later teamed with another driver for the next 4 to 6 weeks. Schneider has an on-going program of driver training to ensure up-to-date skills. Annual recertification in hazardous materials and brake adjustment is required. Training is also offered in logging, backing, defensive driving, slow maneuvering (e.g., corners, etc.), injury prevention, trip planning, and fuel-efficient driving. Schneider also utilizes regular skid-pad training. Drivers who handle special freight are required to complete extra training. For example, those in specialized carriers (flatbed trailers) complete 7 days of classroom instruction and hands-on training. Those in bulk carriers (tankers) complete 6 days of classroom and hands-on instruction.

A final set of examples illustrating requirements for finishing training on entry-level drivers includes the following:

- Robert Hansen Trucking, Inc. (Delevan, WI): 10,000 to 30,000 miles of hands-on training with a company driver trainer-finisher are required *after* the trainee has completed a 12-week, full-time truck driving program (classroom, lab, range, and on-street) covering the PTDI curriculum.
- ROCOR International (Oklahoma City, OK): After a candidate completes a PTDI-certified driving school program, trainees without any prior experience are placed with a driver-trainer for a period of 8 to 10 weeks before being assigned their own truck. Trainees with more than 3 months but less than 6 months of experience must complete the apprentice program of 6 weeks with the driver-trainer. Trainees with more than 6 months but less than 12 months of driving experience must complete 3 weeks with the driver-trainer.
- CRST (Cedar Rapids, IA): Its new drivers must spend a minimum of 50,000 miles on the road with a driver-trainer after graduating from one of seven PTDI-certified training schools.

CHAPTER 4

SURVEY INPUTS ON THE VALUE OF ALTERNATIVE TRAINING METHODS

The other avenue in this project through which industry input was obtained was the survey mailed to schools, truck and motorcoach companies, and associations. This survey sought opinions regarding the effectiveness of various methodologies in completing the training of entry-level CMV drivers to allow them to perform safely under a full range of operating conditions. An assumption stated in the survey introduction was that the PTDI/FHWA model curriculum establishes a minimum standard for the knowledge component of CMV driver training. Prospective survey respondents therefore were asked to focus on the finishing aspects of entry-level driver training and to help identify the best methods of providing beginning drivers with supplemental instruction focused on key safety problems, such as speed and space management, hazardous operating conditions, fitness-to-drive, and lifestyle issues.

Twelve questions were posed, regarding methods to provide training in the following topic areas: (1) hands-on training in speed and space management; (2) hands-on training in driving in hazardous weather conditions; (3) hands-on training in rollover prevention; (4) hands-on training in nighttime operations; (5) hands-on training in tight maneuvering, such as backing, docking, and turning; (6) hands-on training in emergency maneuvering, such as skid control and recovery; (7) hands-on training in vehicle inspection and maintenance; (8) hands-on training in passenger safety and security (for buses) or coupling/uncoupling and cargo loading/unloading/securement (for trucks); (9) maintenance of health and wellness; (10) fitness for duty; (11) management of work schedule and family time; and (12) management of finances. Each of these 12 questions had 2 parts. The first part asked respondents to describe the specific techniques they have used (or are familiar with) to provide training to beginning drivers and what methods work the best, in their opinion, and why. The second part of each question asked respondents to provide ratings from 1 (lowest) to 10 (highest) for five candidate training methods, to express their opinion about the effectiveness of each method in meeting the training goals for the topic area in question. The candidate methods rated for each of the 12 topic areas were (1) e-learning via computer in a remote location; (2) computer-aided instruction in the classroom; (3) noninteractive simulation in a cab mock-up; (4) high-fidelity interactive driving simulators; and (5) conventional training aids, such as textbooks, videotapes, slides, and models. See Appendix A to review the actual survey form.

Five schools (two community colleges, one state university, and two career/technology centers); three truck companies (one regional LTL freight carrier, one over-the-road flatbed company, and one private fleet retail carrier), and one motorcoach company provided responses to the survey. The over-the-road flatbed company reported providing training to new hires. This training is provided by a certified trainer without cost to the new hire during a 6-week period, after which time, the driver is qualified to drive solo. Training is provided in conventional tractors and flatbed trailers using staged training loads. This company trains approximately 600 new hires each year, of which approximately 460 graduate. The community colleges, state university, and technology/career center schools varied in their responses to the average time to qualify as a solo driver in their programs. The range of responses was from 4 weeks to 11 weeks, with one school specifying 400 hours.

Before considering the inputs provided by those who took the time to complete survey responses, it is instructive to note the comments of those who did not. A common response provided during the follow-up telephone requests to encourage survey completion was that a particular carrier does not hire entry-level drivers nor does it provide entry-level training. Such companies simply stated a requirement that new hires have 2 to 3 years of verifiable experience—in one case, a minimum of 100,000 verifiable hours—and a clean record.

Information about training methods provided by the survey respondents is presented below for each of the 12 curriculum topics listed above. Because of the small sample size, care must be taken when generalizing about the results of the effectiveness ratings provided for the various methodologies.

SPEED AND SPACE MANAGEMENT

The most common technique used to provide hands-on training in speed and space management is classroom instruction reinforced by on-the-road training. Classroom instruction includes textbooks, workbooks (e.g., Thomson Delmar Learning's *Trucking: Tractor Trailer Driver Handbook/Workbook* and Great West Casualty Company's *Ethics and Techniques for the Professional Driver*), videotapes, and the National Safety Council DDC-PTD. The *Tractor Trailer Driver Handbook/Workbook* (used by one of the technical centers) was developed by the PTDI and Thomson Delmar Learning; it is based on the standards established by the FHWA in its Model Cur-

riculum and the PTDI certification program. The Great West material is a 4-hour training module delivered by one of the transport companies that responded to the survey.

Two formulas were offered by respondents as techniques used to train speed and space management: one school teaches students to allow 1 second for each 10 feet of their vehicle length under 40 mph and to add 1 second for speeds over 40 mph; and one carrier indicated that it teaches new hires to allow 6 to 7 seconds of following distance, by counting (1001, 1002, 1003, etc) after the vehicle ahead passes a fixed object. One school indicated that it uses commentary driving to ensure that the student is seeing what is important. Another school indicated that the daily evaluation forms used in its on-the-road training have a place to indicate following distance, speed control, passing, lanekeeping, lane changes, and proper mirror use, which are all speed related. One carrier stated that it uses a proprietary training course, the Smith System.

The highest effectiveness ratings were provided for conventional teaching methods (mean = 8.4 out of 10). This may be the result of conventional methodologies being the only methods available to the majority of the respondents. Use of e-learning, computer-aided instruction, and noninteractive simulation received ratings averaging between 3.2 and 4.0. Although eight of the nine respondents reported that they have no simulator, use of a high-fidelity simulator received high effectiveness ratings (7 to 10) for training speed and space management by four respondents. The mean rating for high-fidelity simulators was 5.8, which was second to conventional methods. Only one respondent (a community college) reported that it had a simulator. One respondent representing a career center stated that although his school does not have a simulator, he has looked into buying a fully interactive unit, after talking with other instructors who have used them.

DRIVING IN HAZARDOUS WEATHER CONDITIONS

Specific techniques in use by survey respondents to provide hands-on-training to beginners for driving in hazardous conditions include classroom training using lectures and films, followed up with on-road training (5 respondents), and simulation (1 respondent). Four respondents mentioned that a skid pad is an effective technique, but skid pads are not always available because of cost. One respondent representing a school indicated that he wished the school had a skid pad for this type of training, but it does not. This respondent stated that the school did not stop training for rain, but if the roads are slick with snow or ice, training is discontinued for safety reasons. Another school respondent indicated that although a skid pad works well to instill a healthy respect for ice and snow, the instructors at his school believe that it actually does more to scare new drivers than to train them. He indicated that only driving in poor conditions is effective for training safety under poor conditions and that training must be provided by a competent instructor. A retail carrier indicated that the skid pad works best, but it is not always available; drivers need to feel first-hand what loss of control is like. He indicated that a simulator is second best to a skid pad and that it must be accompanied by classroom training in theory and technique. A respondent from a motorcoach company indicated that on-the-road training and experience has proven most effective for their company; their drivers generally experience mild snow storms and showers before severe storms hit. The regional LTL freight carrier respondent indicated that all new hires for class B must have 1 year of verifiable experience; and class A hires must have 2 years of verifiable experience. Employees have an opportunity for advancement programs; they begin in a class B and are given in-cab instruction during the winter safety campaign.

In terms of effectiveness ratings for the various teaching methodologies for training beginning drivers to drive in hazardous weather conditions, conventional methods were weighted the highest (mean = 7.8 out of 10), followed by high-fidelity simulation (mean = 5.5). As in training for speed and space management, high-fidelity simulation received high ratings (7 to 9) by four respondents, even though only one of the nine respondents had high-fidelity simulation training available. E-learning, computer-assisted instruction, and noninteractive simulation received effectiveness ratings averaging 3.5 to 4.0.

ROLLOVER PREVENTION

Techniques used to train beginning drivers in rollover prevention include classroom training, supplemented by video. One school teaches the "No Lean" policy: if you never go fast enough to cause your cab or yourself to lean, you have less chance to roll over. Another school respondent indicated that in the classroom, they talk about center of gravity, shifting and surging cargo, and speed on curves, and they practice this daily on the road. One school utilizes a high-fidelity simulator to train rollover prevention. A truck carrier with no simulator indicated that a simulator would be a great tool, but hands-on with various loads on a test track works best to let the driver get a feel for the shifting of weight and truck response. This type of hands-on training is risky with an inexperienced driver, so it is imperative that the instructor be competent. This company reinforces the fact that warning sign advisory speed limits are designed for cars and that truck drivers must keep speeds well below postings in curves and on ramps. The respondent from a motorcoach company stated that it trains its drivers that it is better to take a crash head on rather than move to the shoulder or median and risk a rollover. It uses oral instruction to train rollover prevention.

Effectiveness ratings for methods of training rollover prevention followed the same pattern as for speed and space management and hazardous weather; conventional techniques received the highest mean rating (7.0 out of 10), followed by high-fidelity simulation (5.0). Again, e-learning, computer-assisted instruction, and noninteractive simulation were rated between 3.3 and 3.7, on average.

NIGHTTIME OPERATIONS

Techniques used to train beginning drivers in safe nighttime operations include on-road nighttime drives (reported by all respondents), as well as use of a test track with unknown hazards (one carrier) to help demonstrate reaction time and sight distance issues. One school respondent indicated that night operations are conducted near the end of the program after the student has become competent at handling the truck. This school requires 7.5 hours of darkness driving under instructor supervision. Another school respondent indicated that the school takes its students out on both interstate and two-lane roads at night. Another school that provides some night training indicated that it teaches paying attention to offtracking on turns, being able to see the back of the trailer, and increasing following distance. One trucking company stated that a heavy emphasis is placed on proper rest, circadian rhythms, and fatigue management to help encourage nighttime safety.

Effectiveness ratings were highest for conventional methods (mean = 6.9 out of 10), followed by high-fidelity simulation (mean = 5.0). As for the previous topics, high-fidelity simulation, although used by only one respondent, received high effectiveness ratings (between 7 and 9) by four respondents. E-learning, computer-assisted instruction, and noninteractive simulation were rated 3.5 to 3.7, on average.

TIGHT MANEUVERING

Specific techniques reported in use for training beginners in tight maneuvering of the vehicle include range and on-road practice. One school and one trucking company mentioned GOAL (Get Out And Look) training in nontraffic areas or low-volume areas, such as terminals and customer facilities. One career center stated that its students perform a lot of tight turns on-road daily, and they practice straight back, alley dock, and parallel park from both sides each time they have on-road training. A state college respondent indicated that it uses a set of four backing exercises set up with maximum boundaries, points being deducted for encroachments and pull-ups. Students must first test out of each exercise four times and then test out on all four together, scoring 80% in each exercise. A community college reported that it uses a variety of scenarios on the range and also has permission from several local companies to back into their docks when available. One trucking company indicated that it uses a test area with barrels to practice, as this method is flexible and does not cause damage. This company stated that hands-on training is best, but simulator training would be valuable as well. The motorcoach respondent indicated that videos, oral training, a cone course, and on-road training are their best practices.

Effectiveness ratings were again highest for conventional methods (mean = 6.6 out of 10), followed by high-fidelity simulation (mean = 4.9). High-fidelity simulation received high ratings (7 through 9) from four respondents. E-learning, computer-assisted instruction, and noninteractive simulation received average ratings of 3.2 to 3.5.

EMERGENCY MANEUVERING

Specific techniques used to provide training in the performance of emergency maneuvers (e.g., skid control and recovery) to beginning drivers include a skid pad (by one school and one trucking company); a high-fidelity simulator (by one school); videos (a motorcoach company); and classroom and training manuals (two schools and one trucking company). A school that uses a skid pad employs both bobtail and tractor-trailer combinations with the skid pad. A school that does not have a skid pad expressed a desire for one for use in training emergency maneuvers. This school must rely on classroom instruction. Another school respondent indicated that its students try not to perform emergency maneuvers as the school is not set up to teach them. The retail trucking company that uses a skid pad indicated that hands-on training is best to develop skillful execution. This respondent also noted that basic techniques can be taught in the classroom, but they are ineffective alone.

Effectiveness ratings were highest for conventional methods (mean = 7.6 out of 10), followed by high-fidelity simulation (mean = 5.0). Again, four respondents (three schools and one trucking company) provided high ratings for high-fidelity simulation (7 through 9), even though only one school actually utilizes this technology for training. The use of e-learning, computer-assisted instruction, and noninteractive simulation were rated between 3.1 and 3.8 on average.

VEHICLE INSPECTION AND MAINTENANCE

Specific techniques used to train beginners in vehicle inspection and maintenance include demonstration and hands-on practice, which was indicated by all respondents, plus the use of videos (by a motorcoach company), textbooks, and the CDL manual. One school stated the following, “We demonstrate a pretrip inspection before we even study it in the classroom. Then the students do a pretrip every day on the range for a week; and then we do another demonstration. They practice a pretrip every day for the rest of the course. Out of a possible 105 points, most all of our students score above 100.” The state school respondent indicated that its classroom training includes 40 hours of preventive maintenance training that covers all aspects of vehicle systems. The students are constantly coached on PTDI procedures. Another school indicated that it establishes a routine to use during inspections, based on the 7-step routine recommended by the state manuals. A trucking company indicated that it makes the driver perform a pretrip inspection during orientation, and then it takes the driver through the shop and has the maintenance department discuss maintenance issues. Another company indicated that it uses North American inspection criteria and process. They set defects on a unit and then allow the student to inspect the unit. The company reviews any missed defects with the student.

Effectiveness ratings for conventional methods of delivery of training were highest (mean = 6.8 out of 10). Computer-assisted instruction received the next highest rating (average = 3.8), followed by e-learning (mean = 3.0). Not surprisingly, high-fidelity simulation was rated low in effectiveness for training drivers in vehicle inspection and maintenance (mean = 2.4). Noninteractive simulation was also rated low in effectiveness for this application (mean = 2.4).

BUS PASSENGER SAFETY, TRUCK COUPLING AND CARGO TRAINING

Specific techniques used by schools and carriers to provide training to beginning drivers in passenger safety and security (for buses) or coupling/uncoupling and cargo loading/unloading/securement (for trucks) include hands-on practice and classroom lecture. One school respondent stated that cargo securement training is minimal. The school maintains four loaded trailers for road training, one of which is loaded with concrete blocks. Some reference is made to proper securement, but there is no hands-on training in this area. Another school indicated that its students practice coupling and uncoupling after studying it in the textbook. They then do an evaluation for a score in class. The school teaches loading/unloading and securement mainly in class, but it has a few flatbed loads that require securing. Another school indicated that it has an established routine that students follow when coupling and uncoupling. The safety director of a local trucking company instructs the class in the importance of securement/loading/unloading. In another school, theory is taught in the classroom, and then students learn hands-on coupling and uncoupling with the instructor. Students also chain down a load of concrete slab on a flatbed trailer. The trucking companies indicated that hands-on training is the best method. Coupling/uncoupling is not taught in orientation by one company; instead it is covered by the trainer on the road. Cargo securement is covered by this company in about 30 minutes using company-specific diagrams, slides, and digital photographs. The motorcoach company indicated that passenger safety is taught by guidelines, videos, and lecture.

Effectiveness ratings were highest for conventional teaching methods (mean = 7.7 out of 10), followed by e-learning and computer-assisted learning (mean = 3.5) and noninteractive simulation and high-fidelity simulation (means = 2.6 and 2.4, respectively).

WELLNESS

Specific techniques reported by respondents for training beginning drivers to enable them to maintain their health and wellness are limited to classroom lecture, with the exception of one trucking company respondent who indicated that the company demonstrates stretching exercises to prepare muscles for work. One school also distributes a monthly "Wellness Tips" brochure to employees. One instructor at a state college reported that health and wellness maintenance is only one small segment of one 4-hour classroom period.

Effectiveness ratings were highest for conventional teaching methods (mean = 7.8 out of 10), followed by e-learning and computer-assisted instruction (both averaged 4.3) and the two simulation techniques (both averaged 1.4).

FITNESS FOR DUTY

Specific techniques used to provide fitness-for-duty training to beginning drivers include classroom lecture, workbooks, the Federal Motor Carrier Safety Regulations (FMCSR) *Pocketbook,* videos, and testing and logging exercises. One school respondent reported that students fill out a log book every day in class, so that once class is completed, they know how to use the log books and what the laws are. Another school respondent indicated that students spend many hours working on topics such as hours of service, accident procedures, trip planning, customer relations, and employee/employer relations. In contrast, another school respondent reported that fitness-for-duty training is only one small segment of a 4-hour classroom lecture period. A transport company respondent indicated that it had developed its own Hours-of-Service Training Module, which runs 2.5 hours. This respondent indicated that the module is proving to be very effective. Another trucking company respondent indicated it gives the students a trip scenario, including distances and speed limits, and has the students prepare a log. Only one respondent, a motorcoach company, reported using videos.

Effectiveness ratings were highest for conventional methods (mean = 8.4 out of 10), followed by computer-assisted learning (mean = 4.3) and e-learning (mean = 3.3). The two simulation techniques were rated low in effectiveness for teaching fitness for duty (each averaged 1.6).

Specific techniques used to provide training to beginners about management of work schedules and family time include classroom discussion (all respondents) and the video, "The Alert Driver: A Trucker's Guide to Sleep, Fatigue, and Rest in Our 24-Hour Society" (by one trucking company). The company that employs the "Alert Driver" video also focuses on real-life scenarios concerning drivers who failed to manage rest. This company focuses on the family's role in making sure the driver is prepared and reports that if the driver/student does not feel the need to be prepared, he or she will fail. Interestingly, one of the industry contacts reported that in his experience with hiring and training entry-level drivers, approximately 90% quit after the first 6 months on the job because they could not handle or did not like the amount of time they had to spend away from home. A respondent from a community college reinforced this issue, stating, "It seems that no matter how much you tell someone, they don't understand it until they experience it." Two school respondents indicated that it would be helpful to have videotapes or some kind of written material to teach this aspect of truck driver training. One school (a state university) indicated that it does not teach management of work schedules and family time as part of the curriculum;

that training is left up to the counselors at the workforce development level.

MANAGEMENT OF WORK SCHEDULE AND FAMILY TIME

Conventional teaching methods received the highest value ratings for training in management of work and family time (mean = 7.2 out of 10), followed by computer-assisted instruction (mean = 3.7) and e-learning (mean = 2.8). Both simulation methods were rated as low in effectiveness for training in this topic (ratings averaged 1.3 for each method).

MANAGEMENT OF FINANCES

Specific techniques used to provide training to beginning drivers about planning/managing their finances when on the road are generally limited to classroom lecture, although one school reported the use of guest speakers (former students who share their experiences) and one trucking company indicated that it uses experienced drivers to educate new hires about finance management because hearing it from another driver's perspective is very important. This company also provides some ideas for economical survival on the road. One trucking company indicated that it does not cover this topic in its training. One community college reported that planning finances and costs on the road is a large part of trip planning. A career center indicated that finance management is discussed on the road, based on instructors' experiences, but it does not have any textbook material or videos to provide instruction in this area.

Effectiveness ratings were highest for conventional instructional methods (mean = 5.9 out of 10), followed by computer-assisted instruction and e-learning, which received average ratings of 3.7 and 3.5 respectively. Both simulation methods received low ratings, averaging 1.3.

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APPENDIX A

SURVEY MAILED TO TRUCK DRIVING SCHOOLS, TRUCK AND BUS COMPANIES, AND INDUSTRY ASSOCIATIONS

COMMERCIAL TRUCK & BUS SAFETY SYNTHESIS PROGRAM

Requests your participation in a survey:

A critical part of our project, "Training of Commercial Vehicle Drivers: Best Practices," is to gain the perspective of experts regarding what works (and what doesn't work) in training entry-level CMV drivers to perform safely under a full range of operating conditions.

We are most concerned with the 'finishing' aspects of entry-level driver training. Taking as our starting point that the PTDI/FHWA model curriculum establishes a minimum standard for the knowledge component of CMV driver training, less is known about the best means of providing beginning drivers with supplemental instruction focused on key safety problems such as speed and space management, hazardous operating conditions, fitness-to-drive, and other "lifestyle" issues.

Please fax your responses to the number shown below. Responses will be summarized only by topic (survey item 1–12) and type of respondent (driving school, company/carrier, industry organization, etc.). **This will ensure that all individual responses remain confidential.**

Your opinions, expressed through responses to the following twelve survey items, will have a definite impact on the 'best practices' CMV driver training recommendations published by TRB. Thank you, in advance, for the valuable time you contribute to this research.

Contact information:

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Principal Investigator

Survey respondent profile information (no names, please):

What type of organization do you work for? _____

Are you directly involved in training entry-level CMV drivers? YES NO (*If no, go to next page*)

How many students enter and graduate from your program each year? enter: _____ graduate: _____

What is the cost for a student to go through your training program? ____ Who pays? _____

Avg. no. of trainees per group/class? ____ Avg. time for a trainee to qualify as a solo driver? _____

What vehicle types and special equipment are used in the driver training provided by your organization?

_____

What must a trainee do to satisfy the goals of your training program?

PLEASE FAX YOUR COMPLETED SURVEY TO 215-855-5381. THANK YOU!

1. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training in speed and space management to a beginner? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

2. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training to a beginner for driving in hazardous weather conditions? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

3. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training in rollover prevention to a beginner? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

4. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training in safe nighttime operations to beginners? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

5. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training in tight maneuvering of the vehicle (backing, docking, turning) to a beginner? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

6. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training in performing emergency maneuvers (such as skid control and recovery) to a beginner? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

7. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training to beginners in vehicle inspection and maintenance (include pre- and post-trip)? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

8. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide hands-on training to beginners in (a) passenger safety and security *(buses only)* OR (b) coupling/uncoupling and cargo loading/unloading/securement *(trucks only)*? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

9. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide training to beginners to enable them to maintain their health and wellness? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

10. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide fitness-for-duty training to beginners (including hours of service regulations)? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- computer-aided instruction in the classroom ___
- non-interactive simulation in a cab mock-up ___
- high-fidelity fully interactive driving simulator ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*

11. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide training to beginners about how to manage their work schedules and family time? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- non-interactive simulation in a cab mock-up ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*
- computer-aided instruction in the classroom ___
- high-fidelity fully interactive driving simulator ___

12. *In your own words, please explain:* What specific techniques have you used (or are you familiar with) to provide training to beginners about planning/managing their finances when on the road? What works the best, and what makes you say so?

On a scale from 1 (lowest) to 10 (highest), how would you rate the effectiveness of these instructional technologies in meeting training goals in this area? *(Please enter a number for every choice)*

- 'e-learning' via computer in remote location ___
- non-interactive simulation in a cab mock-up ___
- conventional training aids (e.g., textbooks, videotapes, slides, models) ___ *(Please describe below)*
- computer-aided instruction in the classroom ___
- high-fidelity fully interactive driving simulator ___

Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
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	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
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
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation