A Technical Analysis of
DRIVER TRAINING IMPACTS ON SAFETY

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Abstract

This report presents the findings of the American Transportation Research Institute (ATRI) study examining the relationship between driver training and new entrant driver safety performance. The research looks at the overall duration of new entrant driver training, the instructional environment and curriculum topic areas covered, and the relative safety impact of each on new entrant driver safety performance.

Background

Prior to enactment of the Commercial Motor Vehicle Safety Act of 1986, there was no classified driver licensing system in 18 states or the District of Columbia. Of the 32 states with a classified driver licensing system for commercial motor vehicle (CMV) drivers, only 12 required the operator to take a skills test in a representative commercial vehicle.

When the Commercial Drivers Licensing (CDL) Program was established as part of the Commercial Motor Vehicle Safety Act, it set minimum national standards that states must meet when testing and licensing CMV drivers. These federal requirements consist primarily of driver testing criteria based on driver knowledge and skills.

Fifteen years after the implementation of the CDL program, the debate continues over the criteria that should be used to verify a driver's qualifications to operate large commercial vehicles. While proponents of mandatory driver training believe that uniform training requirements are necessary, opponents of mandatory training argue that the emphasis should be on driver competency rather than on learning hours.

Federal Government Action

In 1985 the Federal Highway Administration (FHWA) Office of Motor Carriers[1] published a "Model Curriculum for Training Tractor-Trailer Drivers." Coming in advance of the CDL Program, the model curriculum was designed to provide non-regulatory guidelines and training materials pertaining to vehicles, facilities, instructor hiring practices, graduation requirements and student placement. Among the curriculum content areas addressed were basic operation, safe operating practices, vehicle maintenance and non-vehicle activities.

[1] The FHWA Office of Motor Carriers was the predecessor organization to the Federal Motor Carrier Safety Administration (FMCSA).

In 2004, the Federal Motor Carrier Safety Administration (FMCSA) issued a final rule on entry-level driver training, which focused on four topic areas:

- Driver medical qualification and drug and alcohol testing;
- Driver hours-of-service rules;
- Driver wellness;
- Whistleblower protection.

The 2004 rule did not mandate the number of hours of training in each of the four topic areas. Subsequently, the D.C. Circuit Court of Appeals remanded the rule back to FMCSA for further consideration. In response, in December 2007, FMCSA published a Notice of Proposed Rulemaking (NPRM) on Entry-Level Commercial Driver Training[2].

Industry Training Associations

Truck driver training programs benefit from an active industry network consisting of three major driver training associations described below. These associations represent distinct initiatives that bring subject-matter expertise and collaboration to the topic of driver training curricula and/or standards.

Professional Truck Driver Institute

The Professional Truck Driver Institute (PTDI), founded in 1986, began developing formal truck driver training standards in 1996. The process commenced with four industry stakeholder forums that sought input on questions such as "Do the current standards fairly measure the quality of education and training for entry-level truck drivers?" and "What does a driver need to know?" More than 150 stakeholders participated in the PTDI standards development and testing process. In January 1999, the final PTDI standards were approved by the PTDI Board of Directors. PTDI standards are reviewed and revised on a regular basis, with the last revision occurring in 2003.

At the present time, 66 driver training programs across the U.S. are certified according to PTDI standards. These programs are operated by motor carriers, public education institutions and private companies.

Commercial Vehicle Training Association

The Commercial Vehicle Training Association (CVTA) was formally established in 1996. CVTA members operate private and carrier-based instructional schools at over 180 locations, graduating approximately 50,000 students annually. While

[2] Federal Motor Carrier Safety Administration (FMCSA) Proposed Rule. Available at: http://www.fmcsa.dot.gov/rules-regulations/administration/rulemakings/proposed/E7-24769-12-26-07.htm

CVTA does not publish a detailed training curriculum for its members, it does evaluate schools based on adherence to the Model Curriculum.

National Association of Publicly Funded Truck Driving Schools

The National Association of Publicly Funded Truck Driving Schools (NAPFTDS) represents training programs operated within public education institutions. NAPFTDS was formed in 1990 and represents over 70 training programs. While the association does not promote a standardized training curriculum, members discuss training advancements and regulations at annual and regional meetings.

Driver Training Research

In contrast to the considerable activity taking place within government agencies and commercial vehicle training associations, surprisingly little academic or technical research has been conducted on driver training. In fact, research on CMV driver training is so sparse that baseline driver training data is essentially non-existent.

Typical truck driver training questions that remain largely unanswered include:

- What percentage of the three million professional truck drivers in the United States received any specialized truck driver training before receiving a CDL?
- What percentage of newly issued Class A CDLs are obtained by applicants that have received specialized truck driver training?
- What is the typical or median cost for a truck driver training program?
- What common components or standards exist across training regimen?

While answering these questions is generally beyond the scope of ATRI's research analysis, these questions serve to highlight the dearth of information that would be needed to better inform the public debate on minimum truck driver training standards.

ATRI Approach

Given the lack of available research on mandatory entry-level driver training, the Research Advisory Committee of the American Transportation Research Institute (ATRI) identified a driver training study as a priority issue.

ATRI's research focuses on the critical relationship between driver training and safety among new entrant drivers. As the first known examination of the safety impact of training on new entrant drivers, the study methodology collected and

analyzed the statistical relationship between driver training regimens and the safety records of the new driver registrants that attended each program. The study design attempted to identify and isolate the training program curriculum components that have the greatest impact on driver safety, and determine whether certain curriculum components have a greater influence on driver safety outcomes than other factors.

After an initial review of existing literature (Appendix A), ATRI convened a Technical Advisory Committee (TAC) to oversee the research and provide guidance on the study methodology and findings. The TAC consists of individuals involved with leading truck driver training associations (CVTA, NAPFTDS, PTDI), safety and training managers from representative motor carrier segments and driver trainers currently employed in day-to-day instruction.

Methodology

This study analyzed the relationship between entry-level driver training curricula and safety performance, with training program exposure serving as the independent variable and individual driver safety outcomes serving as the dependent variable. Safety outcomes are measured by the drivers' involvement in U.S. Department of Transportation (U.S. DOT) reportable accidents, separate property damage only (PDO) accidents and traffic convictions. In an effort to adjust for exposure, all safety variables are controlled by length of employment, measured in days.

Driver Population Selection

Motor carriers that participated in the study provided basic demographic and safety history information for all "new entrant" truck drivers. For purposes of this study, new entrant drivers were defined using the following criteria:

- No professional driving experience before being hired by the participating carrier;
- Employed by the participating carrier for a minimum of three weeks, with new entrant safety data collection ceasing at 18 months. Drivers still employed by the carrier after 18 months were included; however the post-18th-month safety performance of those drivers was not included in the statistical analysis to ensure that the data analyzed represented new entrant drivers only.

To ensure confidentiality, no identifying information was collected for drivers whose data was analyzed in this study.

Training Program Data Collection

Participating carriers also provided detailed information on the training programs that drivers attended. Since some carriers focus their hiring on a small number of training programs and others hire from a wide variety of different programs, three types of training programs are represented in the analysis:

1) Company-owned or sponsored programs that train drivers almost exclusively for new entrant employment with the sponsoring company.
2) Private training programs. Often these programs have agreements with trucking companies that allow carriers to recruit among graduating classes or "pre-hire" drivers who receive acceptable scores.
3) Training programs within public education institutions such as technical or community colleges. As with private programs, company recruiting and/or "pre-hiring" is a common practice.

All training program administrators were asked to complete a survey (Appendix B) that included questions on the scope of the training program, CDL testing services offered, credentials of the instructional staff and overall student performance. In addition, the survey asked for relatively detailed information on each curriculum's skill training topic areas, applied instructional methods, and learning resources used as part of the training.

While the initial survey queried schools on the number of total contact hours and contact hours spent in various training environments, follow up interviews were conducted with each participating school to clarify total hours in each learning environment. In particular, clarification was sought on the hours devoted to in-truck instruction versus time spent behind-the-wheel, when the student is in control of the vehicle.

Defining Safety

Data were collected and analyzed for three key safety metrics:

1. **DOT Reportable Accidents:** DOT accidents are those which meet specific criteria and must, by law, be reported to the U.S. DOT[3]. As a result of this requirement, motor carriers typically keep more complete records of these incidents than non-reportable accidents. This detailed record-keeping allows for greater confidence in comparing DOT safety rates for drivers across different motor carriers. From a research standpoint, DOT reportable accidents are of reduced utility relative to other measures due to the infrequency of occurrence. In a study that examines drivers' safety records over a span of less than two years, the likelihood of any particular driver being involved in a DOT reportable accident during this period is small.

2. **Traffic Violation Convictions:** Professional drivers are required to report most traffic violations to employers within 30 days, providing another metric that is relatively comparable across companies[4]. Unfortunately, from a research perspective, traffic incidents are similar to DOT reportable accidents in that occurrences are relatively infrequent (for the time period used to define new entrant drivers). Additionally, research has shown that traffic violations vary widely in severity, with some violations being much stronger in predictive value for future crashes than others[5].

[3] Federal Motor Carrier Safety Regulation §390.5
[4] Federal Motor Carrier Safety Regulation §383.31
[5] American Transportation Research Institute. *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures.* October 2005.

3. **Property Damage Only (PDO) Accidents:** Many truck-involved accidents that occur can be classified as "property damage only" or PDO crashes. These accidents often occur on private property, such as when a truck strikes a loading dock while backing, and thus are typically not reported to the DOT. Since PDO accidents are much more common than DOT reportable accidents or traffic convictions, they represent a more useful metric for evaluating safety in a study where short-term safety records are used. Conversely, the lack of a requirement to standardize, record and report these accidents means that the quality of data and confidence in complete coverage of these incidents may vary from company to company.

All three metrics are included in the analysis. Since limited data is available on the circumstances surrounding each incident, no attempt has been made to account for the relative "severity" of incident categories or incident severity within any one category. Consequently, each incident is given equal weight from a safety standpoint.

Method of Data Collection

A total of six motor carriers provided data for analysis:

- Three large truckload carriers;
- One large less-than-truckload carrier;
- One large specialized fleet;
- One mid-size household goods carrier.

Driver training program survey responses were received from 10 different training programs from which the participating drivers graduated.

The six motor carrier participants submitted safety data for 17,004 drivers that met the new entrant criteria. Detailed training information was available for 16,659 of the drivers. This dataset represents 29 percent of the annual new entrant driver population as estimated by FMCSA[6].

The mean and median age of drivers in the dataset was 38 years. Nearly 17 percent of new entrant drivers were 50 years of age or older, reflecting recent recruitment of drivers among adults previously employed in other professions.

Eight percent of new entrants were female, a high percentage for a traditionally underrepresented demographic group among the professional driver population. The remaining 78 percent were male and 14 percent unidentified.

[6] Federal Motor Carrier Safety Administration (FMCSA) Proposed Rule; Number of Entry-Level Drivers of Heavy Trucks. Available at: http://www.fmcsa.dot.gov/rules-regulations/administration/rulemakings/proposed/E7-24769-12-26-07.htm

The selected driver population matched the national new entrant driver population in another key area; length of employment. Driver turnover is a critical issue within the trucking industry, with many carriers experiencing turnover exceeding 100 percent annually. Among the new entrants included in the study, slightly more than 25 percent were no longer employed by the carrier that initially hired them by the 60th day of employment. At 100 days, more than fifty percent of the new entrants had left and less than three percent worked for the original employer on the one year anniversary of the date of hire.

Findings

Summary of Safety Events

In total, drivers in the dataset were involved in 416 DOT reportable accidents, 5,603 PDO accidents and 959 traffic convictions, totaling 6,978 safety incidents. Approximately 71 percent of drivers were involved in zero safety incidents, and 20 percent were involved in only one.

Of the 4,819 drivers who were involved in at least one safety event, the most common type of safety incident was a PDO accident. Nearly 25 percent of new entrant drivers were involved in a PDO accident compared to 4.7 percent convicted of a traffic violation and 2.4 percent involved in a DOT reportable accident.

Figure 1 presents the distribution of safety events per driver for the new entrant population identified in the study.

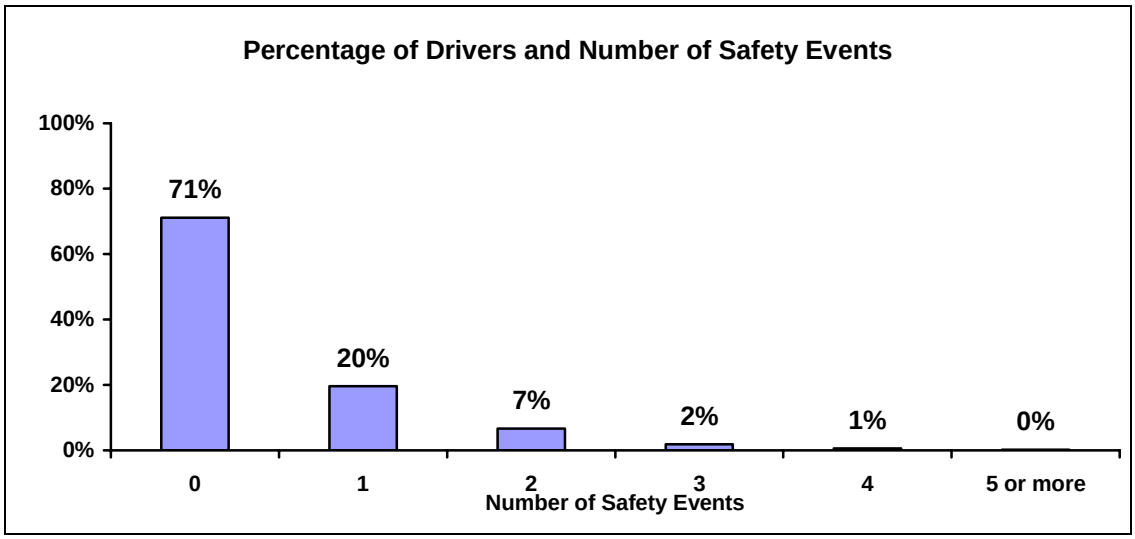

Figure 1: Percent of driver population involved in safety events

Several preliminary analyses were conducted on basic driver demographics. For instance, the number of safety incidents that a driver was involved in was positively correlated with both the driver's age and the driver's length of employment. Figure 2 demonstrates the relationship between length of employment and involvement in a safety event.

Figure 2: Percentage of drivers involved in at least one safety event by length of employment

As the research proposed to examine which training program elements and environments are statistically related to likely reductions in safety event involvement, a robust statistical analysis was utilized. To reduce effects that are not of interest to the study, a logistic regression model was utilized to control for driver age, the relationship between days employed and potential involvement in a safety event.

Summary of Driver Training Programs

Demographic Information

As noted, ten training programs supplied detailed information on the nature of the classroom and in-truck training provided, along with other baseline information. The training programs have been in operation from 2 years to 18 years. Average class sizes varied from 4 to 30 students. Seven programs offer direct CDL testing and five offer third-party CDL testing in addition to training. The percentage of graduates who successfully complete CDL testing ranges from 88 to 100 percent.

The average age of students varies among programs from 28 years to 40 years. Trainers, on average, have 10 years of driving experience and 7.5 years of training experience.

Instructional Environment

The total “contact hours” or hours of interaction provided by training programs vary greatly from 88 hours to 272 hours. In addition to identifying the total contact hours a student is exposed to in a training program, participating training institutions provided details on the number of training hours that occurred within

various training *environments*, such as the classroom, in-truck, behind-the-wheel and using a simulator. These environments vary between programs, with programs weighting and emphasizing classroom and in-truck training differently. Additional information was collected on the type of instruction that takes place within each training environment.

Table 1: Driver training instructional environment

	Average Age of Students	Number of Contact Hours Instructional Environment					
		Total	Classroom	In-truck	BTW*	Simulator	Other
Program A	35	272	80	0	152	0	40
Program B	28	207	127	35	45	0	0
Program C	30	170	45	40	45	20	20
Program D	30	160	58	50	40	2	10
Program E	28	160	80	45	25	10	0
Program F	30	150	50	60	30	10	0
Program G	40	124	42	11	45	13	13
Program H	30	120	40	55	25	0	0
Program I	35	96	48	0	48	0	0
Program J	37	88	32	26	30	0	0

*Behind-the-Wheel training where the student is in control of the vehicle.

Teaching Methods

Schools were asked to provide information on teaching methods used. All ten programs use instructor lectures, written materials and audio-visuals as teaching methods for the classroom instruction.

Nine of the programs have ongoing student assessments which include regular verbal or written quizzes and homework reviews. Additionally, nine of the programs assign homework.

The amount of combined in-truck and behind-the-wheel training ranges from 56 to 152 hours. As part of the in-truck instruction, all ten programs have students drive on local public roads. Nine also include range driving on a private road course, seven provide night driving experience and five provide long-distance driving (50 miles or more) experience.

Five of the programs include simulator training as part of the instruction, with simulator time-on-task ranging from 2 to 20 hours.

Instructional hours spent in “Other” learning environments include:

- Distance learning
- Truck repair and maintenance

- Field trips

Topic Areas

All ten training programs provide instruction in basic operations. On average, backing and docking receive the most contact hours, followed by basic control, shifting and vehicle inspections.

Table 2: Basic operations contact hours

Basic Operations	Number of Programs Offering	Number of Contact Hours		
		Average	Minimum	Maximum
Backing/Docking	10	25	4	60
Basic Control	10	17	1	40
Shifting	9	13	2	40
Vehicle Inspections	10	13	4	50
Coupling/Uncoupling	10	7	1	40
Orientation	10	5	1	10
Control Systems	9	3	1	16

Safe operating practices are covered by all programs. Space management and speed management had the greatest average number of contact hours.

Table 3: Safe operating practices contact hours

Safe Operating Practices	Number of Programs Offering	Number of Contact Hours		
		Average	Minimum	Maximum
Space Management	10	4	1	10
Speed Management	10	4	1	12
Extreme Driving	10	3	1	8
Hazard Perceptions	10	3	1	8
Skid Control	10	3	1	8
Emergency Maneuvers	9	3	1	8
Visual Search	9	3	1	8
Vehicle Communication	9	2	1	8
Unmarked Railroad Crossings	9	2	1	8
Night Operation	7	2	1	10

Hours-of-Service requirements are covered by all training programs included in this study, as are trip planning and accident procedures.

Table 4: Non-vehicle activities contact hours

Non-Vehicle Activities	Number of Programs Offering	Number of Contact Hours		
		Average	Minimum	Maximum
Hours-of-Service Requirements	10	7	2	20
Handling & Documenting Cargo	8	3	1	24
Trip Planning	10	3	1	8
Communication Skills	6	1	1	6
Environmental Issues	4	1	1	4
Accident Procedures	10	2	1	4
Managing Life on Road	8	1	1	4
Other	4	3	2	14

Instruction in identification and maintenance of basic vehicle issues is included in all ten programs. Diagnosing and reporting more serious malfunctions to maintenance personnel is included in eight programs.

Table 5: Advanced operating practices contact hours

Advanced Operating Practices	Number of Programs Offering	Number of Contact Hours		
		Average	Minimum	Maximum
Identification and Maintenance	10	2	1	5
Diagnosing/Reporting Malfunctions	8	2	1	5

Safety Impact Assessments

The impact of contact hours for the following three discrete training components, as collected from the training program surveys, were tested as predictors for driver safety outcomes:

- overall training program;
- different instructional environments; and
- specific training topic areas.

Total Program Contact Hours

The duration of training that was submitted and tested, in terms of total entry-level driver training program contact hours, ranged from 88 to 272. Across that continuum, no relationship is evident between total training program contact

hours and driver safety events when other factors such as age and length of employment are held constant. However, it cannot be concluded that a statistical effect does not exist for more or fewer hours than those tested in this assessment.

Instructional Environment Contact Hours

The instructional environments tested in the analysis, using the logistic regression model, were classroom, in-truck, behind-the-wheel, simulator and other. Controlling for age and days of employment, the analysis determined that no single instructional environment presented a stronger predictor of the likelihood that a driver would not be involved in a safety event than any other instructional environment.

Topic Area Contact Hours

The driver training programs provided information on the number of hours included in the program for specific topic areas, often described as "training duration." A logistic regression model was used to predict the increased or decreased likelihood that a driver will not be involved in a safety event given the number of hours in each topic area. Controlling for age and days of employment, the analysis determined that just one of the topic areas – accident procedures instruction – significantly influenced the probability that a driver does not have an event. Specifically, examining the odds ratios for the model, for every one hour increase in accident procedures instruction, the odds of not having an event increased by a factor of 1.409. These results are highly significant at the 0.0001 significance level.

The statistical testing cannot state or predict the underlying cause of the significant effect; however the researchers have proffered one likely hypothesis for this unique finding. Initially new entrant drivers have little experience or empathy with large truck crashes, but accident procedures training increases the cognitive awareness and seriousness of crashes for new entrant drivers in a way that increases their understanding and appreciation for mitigating crashes. If that hypothesis were true, it is possible that the accident procedures instruction mentally prepares new entrant drivers for improved learning of all other training components. However, it cannot be determined in this study whether or not moving this significant safety component forward in the training regimen could improve overall learning and positive safety outcomes, but it should be considered in future research.

Training Staff Credentials and Student Safety Outcomes

The credentials of the training program staff, such as average years of experience driving a truck and average years of experience with driver training, was not shown to have any statistically significant effect on the safety performance of the drivers who graduated from the programs. Information on professional driving and training experience was only available as a mean per-trainer figure, leaving open the possibility of significant intra-program variation in trainer experience levels that may impact a driver's future safety performance.

Testing for Location/Instructor Effects

The training program instructional components and the overall curricula to which they belong are independent of the quality of instructional delivery by the trainer. Since there is a widespread support within the driver training community for the importance of instructional delivery (the "instructor effect"), ATRI attempted to test for evidence of the instructor effect within the data.

Several training programs in the dataset operated facilities in multiple locations using identical curricula. Motor carriers provided information on the location that new entrant drivers attended. Comparing across geographic locations for students that were instructed using the same curriculum allowed for a rudimentary test of the effect of within-program variation by geographic location and the possibility for "instructor effect." Among the three training programs that were analyzed using this within-program approach, no statistically significant difference was found between a specific training program location and driver safety.

Carrier Comparison of Student Safety Outcomes

As a final control for the effect of company safety policies and safety incident reporting variability, a direct comparison of the safety performance of drivers hired by the six participating carriers was conducted. No statistically significant relationships were seen between the carrier that a driver was hired by and the safety performance of the driver, when controlling for length of employment.

Conclusions

While the preliminary results presented herein serve to provide key statistical findings on driver training exposure and safety performance, the analysis finds little variation among driver safety performance that can be explained by training program duration within the range of 88 to 272 hours. However, time duration does become statistically important for one specific training topic within a training regimen once age and days of employment are controlled for. The one variable that significantly influenced the probability that a driver does not have a safety event is post-accident procedure instruction duration.

The lack of an overall relationship in the duration of new entrant driver training exposure with driver safety outcomes may be interpreted several ways. One conclusion might be that more hours than those submitted and tested could have an effect. However, the lack of a safety improvement trend line towards the longer duration programs does not provide the researchers with a basis for this conclusion. The fact that one training topic within the tested duration had a statistically significant effect on driver safety may indicate that one topic area (and others not included in the test) could be under-utilized. With more emphasis placed on training components that effect positive safety outcomes, it would be expected that overall duration might become more significant. Conversely, more strategic use of significant components could, theoretically, reduce the overall number of training hours needed.

The findings indicate the need for further research on driver training and driver safety, beginning with additional data collection and analysis as part of the present study. Toward that end, ATRI continues to undertake analytical research on other aspects of the relationship between driver training and safety. A key component of this additional research includes data analysis relating to the impact of entry-level driver training on the CDL testing process. In addition, ATRI will continue to investigate the significant correlation between age and safety performance outcomes.

Appendix A – TAC Literature Review

TRAINING IMPACTS ON SAFETY

LITERATURE AND STATE OF PRACTICE REVIEW

OVERVIEW

The following represents a review of research conducted on the current status of commercial driver training and large truck driver training program development, as well as various instructional methods used to train commercial drivers.

LITERATURE REVIEW

An examination of existing literature on the development of training program curricula and curriculum review standards reveals that little research has been conducted on the relative efficacy of various training program elements or the overall contribution of training program curriculum to driver skill development or driver safety outcomes. Indeed, only a handful of studies have examined the role of training programs and training methods in creating skilled, safe large truck operators.

Commercial Driver Training Research

Dobie and Glisson (2005) provide the most comprehensive insight into the current status of commercial driver training. The authors polled drivers of large trucks in an effort to determine where drivers received training prior to entering the profession and found that 55.1 percent of respondents had received training through either a program run by a technical college or by a carrier. The researchers noted that this figure likely grossly underestimates the importance of formal training for drivers new to the field, as drivers who had entered the field since the introduction of the CDL program were far more likely to have attended a formal training program.

In addition to collecting information about driver training backgrounds, the study polled carriers to determine the training provided to drivers. Of the 95.7 percent of carriers who offered training to drivers, 87.2 percent offered training conducted by company personnel or outside training consultants, while an additional 8.5 percent offered time off to attend training events outside the company. The most common training provided was on safety and driver log maintenance, which 97.9 percent of carriers provided.

Program Design

Shortly after World War II, research conducted by the U.S. military found that outcome-centered training had been an essential tool in achieving its recent military success. In response, over the next several decades the military worked to institutionalize training based on outcomes rather than process, using innovative techniques to establish performance benchmarks and testing methods. Academic research has followed the military's lead, shifting emphasis from training process design to training outcome goal development and benchmarking techniques. An academic consensus has arisen around the belief that successful training program designs require accurate, precise measurement of student performance when attempting to achieve training outcome goals (Brock et al. 2007).

The fundamental component to the model is the learning objective, which the student must fulfill through performance of a task or tasks under prescribed conditions. Finally, a student's performance of the task under the specific conditions must be measured against a set standard. To this end, Glaser (1963) and Glaser and Klaus (1962) created the term "criterion-referenced measures" to differentiate the practice of measuring students against established standards rather than other students, which had been the practice before the 1960s.

It was in this outcome-based environment that the national CDL testing program was developed and signed into law in 1986. Though specific requirements vary by state, the core of the program retains an emphasis on demonstrated proficiency in answering questions about driving laws and techniques (knowledge test) and operating a commercial motor vehicle (skills test). Currently, no state requires that a CDL applicant receive any training before attempting to pass the test, though many applicants do receive some training before attempting the test.

The de-emphasized position of training process within CDL testing development and practice has led to a lack of research focused on effective truck driver training methods. Since the CDL only requires applicants to meet certain well-defined and independent benchmarks, some training programs have provided training exclusively focused on training drivers to meet those benchmarks. Such narrowly-focused training may provide little practical safety benefit, as it balkanizes driver knowledge and skills. Recognizing that limiting training to the skills necessary for successful completion of CDL testing is inadequate for producing safe drivers, many training programs have designed far more robust curricula. Unfortunately, little research exists to guide these programs in designing training that maximizes resources and produces safe drivers.

Curriculum Development Initiatives

Commercial Driver Training Programs: Performance Report

By far the most expansive research initiative focused on the development of a training program for large truck drivers was the late 1980's study undertaken at

the New Hampshire Vocational Technical College in Nashua. Sponsored by the U.S. Office of Vocational and Adult Education, it focused on developing a training curriculum for large truck operators. Though little of the analytical justification for including various training materials and recommended activities was included in the published report, the study developed over 500 pages of training materials and tracked student progress through a training course based on the curriculum. The abstract describes the study as follows:

> This document describes a project to develop a 320-hour tractor trailer driver training program and a 20-hour commercial driver licensing upgrade training program. Of 34 graduates from the training program, 28 secured employment in the trucking industry. From August 1989 to June 1990, 725 students were trained in the upgrade training program with a 100 percent success rate on the National License examination. The five-page project report is followed by the program materials. The training program consists of two sessions. Session I covers laws, double and triple trailers, tank vehicles and hazardous materials. Session II covers hazardous materials more extensively. The retraining program consists of four sessions. Session I covers law, control systems, basic control, shifting, backing and speed management. Session II topics are visual search, communication, space management, night operation, extreme driving conditions and hazard perception. Session III topics are pre-trip and post-trip inspection, air brakes, skid control and recovery, emergency maneuvers and emergency reporting. Session IV covers cargo inspection, weights and balances, securing cargo, special cargo, combination vehicles and curricula overview. Each session concludes with test-taking skills and a proficiency test with answer key. Each topic consists of some or all of these components: objectives, topic outline or information, and techniques/procedures and activities.

Unfortunately, the Nashua study's methodology did not incorporate a longitudinal component to collect data on the safety history of the 725 students that were trained using the curriculum between 1989 and 1990. Presumably, most of these students went on to find employment driving large trucks, and it is impossible to determine the impact that the training had on the drivers' immediate and long-term driving behavior.

PTDI Training Curriculum

The Professional Truck Driver Institute (PTDI), founded in 1986, began a process to develop formal truck driver training standards in 1996. Beginning with four forums with industry stakeholders that extended through 1997, PTDI sought input on questions such as "Do the current standards fairly measure the quality of education and training for entry-level truck drivers?" and "What does a driver

need to know?" Between late-1997 and early-1999, 62 training schools across the nation participated in a beta test of the standards which had been developed over the course of the four forum meetings, with 41 of the schools receiving certification. In January 1999, upon review and revision by over 150 of the PTDI standard development and testing process participants, the final PTDI standards were submitted to the PTDI Board of Directors and approved. Since the initial development, PTDI standards have been regularly reviewed and revised, with the last revision occurring in 2003.

Currently, 66 training programs across the U.S. operate training programs which have been certified according to PTDI standards. Members include training programs operated by motor carriers, public education institutions, and as private entities.

The PTDI curriculum for entry-level driver training is grouped in five main areas:

1. Basic Operation
2. Safe Operating Practices for Basic Operation
3. Advanced Operating Procedures
4. Vehicle Systems and Reporting Malfunctions
5. Non-vehicle Activities

An additional key component of PTDI is mandatory contact hours and student contact hours operating a large commercial motor vehicle. The program requires 104 classroom contact hours and 44 hours "behind the wheel" per student.

Uniquely, PTDI also publishes a "Checklist for Quality Courses in Tractor-Trailer Driver Training" guide which outlines what criteria to check for in a high-quality driver training program. While much of this guide involves checking for the presence of training standards that are part of the PTDI curriculum, there is additional information about examining teaching credentials held by instructors, the physical condition of both the classroom environment and truck equipment, and the school's ability to provide transcripts and other records of program completion.

CVTA Curriculum

The Commercial Vehicle Training Association (CVTA) was formally established in 1993 after existing under various other organizational names since the early 1980s. CVTA members operate private and carrier-based instructional schools at over 180 locations, graduating approximately 40,000 students annually. While it does not publish a detailed training curriculum for members to follow, CVTA does require that all member schools follow a detailed code of conduct, which includes some guidelines for program operations. CVTA does offer resources for schools when hiring instructors in the form of pre-hire checklists and performance evaluation forms. These forms highlight a very "process-centric" approach, with

a focus on instructional delivery methods and techniques rather than objective assessments of student performance. In addition to these pre-hire and evaluation forms, CVTA offers a web-based Instructor Certification Program centered on vocational instruction modules.

Smith System

The Smith System Driver Improvement Institute was founded in Arlington, Texas by Harold Smith in 1952. The curriculum, known as the Smith System, supports the idea that most collisions can be prevented if the right driving behavior is practiced. Drivers are taught to observe surroundings, anticipate challenges and react safely. The trademarked "Five Keys of Space Cushion Driving" focus on the central components of safe driving: space, visibility and time. The Five Keys are:

1. Aim high in steering,
2. Get the big picture,
3. Keep your eyes moving,
4. Leave yourself an out, and
5. Make sure they see you

The Smith System emphasizes the importance of practice and repetition to build safe driving habits. For this reason, driving simulator and behind-the-wheel training is the foundation of the curriculum.

Supplementing behind-the-wheel training are videos, web-based training and fleet monitoring. The web-based training, known as the E-Learning Center, addresses such topics as key factors in traffic collisions, proper following distance, identifying potentially dangerous situations as early as possible and reducing the threat of other drivers.

Current Instructional Methods

There are currently several instructional methods used by trainers with most programs employing some combination of classroom lecture, supervised "closed course" driving and supervised public road driving and/or observation. Due to access to computers and technology, particularly high speed internet, computer use is beginning to play a large part in many training programs. Known by several names, such as computer-based training (CBT), computer-based instruction (CBI) and computer-assisted training (CAT), this technology enables training efforts to reach a much wider audience in a very efficient manner. Electronic training programs are typically disseminated through CDs, downloadable movie files or interactive online sessions with live instructors. Related to these more "instructional" uses of computer technology is the use of driving simulator programs to augment the benefits gained from supervised, real world driving sessions.

As training design has progressed, computer-based instruction (CBI) has grown in popularity along with more widespread access to computers and internet. CBI alone will not necessarily produce better training results, but research has been conducted to evaluate its effectiveness (Brock et al. 2007). Recent research by Fletcher (2006), Kulik (1994), and Kulik and Kulik (1991) posits that CBI works if conducted correctly. One study by Dodds and Fletcher (2004) demonstrated a one-third increase (33%) in amount of material learned or a one-third (33%) decrease in time spent learning the material needed to master the learning objective. Though subsequent research by Brock (2007) has shown that CBI may be successful in certain circumstances when training new-entrant drivers, the aforementioned research focused on its effectiveness when deployed within a professional driver population (Fisher et al. 2002).

Although most training programs employ similar instructional methods, there is not general agreement on the subject matter. While most programs cover very similar topics, it is important to note that there is no national standard for commercial motor vehicle safety training curriculum. Additionally, while many of the various training entities within the industry have come to an informal consensus on the subject of commercial driver training topics, it has been nearly 20 years since a formal curriculum design for commercial drivers was systematically developed. During this time period there have been numerous advancements in vehicle technology as well as in the analysis of human factors that affect driver safety and performance (Brock et al. 2007). Thus many of the standard teaching materials used by training entities may be in need of an update, particularly those having to do with the proper use of new technologies and items related to driver performance concepts.

CONCLUSIONS

While little academic research exists to guide those interested in developing effective truck driver training programs, several training associations have stepped in to fill the void left by developing useful tools for guiding program design and instruction methods. In addition to the organized efforts of these associations, several private and public entities have developed programs which are used for training commercial drivers. ATRI's research is designed to capture information about various techniques utilized by these programs and the resultant safety performance outcomes.

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Appendix B – Training Program Curriculum Survey

Driver Training Impacts on Safety

The American Transportation Research Institute (ATRI) is currently undertaking research on the effectiveness of various entry-level truck driver training instruction methods in improving the safety performance of new-entrant commercial truck drivers.

A key component of this research is the collection of baseline data about various large truck driver training programs in operation around the country. One of the carriers who recruits a large number of entry-level drivers from your training program recommended we contact you to participate in this research. The information you provide about training program components and administration is an essential component to this research, and we sincerely hope that you will take the time to complete this survey. The survey should take between 10 and 20 minutes to complete. All responses will be kept confidential and reported in aggregate only.

If you have any further questions, please contact William McDonald at wmcdonald@trucking.org or 770-432-0628.

Driver Training Impacts on Safety

Please provide the official name of the training program you are providing information for.

Approximately how many years has the training program been in existence?

How many locations does the training program you are providing information for operate?

Approximately how many students graduate from your training program each year?

What is the approximate graduation rate for students who begin training at your training program?

Does your program offer CDL testing in addition to training?

☐ Yes ☐ No

Is third-party CDL testing offered in addition to training?

☐ Yes ☐ No

Approximately what percent of students who graduate from your training program successfully complete CDL testing?

What is the average class size for training programs you operate?

What is the average age of the students who enroll in your training program?

How many total contact hours does the typical student receive within your training program? One contact hour is 60 minutes.

Please indicate whether training is provided in each of the following environments and the number of contact hours that the typical student spends engaged in each of the following environments.

	Is training provided in this environment?		Number of Hours
	Yes	No	
Classroom Instruction	☐	☐	
In-truck Instruction	☐	☐	

Simulator Instruction	☐	☐	
Distance Learning	☐	☐	
Other	☐	☐	

Please indicate whether training is provided in the following topic areas and the number of hours of that the typical student at your school receives.

Basic Operation	Is instruction provided on this topic? Yes	No	Number of Hours
Orientation	☐	☐	
Control Systems	☐	☐	
Vehicle Inspections	☐	☐	
Basic Control	☐	☐	
Shifting	☐	☐	
Backing and Docking	☐	☐	
Coupling and Uncoupling	☐	☐	

Safe Operating Practices for Basic Operation	Is instruction provided on this topic? Yes	No	Number of Hours
Visual Search	☐	☐	
Vehicle Communication	☐	☐	
Speed Management	☐	☐	
Space Management	☐	☐	

Night Operation	☐	☐	
Extreme Driving Conditions	☐	☐	

Hazard Perception	☐	☐	
Emergency Maneuvers/Skid Avoidance	☐	☐	
Skid Control and Recovery	☐	☐	
Passive (Unmarked or Uncontrolled) Railroad Crossings	☐	☐	

Vehicle Systems and Reporting Malfunctions	Is instruction provided on this topic? Yes	No	Number of Hours
Identification and Maintenance	☐	☐	
Diagnosing and Reporting Malfunctions	☐	☐	

Non-Vehicle Activities	Is instruction provided on this topic? Yes	No	Number of Hours
Handling and Documenting Cargo	☐	☐	
Environmental Issues	☐	☐	
Hours of Service Requirements	☐	☐	
Accident Procedures	☐	☐	
Managing Life on the Road/Personal Resources	☐	☐	
Trip Planning	☐	☐	
Communication Skills	☐	☐	

If there are any other training topics that are covered as part of your training program, please list them below along with the number of hours of instruction that a typical student receives on the topic.

Please indicate which of the following teaching methods are used during classroom instruction. Check all that apply.

- ☐ Instructor Lecture (guided reading, verbal instruction)
- ☐ Written Materials (textbooks, handouts, etc.)
- ☐ Audio-Visual Tools (videos, model vehicles, etc.)
- ☐ Ongoing Student Assessment (regular verbal or written quizzes, homework review)
- ☐ Homework (reading or written work)
- ☐ Other: _____

Please select which simulation technologies are used during simulation instruction. Please select all that apply.

- ☐ Single-Monitor Simulator
- ☐ Multi-Monitor Simulator
- ☐ Instructor-led Simulator Lesson (Instructor drives and students watch)
- ☐ Student-led Simulator Lesson (Student drives and other students watch)
- ☐ Dynamic Simulator Scenarios (Instructor-adjusted scenarios to target student skill weaknesses or other specific issues)
- ☐ Other: _____

If you are familiar with the simulation technologies available to you, please list the simulator models and software packages your program utilizes.

Driver Training Impacts on Safety

Please select which techniques are used during in-truck instruction. Please select all that apply.

- ☐ Instructor In-truck Instruction (Instructor drives and students watch)
- ☐ Student In-truck Instruction (Student drives and instructor/other students watch)
- ☐ Driving on private road course or non-public area (Range driving)
- ☐ Driving on local public roads
- ☐ Driving on non-local roads (long distance trips of 50 miles or more)
- ☐ Night driving
- ☐ Other:

Please take a minute to describe the road range which you use to instruct students. Include information about size, configuration, and any unique features.

Driver Training Impacts on Safety

How many trainers are employed by your training program in a **full-time** capacity?

How many trainers are employed by your training program in a **part-time** capacity?

Driver Training Impacts on Safety

Approximately what percentage of the instructors employed by your program have

previous experience as professional truck drivers?

Approximately how many combined years of previous experience as professional truck drivers do the instructors employed by your program have?

Approximately how many combined years of experience as driving instructors do the instructors employed by your program have?

Please list any accreditations your school holds or certifications it has received. Additionally, list any awards or commendations it has received.

Please provide contact information. You will only be contacted if clarification is needed for response or if additional questions are required.

Name:

Title:

Phone: Email: