Session No. 669

Develop and Sustain an Effective Fleet Safety Program – Z15 Can Help

Brian S. Hammer, MPA, CDS
Risk Management Consultant, Fleet
Nationwide Agribusiness Insurance
Des Moines, IA

William J. Hinderks, CSP, CPCU, ARM, ALCM
Senior Loss Control Specialist
Artex Risk Solutions (a subsidiary of Arthur J. Gallagher & Company)
Bloomington, IL

Stephanie G. Pratt, PhD, MA
Coordinator, NIOSH Center for Motor Vehicle Safety
National Institute for Occupational Safety and Health
Morgantown, WV

Peggy Ross, RN, MS, CSP, COHN-S/CM, CPE
Corporate Manager, Environment, Health and Safety
Baxter Healthcare Corporation
Deerfield, IL

Introduction

Millions of U.S. workers are at risk for a work-related motor vehicle crash (MVC). Fatality data show that across all industries, MVCs are consistently the leading cause of work-related fatalities. Of 43,025 work-related fatalities reported by the Bureau of Labor Statistics between 2003 and 2010, 10,202 were the result of single- or multiple-vehicle crashes of workers driving or riding in a vehicle on a public roadway, and 2,707 were pedestrian workers struck by a motor vehicle.[1] [2] An analysis of the costs of MVCs to U.S. employers using data from 1998-2000 found that on average, each fatality cost a business over $500,000 in direct and liability costs, and each non-

[1] Source: Bureau of Labor Statistics online query system at http://data.bls.gov/cgi-bin/dsrv?fi
[2] From 2003-2010, there were an additional 2,487 worker deaths in crashes that occurred off a public roadway or on industrial premises.

fatal injury cost nearly $74,000 (National Highway Traffic Safety Administration 2003). More recently, for MVC-related injuries requiring more than 6 days away from work, workers' compensation costs were estimated to be nearly $2 billion (Liberty Mutual Research Institute for Safety 2).

The risk of work-related MVCs cuts across all industries and occupations. Between 2003 and 2008, workers employed by truck transportation companies had the highest risk of work-related fatality due to an MVC while driving or riding in a motor vehicle on a public roadway (19.6 deaths per 100,000 workers), followed by logging (11.7), wholesale distribution of petroleum products (8.6), waste management services (8.5), and support activities for mining (7.9) (CDC 500). Heavy and tractor-trailer truck drivers account for the highest proportion of fatalities in any single occupation: 39% of the total for 2003-2010.[3]

The history and scope of the ANSI Z15.1 standard

The ANSI Z15 Committee was organized in 2001 to create a consensus standard with requirements for policies, procedures, and management processes for organizations to control risks associated with motor vehicles (ANSI/ASSE 2012 9). The American Society of Safety Engineers (ASSE) has served as the secretariat for the standard throughout its history. The first chairman of the ANSI Committee was Carmen Daecher, who served from 2001 until 2009, when he stepped down and William Hinderks was elected chairman.

The ANSI/ASSE Z15.1 standard, first published in 2006, sets forth practices for the safe operation of organizational vehicles, defined as licensed vehicles designed to be driven primarily on public roads. The standard extends to use of this category of vehicles off public roadways. It provides organizations a template for development of policies, procedures, and processes to better manage the risks associated with vehicle use. ANSI/ASSE Z15.1 is applicable to organizations whose vehicles and drivers are covered by the Federal Motor Carrier Safety Regulations (FMCSRs) ("regulated" fleets), as well as to organizations whose vehicles and drivers do not operate under the FMCSRs ("non-regulated" fleets).

For organizations just beginning to formalize their vehicle operations safety program, the standard provides comprehensive guidance on what a program shall include, but leaves it up to the organization to design the specific detail based on their unique circumstances. For organizations with mature programs, fleet managers can use the standard to audit their existing program or provide a risk-based approach to fleet management.

It is important to point out that the field of vehicle risk management has evolved in recent years. ANSI/ASSE Z15.1-2012 was a moderate revision that includes more guidance in a number of areas (e.g., distracted driving) than its predecessor. Furthermore, the standard provides additional suggestions for measuring performance over time.

Basic Outline of ANSI/ASSE Z15.1-2012

The main body of the ANSI/ASSE Z15.1 standard is divided into seven major sections:

1. Scope, Purpose, Applications, Exceptions and Interpretations
2. Definitions
3. Management, Leadership and Administration
4. Operational Environment
5. Driver
6. Vehicle

---

[3] Source: Bureau of Labor Statistics online query system at http://data.bls.gov/cgi-bin/dsrv?fi

7. Incident Reporting and Analysis

Each section of the standard is divided into two columns. The text in the left column contains requirements: what an organization "shall" do in order to be in compliance with the standard. The right column provides non-mandatory guidance and interpretation of the corresponding material in the left column. After the main body of the standard, the Appendices provide valuable supporting information and tools to help organizations apply the standard.

ANSI/ASSE Z15.1-2012 and Non-regulated Fleets: One Company's Experience

The ANSI/ASSE Z15.1 standard was intended to be applicable to both regulated and non-regulated fleets. The following section discusses one company's experience in implementing the standard in its non-regulated fleet. Baxter Healthcare has approximately 1,000 U.S. employees who drive regularly on business and are considered non-regulated fleet drivers. Most of these employees are part of the sales force. Baxter applies the Occupational Health and Safety Assessment Series (OHSAS) 18001 to assess and manage hazards that pose risk to employees. The Environment, Health and Safety (EHS) management system approach drives continuous performance improvement for Baxter.

In December 2008, the Baxter Corporate EHS audit team engaged an external fleet-safety expert and facilitated the first EHS-focused audit for its U.S. non-regulated fleet. The goal was to understand how Baxter managed its non-regulated fleet and more importantly, *fleet risk*. Managing fleet risk is important because it goes beyond the vehicle and incorporates effective management of drivers and driving behaviors. The audit revealed strong management of fleet operations, vehicle selection, and acquisition, with opportunities to improve upon a risk-based approach to manage fleet risk. Fleet safety audit components included interviews and an assessment of various areas including:

- The current process for managing fleet
- Identification of key stakeholders
- Types and number of vehicles
- Selection and acquisition of vehicles
- Vehicle use (e.g. carrying items, miles per year, type of driving…)
- Inspections, repair and maintenance
- Incident reporting and investigation
- Driver qualification
- Policies and procedures
- Performance evaluation (success metrics)
- Training and communication

Beginning early in 2009, a strong partnership was formed between Corporate EHS and the U.S. Fleet Manager. A strategy was developed and tactical plans defined an action timeline to close gaps identified during the fleet audit and to strengthen management of non-regulated fleet *risk*. Baxter's Fleet Manager led the effort and EHS leveraged a transitional leadership/ partnership style to provide guidance, expertise and support. The U.S. Fleet Manager engaged key stakeholders to support development and deployment of a tailored, Baxter approach.

Baxter referenced the voluntary consensus standard, ANSI/ASSE Z15.1-2006, *Safe Practices for Motor Vehicle Operations*, to support the development of a best-in-class approach to managing fleet risk. Because policies and procedures are the foundation of a non-regulated fleet program, Baxter strengthened the overall driver policy. Further, Baxter developed and deployed a non-regulated fleet safety program and specific guidelines to cover aspects such as authorized driver requirements, safe vehicle use, and expected maintenance. Z15.1 provided the framework for Baxter's policy and guide, tailored to fit Baxter. Measurement systems were also enhanced, leveraging concepts from the standard. In 2009, Baxter was selected to participate on the ANSI/ASSE Z15 committee supporting the review and revision of the ANSI/ASSE Z15.1-2006 standard, *Safe Practices for Motor Vehicle Operations*, and supported revisions for the recently released ANSI/ASSE Z15.1-2012 revised standard.

ANSI/ASSE Z15.1-2012 and Commercial Fleets

When the ANSI/ASSE Z15.1 standard was first issued, it was hailed as a great document to help non-commercial fleets organize a safety effort to reduce costly motor vehicle crashes and reduce risk in motor vehicle operations. The following section of this paper will demonstrate the value of the standard for managing commercial fleets as well. In contrast to non-commercial fleets, commercial motor vehicle fleets are heavily regulated by Federal Motor Carrier Safety Administration (FMCSA) if they are interstate carriers and to a lesser degree by similar state agencies if they are intrastate carriers. It was theorized that commercial motor fleets were heavily regulated, and while parts of Z15 would certainly cover their operations, the FMCSA and its FMCSRs would ensure that commercial fleet operators had the required safety structure in place. Regulatory efforts notwithstanding, injuries and fatalities involving commercial motor vehicles continue to occur, and liability remains. Despite general declines in the number and rate of fatal crashes involving large trucks and buses in past decades, 573 occupants of these vehicles and 3,371 other road users died in large truck and bus crashes in 2010 (Federal Motor Carrier Safety Administration 2012 4). From 2009 to 2010, this represented a 9% increase in the number of large trucks and buses involved in fatal crashes, and a 9% increase in the rate of fatalities per 100 million miles driven (Federal Motor Carrier Safety Administration 2012 3).

Limitations of the FMCSRs

The FMCSRs contain detailed requirements for specific concerns such as hours of service (49 CFR Part 395), but have little to say about the basic policies and procedures that are the foundation of a workplace safety program. Overall, the FMCSRs are limited in scope and nonspecific. For example, the FMCSRs have very few requirements for written policies and procedures or documented annual training. The only required written procedures/policies in the FMCSRs are related to drug and alcohol testing (49 CFR Part 382) and a written security plan for hazardous materials (49 CFR Part 172.800). The FMCSRs have no requirements for a written crash/incident review policy, discipline procedure, driver hiring/orientation, and training in vehicle operation and inspection. There are some training requirements for drivers of longer combination vehicles, entry-level drivers, and HAZMAT drivers, including retraining for HAZMAT drivers every 3 years (49 CFR Parts 380 and 397). However, there are no requirements for annual defensive driving training, hours-of-service training, truck inspection training, or annual drug and alcohol training (although some initial training is required).

In the past, the FMCSA rarely had any interactions with commercial fleets, with the exception of Compliance Reviews (CRs). A CR was a full-blown audit that resulted in a rating of Satisfactory, Conditional, or Unsatisfactory. Fines could result, and an "Unsatisfactory" rating

could cause the motor carrier to be shut down. The FMCSA also conducted Safety Reviews, normally after a significant event such as a fatality or too many serious crashes in a short period of time. Generally, however, few carriers interacted with the FMCSA; the number of drivers and carriers was far greater than the number of CRs performed each year (Federal Motor Carrier Safety Administration 2013).

ANSI/ASSE Z15 approach

ANSI/ASSE Z15.1 follows the same approach as Occupational Safety and Health Administration (OSHA) 29 CFR Parts 1910 and 1926 in that it is far more specific and broader in scope in its requirements for written policies/procedures and training than are the FMCSA regulations. It provides an all-inclusive framework for developing, implementing, and monitoring an organizational motor vehicle safety program. OSHA took a proactive and cooperative approach to work with employers to promote worker safety. OSHA also built more flexibility into their approach. They may visit a workplace to address a single issue. Although that issue may lead to a full audit, it is often the sole basis of OSHA's action. OSHA also has the authority and flexibility to forgo or reduce fines based on the individual company's response and actions to abate hazards identified. OSHA audits (those in which the company was fined as well as those in which the company agreed to certain actions to improve safety) seem to be very effective. They work!

The CSA model

The FMCSA introduced the Compliance, Safety, Accountability (CSA) program in late 2010 as a way to make significant reductions in large truck crashes and make this segment of highway transportation safer (Exhibit 1). The program was to be introduced in several phases, with the last part, the Safety Fitness Determination, possibly coming by the end of 2013.

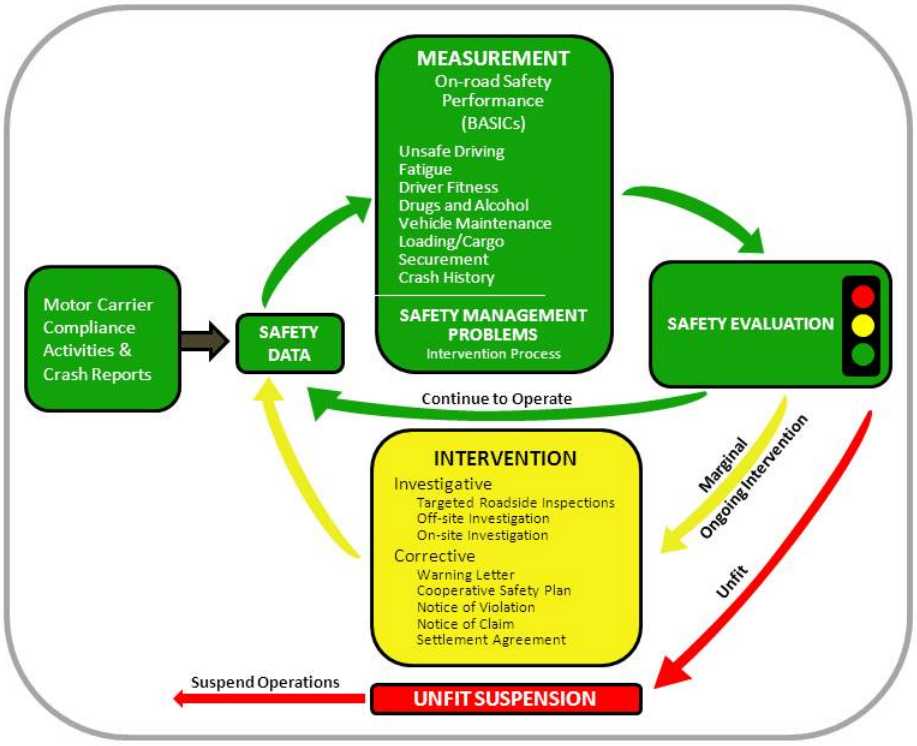

Exhibit 1. This shows the original CSA operational model put out by FMCSA in 2010. Source: http://csa.fmcsa.dot.gov/about/csa_how.aspx.

The first phase of the CSA model is Measurement (Exhibit 2). Under CSA, the FMCSA has made a number of changes in the way it reports violations by each motor carrier. Violations are now grouped into seven categories of similar violations, referred to as "BASICs," and assigned weights as to the probability of causing a crash. Since development of the original model (Exhibit 1), the FMCSA has made changes to the original BASICs: "Fatigue" is now "Hours of Service;" the "Cargo" BASIC is now a dedicated "Hazardous Materials" BASIC; and load securement violations are now in the "Maintenance" BASIC.

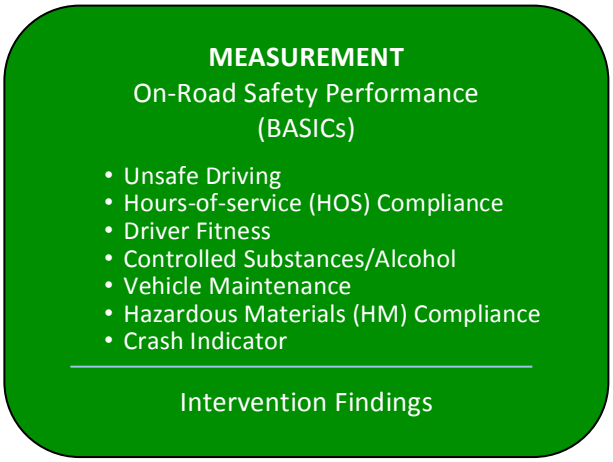

Exhibit 2. For reporting safety performance under CSA, FMCSA now groups violations into seven categories called BASICs.

The final phase of the CSA model, Safety Fitness Determination, is vitally important to a carrier, as this determination can mean whether they are able to continue to do business or must operate under a "marginal" designation. However, it is the middle phase, Intervention, which makes the ANSI/ASSE Z15.1 standard directly relevant to commercial fleets (Exhibit 3). The FMCSA envisioned a broader array of intervention tools that would be applied directly or in a progressive fashion to "motivate" fleets to be more proactive in their safety efforts.

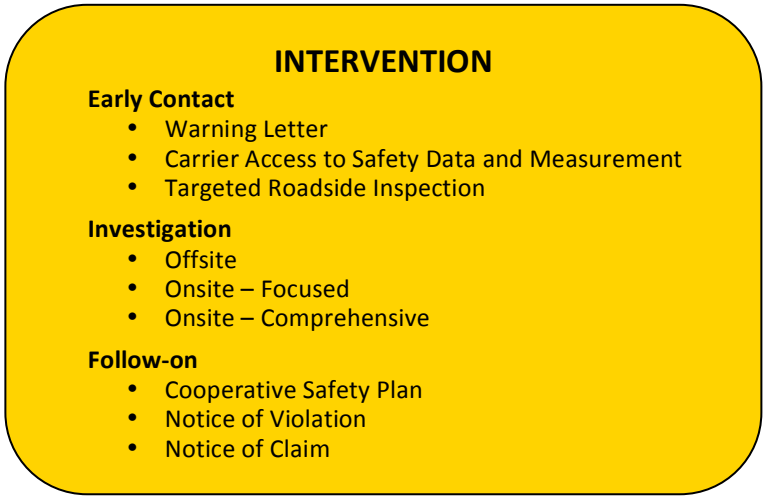

Exhibit 3. CSA interventions to improve safety performance are progressive in nature.

FMCSA Safety Interventions under CSA

Under the new CSA model, the FMCSA looked for ways to increase interactions with carriers that were having "problems" as indicated by the new safety measurement system (SMS), but using methods that were less intensive than traditional CRs. One "early contact" intervention that has drawn a lot of attention from commercial fleet owners is warning letters, which are generated based on SMS scores. Nationwide's regular customer service outreach includes "DOT Compliance Class," which cover the FMCSRs for motor carriers. Although invitations were sent to a large number of carriers, only a small percentage of carriers attended, *unless* they had recently received a warning letter.

A second FMCSA intervention targets a company at the roadside, looking for specific violations as indicated by the SMS. This may include off-site and on-site reviews. For instance, if the SMS scores indicate that the company is having hours-of-service problems, FMCSA safety investigators may come to a carrier's main office, reviewing and scanning hours-of-service logs and taking action based on what they find. FMCSA investigators will likely look only at the hours-of-service records, focusing the visit on those violations and not examining other safety items such as maintenance records or driver qualification files. The advantage of this technique is that it allows the FMCSA to have contact with more carriers and to focus only on the areas in

which the SMS indicated these carriers have issues. The rationale is that more contacts or higher chance of having a contact will result in carriers paying more attention to their SMS scores and that fearing fines, they will make improvements.

The Cooperative Safety Plan (CSP) is a new "Follow-on" intervention under CSA which to some extent addresses one of the shortcomings of FMCSA's approach: the lack of a model that allows it to work more cooperatively with carriers to reduce violations and improve performance. After intervening at a company, FMCSA may agree to withhold a Notice of Violations (NOV) if the company can devise ways to reduce the violations. While the term is Cooperative Safety Plan, essentially the company is charged with developing effective solutions to the areas in which they have problems. The FMCSA will either agree or disagree as to whether the actions are a good faith effort and will then monitor the company for progress. This is where the gap in the FMCSRs with regard to written policies and procedures is evident, and this is where ANSI/ASSE Z15.1-2012 comes into play.

It is difficult to envision how FMCSA can be assured that the carrier will follow the CSP in the absence of the policies and procedures needed for implementation and the documented training to show commitment and improvement. The answer is simple. Participating in a CSP to ward off a Notice of Violation (NOV) requires a written plan submitted to FMCSA, and such a plan will clearly need to be supported by a policies and procedures manual. Using Z15 as a guide will make this easy.

The Safety Management Cycle

The FMCSA has put forth the Safety Management Cycle (SMC) as a guide to help motor carriers develop the required CSP documents. The SMC starts with the concept that policies and procedures are needed to move forward. The SMC has six elements that are referred to as safety management processes (SMPs) (Exhibit 4). The FMCSA has prepared a document for each of the seven BASICs, which will help companies develop policies and procedures for that BASIC in accordance with the SMC (http://csa.fmcsa.dot.gov/about/smc_overview.aspx).

Exhibit 4. The FMCSA has recommended the Safety Management Cycle (SMC) as a guide to implementing CSA and preparing CSPs. Source: http://csa.fmcsa.dot.gov/about/smc_overview.aspx

Safety Management Processes
The six SMPs are the backbone of the SMC. As demonstrated below, the ANSI/ASSE Z15.1-2012 standard matches up well with the SMC and the safety management processes (SMPs) that were recently introduced by the FMCSA:

1. **Policies and Procedures** define the "what" and "how" of a motor carrier's operations. Policies establish the guidelines for how motor carriers and their employees behave in a given situation. Procedures explain how to accomplish policies. The other five SMPs focus on how to implement the policies and procedures. It is important to understand that the FMCSA is basing agreements on improvements on a sound foundational policies and procedures manual, one that covers the areas it sees as having a great impact on safety. Many companies don't have a well-thought-out written policies and procedures manual. ANSI/ASSE Z15.1-2012 provides that foundation.
2. **Roles and Responsibilities** clearly define what each employee should do to successfully implement the policies and procedures. A good policy manual discusses roles and responsibilities at each level of the employee/employer relationship. ANSI/ASSE Z15.1-2012, Section 3.2.1.3, requires that a system of accountability and responsibility be established. It advises implementation of this system through several of an organization's units, including operations, human resources, and safety.
3. **Qualification and Hiring** discusses recruiting and screening applicants to fulfill the roles and responsibilities for positions. ANSI/ASSE Z15.1-2012, Section 3.2.1.3, covers driver recruitment, selection and assessment, and Section 5.1 covers the development of driver qualifications, job descriptions, applications, and background checks. Companies should have a defined policy that lists minimum qualifications or disqualifying events – these should be concrete requirements that don't fluctuate with the job market – and systems in place to conduct adequate background checks as required by statute. They should also consider other processes that are not required, such as pre-employment screening, bonding, and criminal checks.
4. **Training and Communication** outlines a motor carrier's communication of its policies, procedures, roles, and responsibilities so that everyone understands the expectations and has the adequate skills and knowledge to perform their assigned function. ANSI/ASSE Z15.1-2012, Section 3.2.1.5 covers orientation and training, and Section 5.3 covers driver training. Ideas from both these sections need to be incorporated into a procedure that tracks how orientation and training goals are achieved. Section 3.2.1.7 highlights the need for communication.
5. **Monitoring and Tracking** concentrates on the need to have a system in place to monitor and track employee performance, enabling a company to be aware of employees' safety performance and compliance with its policies and procedures and how they execute their roles and responsibilities. "Monitoring" represents the motor carrier looking at the performance of the operation, and "Tracking" is assessing the data collected, leading to meaningful action. ANSI/ASSE Z15.1-2012, Section 3.2.1.11 requires a system of

management audits to ensure that requirements within a policy/procedure are in fact carried out.

6. **Meaningful Action** gives motor carriers the tools to correct or improve employee behavior, including training and positive reinforcement such as rewards or bonuses, in order to improve the motor carrier's overall safety performance. Sections 7.2.3, 7.2.4, and 7.2.5 all talk about corrective action and incident review, which are meant to spur meaningful action.

Merging ANSI/ASSE Z15.1-2012 with the material provided by the FMCSA results in a very thorough policies and procedures manual. The Appendix at the end of this paper recommends additional elements to be included in the manual.

A Systems Approach to Z15.1 Implementation

The safe-system approach to road safety

The last two decades have brought a gradual shift in thinking about how road safety improvements can best be achieved. This shift is marked by a new view of the road as a system, and a shift in responsibility for road safety away from the individual road user to designers of the road infrastructure and designers of vehicles (Organization for Economic Cooperation and Development 107-112). The ANSI/ASSE Z15.1 standard is consistent with the safe-system approach in several ways:

- It assumes that the organization is responsible for developing programs, policies, and procedures for managing road risk associated with any motor vehicle operated on behalf of the organization.
- It addresses management of risks related to the driver, vehicle, and operating environment.
- It advocates continuous measurement and review to document successes and identify areas for improvement.

This section provides background information on several safe-system initiatives and explains how ANSI/ASSE Z15.1 is congruent with them.

Vision Zero and the safe system

The safe-system approach to road safety management originated with the "Vision Zero" model developed in the Swedish Road Administration in the mid-1990s. Although road users are still expected to follow the rules of the road, Vision Zero makes designers responsible for continuous modifications to the road system as situations in which human error leads to crash-related injuries are identified (Johansson 827). The goal for traditional road safety approaches was to prevent crashes, while the Vision Zero goal is to eliminate death and serious injury. Vision Zero accepts the idea that road users will inevitably make errors, but its aim is to engineer the road environment and the vehicle to be so forgiving of human error that deaths and serious injuries will be eliminated.

Although Vision Zero was formulated as a framework for managing the entire transport system, it also applies to management of road safety within companies and organizations. In the same way that it sees the road environment as a system that should be forgiving of human error, Vision Zero also calls for a management system at the organizational level that is responsible for modifying the conditions of work to reduce, if not eliminate, the potential for road traffic injury. A primary contribution of Vision Zero to occupational road safety is its support for shifting responsibility away from the individual driver toward the company or organization that employs the driver.

Road safety initiatives similar to Vision Zero have been adopted in other countries, most prominently in the Netherlands through its "Sustainable Safety" strategy and in Australia through its "Safe System" model (Organization for Economic Cooperation and Development 108). In 2009, the United States began to move in a similar direction with the launch of "Toward Zero Deaths," for the first time pursuing a strategy that conceptualized any injury or death on the road as unacceptable (http://safety.fhwa.dot.gov/tzd/).

The ISO 39001 standard

Another outgrowth of the safe-system approach to road safety is a new global standard for road safety management, ISO 39001:2012, *Road Traffic Safety (RTS) Management Systems – Requirements with Guidance for Use.* Because the Swedish Standards Institute serves as the secretariat for ISO 39001, this consensus standard was strongly influenced by Vision Zero. ISO 39001 was designed for use by any public or private organization that wishes to improve its road safety performance, develop and implement a road safety management system, and check its progress toward road safety targets. It is relevant for organizations that transport goods or people, or whose employees or contractors interact with the road system in any way in the course of doing business. Like the ANSI/ASSE Z15.1 standard, ISO 39001's requirements are placed within a framework of roads, vehicles, and users. The main body of ISO 39001 is supplemented by non-mandatory appendices that provide guidance for implementation (International Organization for Standardization).

ANSI/ASSE Z15.1 as a systems approach

All the initiatives described here have common features that are especially relevant to the management of vehicles by companies and organizations – features that they share with the ANSI/ASSE Z15.1 standard:

- They value comprehensive management and communications structures that incorporate all the stakeholders for road safety, including private- and public-sector organizations that are key users of the road system.
- They see road safety as a responsibility shared among all these stakeholders.
- They value continuous data collection and feedback, including cost and economic analysis, as critical to ensuring that investments in road safety are effective and provide a favorable return on investment (Organization for Economic Cooperation and Development 108).

Using ANSI/ASSE Z15.1 to develop and implement a motor vehicle safety program

ANSI/ASSE Z15.1 assumes that management commitment and leadership are the foundation of any organization's road safety management program. It uses a central framework of drivers, vehicles, and operating environment to organize policy areas that should be managed by organizations, and it mandates a process of continuous review and improvement based on in-depth review and response to individual incidents combined with analysis of aggregated data (ANSI/ASSE 2006, 2012). Organizations can use the basic structure of ANSI Z15.1 at several points during development and implementation of a road safety management program: to identify gaps in an existing program, to ensure that policies and procedures are adequately addressing the gaps identified, and to develop key performance indicators (KPIs) that will be used to set program goals and track progress.

Identifying program gaps and implementing interventions

The Haddon Matrix is a tool that can be used in conjunction with the ANSI/ASSE Z15.1 standard to help identify program gaps. It was developed by American epidemiologist William Haddon, Jr., who was a prominent advocate for crash prevention and injury control and the first

Administrator of the National Highway Traffic Safety Administration. Haddon conceptualized injury prevention as a problem of reducing or eliminating the exchange of harmful mechanical energy (Haddon, Jr. 1968 1433). The simplest version of the Matrix is a 3 x 3 table (Table 1). The rows denote "phases:" points in time a hazard is present or an intervention can be put in place. The columns denote "factors:" sources of risk or points of intervention to control the risk (Haddon, Jr. 1972 96-97).

	Human	**Vehicle/ Equipment**	**Environment**
Pre-crash			
Crash			
Post-crash			

Table 1. The basic Haddon Matrix combines temporal 'phases' with 'factors' where crash risks and injury prevention opportunities are present.

The use of the Haddon Matrix is not limited to road safety for the general population. The Matrix can be expanded to fit the needs of any organization that operates motor vehicles, and this expansion can aid in implementing the ANSI/ASSE Z15.1 standard. Haddon himself showed how the "Human" cell could be separated into road user types such as drivers, pedestrians, and motorcyclists, allowing a more refined assessment of risks and interventions (Haddon, Jr. 1968 1436).

For organizational users, research and policy documents have recommended the addition of columns to cover factors related to management and journeys (see, for example, European Transport Safety Council 4-5).[4] Addition of information on management reinforces the ANSI/ASSE Z15.1 standard, where discussion of the importance of leadership, management commitment, and a strong administrative structure precedes any discussion of policies for the driver, vehicle, and operating environment. Published case studies of successful fleet safety programs underscore the importance of having a steering committee charged with implementation and oversight. Not only does this promote broad buy-in across organizational units, but it guards against the danger of entrusting the program to a single key individual whose departure could threaten the program's future (Murray et al. 6-7).

For identifying program gaps, the Haddon Matrix helps an organization to ask the questions: "Which of these risks are we addressing?" and "Where are policies and procedures needed?" For identifying and implementing interventions, the Matrix helps an organization to ask: "What interventions can we put in place to reduce or eliminate these risks?" Table 2 below shows how the Haddon Matrix might be adapted to an initial assessment of program gaps or a check for compliance with ANSI/ASSE Z15.1 elements.

Original elements of Haddon Matrix	**Additional elements for occupational road safety**

[4] The Haddon Matrix has also been suggested as a way to identify gaps and interventions related to an organization's engagement with external partners and its "corporate social responsibility" agenda for road safety (European Transport Safety Council 4-5). This is largely outside the scope of the ANSI/ASSE Z15.1 standard.

Human	Vehicle	Environment	Management	Journey
Pre-crash				
Formal criteria for: • Driver qualification and selection (3.2.1.3, 5.1.1, 5.1.2) • Motor vehicle record checks (5.1.3) • Driver orientation and training (3.2.1.5, 5.3) Driver management program (5.2)	Formal criteria for: • Vehicle selection and specification (3.2.1.8, 6.1) • Vehicle modifications (6.2) • Regular servicing and maintenance (3.2.1.9, 6.6) • Pre-trip vehicle checks (6.5) • Vehicle replacement (6.7) Policy for business and personal use of organizational vehicles (4.7.1, 4.7.2, Appendix A, B Policy for business use of personal vehicles (4.7.3, Appendix C)	Formal policy on: • Use of occupant restraints (4.1) • Impaired driving (4.2) • Distracted driving (4.3, Appendix E) • Aggressive driving (4.4) System to monitor regulatory compliance (3.2.1.10, 3.2.1.11)	Interest, involvement and commitment to road safety from senior management (3.1) Allocation of adequate staffing and resources to manage and support the program (3.1) Written safety program defining organizational requirements (3.2) Accountability and responsibility throughout the organization (3.2.1.2) Auditing process (3.2.1.11) Procedures to document driver qualification and training (5.4) Procedures to report, record, and investigate incidents, and to track safety performance over time (7.3; Appendix F, G, H) Reporting of major incidents and overall road safety performance to all levels of management (3.2.1.6)	Risk assessment covering: • Need to travel for specific purposes • Modal choice • Journey planning and route selection • Inclement weather • Journey scheduling • Shifts/working time • Means of communicating information about weather emergencies, road construction (4.5, 4,6) Travel policy to cover decision processes for: • Fatigue management • Changes in travel plans due to inclement weather or emergency (4.5, 4.6)
Crash				
Instructions for drivers in the event of a crash (7.1.1, Appendix F, A)	Emergency equipment/kit for use in the event of a crash (6.3)	Policies for managing crash scene (Appendix F)	Policies for interactions with law enforcement and third parties at the scene (Appendix A)	
Post-crash				
Driver reporting of incident/crash to organization (7.1.2, Appendix A, F) Corrective action directed at driver, if appropriate, to improve skills and behaviors (7.2.4,	Review of vehicle-related factors and circumstances (7.2, Appendix G) Corrective action related to vehicle policies, if appropriate (7.2.5)	Review of factors and circumstances related to operating environment (7.2, Appendix G) Corrective action related to policies for the operating environment, if	Process to report and record incidents (7.1, 7.1.1) Process to review incidents and identify causal and contributing factors (7.2, 7.2.1, Appendix F, G)	Review of factors and circumstances related to journey management (7.2, Appendix G) Corrective action related to journey management policies, if appropriate (7.2.5)

7.2.5)		appropriate (7.2.5)	Incident review report (7.2.3) Corrective action communicated throughout organization, if appropriate (7.2.5)	

Table 2. The Haddon Matrix is easily expanded and adapted to check for compliance with provisions of the ANSI/ASSE Z15.1 standard. Relevant portions of the standard are referenced in parentheses.

A number of prominent policy documents have cited the Haddon Matrix as a valuable tool for identifying problems and prioritizing interventions. Chief among these is the influential *World Report on Road Traffic Injury Prevention* (Peden et al. 12-13). In addition, the plan of action developed for the UN Decade of Action for Road Safety 2010-2020 is based on five "pillars:" road safety management, safer vehicles, safer roads and mobility, safer road users, and post-crash response (World Health Organization and UN Road Safety Collaboration 11). The pillars for the Decade of Action closely mirror both the Haddon Matrix and sections 3 through 6 of the ANSI/ASSE Z15.1 standard. Finally, and most important, fleet and safety managers, fleet service providers, and researchers have reported successfully using the Haddon Matrix for assessment of program gaps, as discussed above and shown in Table 2 (Darby et al. 437, Murray et al. 4, Wallington et al. 4-5).

Using ANSI/ASSE Z15.1 to develop metrics and track progress

The main portion of the ANSI/ASSE Z15.1 standard requires organizations to follow a process of reporting, reviewing, analyzing, and corrective actions in response to individual motor vehicle incidents and collisions. It also requires organizations to take a broader view by collecting data needed to track road safety performance over time. Early in its deliberations, the ANSI Z15 Committee determined that the standard should not mandate that all organizations use the same outcome measures or the same reporting intervals. Instead, ANSI/ASSE Z15.1 provides appendices with more specific but non-mandatory guidance in these areas, allowing organizations the discretion to select what is most appropriate. The current version of the standard, ANSI/ASSE Z15.1-2012, offers the following:

- Appendix F recommends specific points to be included in instructions for the driver's on-scene response in the event of a collision.
- Appendix G recommends factors to be considered during reviews of incidents and collisions. The list of factors is organized according to those related to the driver, the vehicle, and the environment.
- Appendix H provides several basic measures that may be used to track motor vehicle incidents.

  (ANSI/ASSE 2012 33-38).

Rate calculation examples from ANSI/ASSE Z15.1

For the rates suggested by ANSI/ASSE Z15.1 -2012, the numerator is generally either the number of incidents or the number of incidents resulting in injury. The denominator for a rate is the exposure unit of interest. Key denominator data for tracking fleet safety performance are the number of vehicles and number of vehicle miles traveled (VMT). Depending on its operating environment, an organization may also choose to report rates based on units of service such as the

number of deliveries or loads. Selected rates included in Appendix H of the standard are discussed below (ANSI/ASSE 2012 37-38).

An incident rate based on the number of vehicles is essentially the proportion of the vehicle fleet involved in an incident over some pre-determined period of time. It can help an organization assess the proportion of the fleet that may be out of service at any given time, and can also inform decisions about vehicle replacement.

- Incident rate based on number of vehicles operated:

  $$\frac{\text{Number of incidents} \times 100}{\text{Number of vehicles}}$$

VMT-based rates are important measures because they are based on exposure to road traffic hazards. They may also be adapted to compare the rate of incidents for different types or models of vehicles in the fleet, or under different operating conditions.

- Incident rate based on vehicle mileage:

  $$\frac{\text{Number of incidents} \times 1{,}000{,}000}{\text{Vehicle miles traveled}}$$

The calculation of the rate of injury incidence is another good example of the flexibility the ANSI/ASSE Z15.1 standard affords an organization. Here, the numerator may be adjusted in a number of ways. At the outset, it is important that an organization-wide definition of an injury be established. ANSI/ASSE Z15.1-2012 defines an injury as "Physical harm or damage to a person resulting in the marring of appearance, personal discomfort and/or bodily harm, impairment or death" (ANSI/ASSE 2012 11). By design, this definition does not dictate specific criteria for an injury; an organization may choose its own threshold. Commonly used thresholds for classifying a case as an injury are the requirement for any kind of medical treatment, restricted work activity, or 4 or more hours of lost work time.

Once a clear definition of an injury is established, if the goal is to supplement data on lost productivity or workers' compensation costs, the numerator might appropriately be the number of injury incidents for workers in the organization only. If the goal is to assess the number of incidents with potential liability for the organization, the number might be the number of incidents involving injury to a third party. If the goal is to assess overall exposure for the organization, the two numbers might be combined.

- Injury incident rate:

  $$\frac{\text{Number of incidents with injury} \times 1{,}000{,}000}{\text{Vehicle miles traveled}}$$

Developing and using key performance indicators

Basic rates shown in Appendix H of ANSI/ASSE Z15.1 are useful for summarizing road safety performance within an organization and tracking progress over time. The standard can also help organizations set targets and track progress toward specific program goals and objectives. Again, elements of the standard, organized within the Haddon Matrix, help an organization to select the most appropriate key performance indicators (KPIs) for its needs, and to check to ensure that data are being collected to make it possible to calculate these KPIs.

When considering data collection requirements related to management of a motor vehicle safety program, it is important not to lose sight of which data elements are essential and which are merely "nice to know." Data collection requirements should be linked to specific reporting requirements: those that are needed to calculate basic rates described above, and those that contribute to calculation of KPIs.[5] Data elements are generally a combination of "process" and "outcome" measures. Outcomes are important because they are the end points a program wants to achieve, for example, a certain level in reduction in crashes per million miles. The recommended rates provided in Appendix H of the ANSI/ASSE Z15.1 standard are outcome measures.

Processes are also important, however, because they represent milestones along the way to achieving those outcomes, and they can pinpoint places in the management system where adjustments are needed to continue progress toward the desired outcome (Poister 106-111). A process indicator relevant to the ANSI/ASSE Z15.1 standard might be the percentage of workers completing behind-the-wheel training within 6 months of hire.

The Haddon Matrix example provided in Table 2 can be a starting point for developing process and outcome KPIs for specific program areas. Table 3 below shows how an organization might think through what is needed to support a KPI related to distracted-driving crashes. Some of the more process-related measures are quantitative, while others will be based on more qualitative assessments and knowledge of the organization. Here, it is important to note the distinction between a KPI and a target value for that KPI. The KPI is the measure, but the organization should also determine the value it wants to achieve for that KPI.

Sample KPI: % of 'preventable' incidents in which organization's driver was distracted
Relevant data elements:
• Total number of incidents (based on organization's pre-determined criteria for defining an incident) • Number of distracted-driving incidents (based on incident review procedures, and including external sources of information such as police reports and cell-phone records, if applicable) • Number of 'preventable' incidents (based on incident review procedures)
'Process' measures to support this KPI:
• Does organization have a cell-phone policy or a more general distracted-driving policy? • What percentage of the organization's drivers has signed an acknowledgment of this policy? • How well do supervisors reinforce importance of the policy? • Are other organizational practices and policies consistent with workers abiding by this policy? For example, do scheduling practices allow time for organizational business to be completed without incentivizing use of electronic devices or eating meals while driving? • Are there results from employee surveys on safety climate or safety attitudes that suggest how communications strategies can be adjusted to increase compliance?

[5] There are of course many other reporting requirements related to financial, human resources, and regulatory compliance. These are outside the scope of this discussion.

Table 3. A KPI should be supported by other data that will help identify opportunities to accelerate progress toward the organization's target for that KPI.

Summary and Conclusion

The ANSI/ASSE Z15.1 standard, *Safe Practices for Motor Vehicle Operations*, provides minimum requirements for workplace motor vehicle safety programs. Although the standard was initially conceived as filling a gap by providing guidance for non-DOT-regulated fleets, Z15 is, in fact, applicable to any size fleet and any type of organization that operates motor vehicles. It complements the FMCSRs and FMCSA's new CSA initiative by providing a critical framework for development of a safety management system and policies and procedures – a framework not found in the FMCSRs.

Because it specifies policies and procedures related to the driver, vehicle, and operating environment, all of these in the context of a safety management system, Z15 is also consistent with other well-established injury prevention models, including those that follow a "systems" approach. Combined with the Haddon Matrix, Z15 can be a starting point for a comprehensive risk assessment for any type of vehicle fleet, leading to development of appropriate interventions.

For more information about ANSI/ASSE Z15.1-2012

For more information, or to purchase a copy, please consult the following resources:

- ASSE Tech Brief on the revised standard, ANSI/ASSE Z15.1-2012: http://www.asse.org/publications/standards/z15/docs/Z15_1_Tech_Brief_4_2012.pdf
- Trifold brochure on the revised standard: https://www.asse.org/ShopOnline/products/docs/ANSI%20Brochure%20Z15%20Std_%20Final.pdf
- Ordering page: https://www.asse.org/shoponline/products/Z15_1_2012.php

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

Bibliography

ANSI/ASSE. *Safe Practices for Motor Vehicle Operations* (ANSI/ASSE Z15.1-2006). New York, NY: American National Standards Institute, 2006.

ANSI/ASSE. *Safe Practices for Motor Vehicle Operations* (ANSI/ASSE Z15.1-2012). New York: American National Standards Institute, 2012.

CDC. "Occupational Highway Transportation Deaths – United States, 2003-2008." *Morbidity and Mortality Weekly Report.* 2011; 60(16): 497-502.

Darby, P., Murray, W., Raeside, R. "Applying Online Fleet Driver Assessment to Help Identify, Target and Reduce Occupational Road Safety Risks." *Safety Science* 2009; 47(3): 436-442.

European Transport Safety Council. *Fit for Road Safety: From Risk Assessment to Training* (PRAISE Thematic Report 2) (retrieved February 13, 2013 from http://www.etsc.eu/documents/PRAISE%20Report%202.pdf).

Federal Motor Carrier Safety Administration. *Large Truck and Bus Crash Facts 2010* (FMCSA-RRA-12-023). Washington, DC: Federal Motor Carrier Safety Administration, 2012.

Federal Motor Carrier Safety Administration. *Motor Carrier Safety Progress Report, Federal Motor Carrier Safety Administration (as of September 30, 2012)* (retrieved February 21, 2013 from http://www.fmcsa.dot.gov/facts-research/art-safety-progress-report.htm).

Haddon, Jr., W. "The Changing Approach to the Epidemiology, Prevention, and Amelioration of Trauma: The Transition to Approaches Etiologically Rather than Descriptively Based." *American Journal of Public Health* 1968; 58: 1431-1438.

Haddon, Jr., W. "A Logical Framework for Categorizing Highway Safety Phenomena and Activity." *Journal of Trauma.* 1972; 12(3): 193-207.

International Organization for Standardization. *Road Traffic Safety (RTS) Management Systems - Requirements with Guidance for Use* (ISO 39001:2012). Geneva, Switzerland: International Organization for Standardization, 2012.

Johansson, R. "Vision Zero - Implementing a Policy for Traffic Safety." *Safety Science.* 2009; 47(6): 825-831.

Liberty Mutual Research Institute for Safety. *2012 Liberty Mutual Workplace Safety Index* (retrieved February 9, 2013 from http://www.libertymutualgroup.com/omapps/ContentServer?pagename=LMGroup/Views/LMG&ft=2&fid=1138356633468).

Murray, W., Ison, S., Gallemore, P., Nijjar, H. "Effective Occupational Road Safety Programs: A Case Study of Wolseley." *Transportation Research Record: Journal of the Transportation Research Board* 2009; 2096:55-64.

National Highway Traffic Safety Administration. *The Economic Burden of Traffic Crashes on Employers: Costs by State and Industry and by Alcohol and Restraint Use* (retrieved February 8, 2013 from http://www.nhtsa.gov/people/injury/airbags/EconomicBurden/pages/WhatDoTCCost.html) .Washington, DC: National Highway Traffic Safety Administration, 2003.

Organization for Economic Cooperation and Development. *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach*. Paris: Organization for Economic Cooperation and Development and International Transport Forum, 2008.

Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A., Jarawan, E., Mathers, C. *World Report on Road Traffic Injury Prevention*. Geneva: World Health Organization, 2004.

Poister, T.H. "Performance Monitoring." In: Wholey, J.S., Hatry, H.P., Newcomer, K.E. (ed.), *Handbook of Practical Program Evaluation* (second edition). San Francisco, CA: Jossey-Bass, 2004, 98-125.

Wallington, D., Murray, W., Darby, P., Raeside, R., Ison, S. "Work-related Road Safety: Case Study of British Telecommunications" (Paper No. 12-1196). Unpublished paper presented at the 91st Annual Meeting of the Transportation Research Board, January 22-26, 2012, Washington, DC.

World Health Organization and UN Road Safety Collaboration. *Global Plan for the Decade of Action for Road Safety 2011-2020*. Geneva, Switzerland: World Health Organization, 2010.

Appendix

Recommended Outline for Policy and Procedure Manuals

Safety Policy/Statement

- Safety mission statement that is conveyed on a constant basis

Responsibility and accountabilities

- Policy setting forth who is responsible for what. **Very Important.**
  - *Assignment of safety functions*
  - *Assignment of auditing requirements*
  - *Chain of command on safety issues*

Driver Recruitment

- Assessment
  - *Job description, with safety expectations*
  - *Road test*
  - *Written test (not required)*
  - *Background check*
    - *Work history documentation*
    - *Drug and alcohol checks*
    - *Criminal history, if required*
- Selection guidelines
  - *Experience required*
  - *Medical examination*
  - *Motor vehicle record (MVR): what is acceptable*
  - *PSP: Pre-employment safety screening program report/roadside history*
  - *If owner/operator, a review of their DOT number*

Orientation and Training

- New employee training and orientation
  - *New driver checklist*
  - *Driver qualification files*
    - *Biennial review of file*
    - *Annual checks of MVR*
    - *Review of driver qualifications*
      - *Hazmat*
      - *Entry level*
      - *Longer combination vehicles*
      - *Tanker Driver Trainer*
      - *New driver ride-alongs*
      - *Training on your equipment and configurations*
    - *Drugs and alcohol*
      - *Decision on allowing return to work*
      - *Retention and storage of records*
      - *Procedure for immediate removal*
- Employee retraining
  - *Post-crash*
  - *Post-incident*

- Recurrent training
  - *Hazmat*
  - *OSHA safety training*
- Specialized training
  - *Tanker*
  - *Load securement*
  - *Longer combination vehicles*

Organizational Procedures and Rules

- ***General Discipline Procedure*** that can be applied to safety and operational violations
- ***General Safety Policies***
  - Required by regulations
    - *Drug and alcohol testing procedures/policies (if you employ drivers with a Commercial Driver's License (CDL)*
    - *Security Plan (if you haul hazardous materials*)
  - Company directed
    - *Passengers*
    - *Personal use*
  - Compliance with all traffic and motor carrier regulations and laws – General in nature
- ***Crash Countermeasures/ Driving practices***
  - Distracted driving
  - Weather/dispatch policy
    - *General*
    - *Procedures to hold dispatchers accountable for dispatching drivers in runs that cannot be made legally*
  - Speed policy
  - Following distance policy
  - Right lane/ lane change policy
  - Safety belts
  - Hours of Service (HOS)
    - *Adherence to the regulation*
    - *Log retention and submission*
    - *Procedure on how HOS are audited*

Incident and Crash Review

- Evidence retention
- "Black box" retention policies
- Files and photos
- Purpose of incident and crash reviews:
  - *Preventability determination?*
  - *Development of procedures/training to prevent future accidents?*

Rewards and Recognition

- Does the company have a system to reward and recognize achievements of drivers?

Vehicle Specification and Selection

- A policy that details the development of specifications for vehicles and trailers to be used in the operation. This policy should help determine which equipment is proper for the safe operation rather than external factors such as cost, availability or driver wants.

Inspection and Maintenance

- Does the company have a policy describing the system to:
  - Maintain records
  - Maintain system of preventative inspections
  - Roadside inspections reported
  - Driver vehicle inspection report (DVIR)
- If company uses owner/operators (O/O), policy to review O/O equipment prior to allowing use? Policy on repairs of O/O equipment?

Management Program Audits

- Is there a procedure specifying audit functions that management does to insure requirements are being met at all levels? Are they reported back to top management?