Fleet Safety

Developing & Sustaining an Effective Program With ANSI/ASSE Z15.1

By Brian S. Hammer, Stephanie G. Pratt and Peggy Ross

Millions of U.S. workers are at risk for a work-related motor vehicle crash. Fatality data show that across all industries, motor vehicle crashes are consistently the leading cause of work-related fatalities. Of 43,025 work-related fatalities reported by BLS 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. During the same period, an additional 2,487 workers died in crashes that occurred off a public roadway or on industrial premises (BLS, 2013).

An analysis of the costs of motor vehicle crashes to U.S. employers using data from 1998 to 2000 found that on average each fatality cost a business more than $500,000 in direct and liability costs, and that each nonfatal injury costs nearly $74,000 (National Highway Traffic Safety Administration, 2003). More recently, workers' compensation costs for motor vehicle crash-related injuries requiring more than 6 days away from work were estimated to be nearly $2 billion (Liberty Mutual Research Institute for Safety, 2012).

The risk of work-related motor vehicle crashes 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 vehicle crashes 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, 2011). Heavy and tractor-trailer truck drivers account for the highest proportion of fatalities in any single occupation: 39% of the total for 2003 to 2010 (BLS, 2013).

ANSI/ASSE Z15.1: History & Scope

The ANSI/ASSE Z15 Accredited Standards Committee (ASC) was organized in 2001 to create a consensus standard with requirements for policies, procedures and management processes that organizations

IN BRIEF

- **The risk of work-related motor vehicle crashes 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 vehicle crashes while driving or riding in a motor vehicle on a public roadway.**
- **ANSI/ASSE Z15.1-2012 provides comprehensive guidance on fleet safety program elements and can be used as a tool for auditing an existing program.**

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ANSI/ASSE Z15.1-2012 provides a template for developing policies, procedures and processes to better manage the risks associated with vehicle use.

can implement to control risks associated with motor vehicles (ANSI/ASSE, 2012).

First published in 2006, ANSI/ASSE Z15.1, Safe Practices for Motor Vehicle Operations, 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 a template for developing policies, procedures and processes to better manage the risks associated with vehicle use. The standard is applicable to organizations whose vehicles and drivers are covered by Federal Motor Carrier Safety Regulations (FMCSRs; "regulated" fleets), as well as to organizations whose vehicles and drivers do not operate under the FMCSRs ("nonregulated" fleets).

For an organization seeking to formalize its vehicle operations safety program, Z15.1 provides comprehensive guidance on program elements, but leaves it up to the organization to design the specific detail based on its unique circumstances. For an organization with a mature program, a fleet manager can use the standard to audit the existing program or provide a risk-based approach to fleet management.

The field of vehicle risk management has evolved in recent years. The 2012 version of Z15.1 includes more guidance in several areas (e.g., distracted driving) than the 2006 version. Furthermore, the standard provides suggestions for measuring performance over time.

The standard contains seven major sections:

1) scope, purpose, applications, exceptions and interpretations;
2) definitions;
3) management, leadership and administration;
4) operational environment;
5) driver;
6) vehicle;
7) incident reporting and analysis.

Each section is divided into two columns. 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 nonmandatory guidance and interpretation of the corresponding material in the left column. Several appendices provide valuable supporting information and tools to help an organization apply the standard.

ANSI/ASSE Z15.1-2012 & Nonregulated Fleets: One Company's Experience

ANSI/ASSE Z15.1 was intended to be applicable to both regulated and nonregulated fleets. This example shares one company's experience in implementing the standard for its nonregulated fleet.

Baxter Healthcare has approximately 1,000 U.S. employees who drive regularly on business. Most of these employees are part of the sales force and are considered nonregulated fleet drivers. In December 2008, the company's corporate SH&E audit team engaged an external fleet-safety expert and facilitated the first SH&E-focused audit for its U.S. nonregulated fleet.

The goal was to understand how the company managed its nonregulated fleet and, more importantly, fleet risk. Managing fleet risk goes beyond the vehicle itself and encompasses effective management of drivers and driving behaviors.

The audit revealed strong management of fleet operations, vehicle selection and acquisition, as well as opportunities to improve a risk-based approach to managing fleet risk. The audit encompassed interviews and an assessment of various areas including:

- current process for managing fleet;
- identification of key stakeholders;
- types and number of vehicles;
- vehicle selection and acquisition;
- 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.

In early 2009, the corporate SH&E manager and U.S. fleet manager formed a strong partnership. They developed a strategy and tactical plans, as well as an action timeline, to close gaps identified during the fleet audit and to strengthen management of nonregulated fleet risk. Baxter's fleet manager led the effort and the SH&E manager leveraged a transitional leadership/partnership style to provide guidance, expertise and support. The fleet manager also engaged key stakeholders to support development and deployment of a tailored approach.

The company referenced ANSI/ASSE Z15.1-2006 to develop a best-in-class approach to managing fleet risk. Because policies and procedures are the foundation of a nonregulated fleet program, the company strengthened its overall driver policy. In addition, Baxter developed and deployed a nonregulated fleet safety program and specific guidelines to cover aspects such as authorized driver requirements, safe vehicle use and expected maintenance. The Z15.1 standard provided the framework for the policy and guide, tailored to fit Baxter. Measurement systems were also enhanced, leveraging concepts from the standard.

ANSI/ASSE Z15.1 & Commercial Fleets

Unlike noncommercial fleets, commercial motor vehicle fleets are 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. When it first promulgated the standard in 2006, the Z15 ASC theorized that since commercial motor fleets were heavily regulated, FMCSA and its FMCSRs would ensure that commercial operators had the required safety structure in place (although parts of Z15 apply to commercial operations).

However, 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 (FMCSA, 2012). 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 (FMCSA, 2012).

Limitations of the FMCSRs

The FMCSRs contain detailed requirements for specific concerns such as hours of service (HOS) (49 CFR Part 395), but say little about the basic policies and procedures that are the foundation of a workplace safety program. The only required written procedures/policies 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 regulations contain no requirements for a written crash/incident review policy, discipline procedure, driver hiring/orientation, and training in vehicle operation and inspection.

The regulations include 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, HOS training, truck inspection training, or annual drug and alcohol training (although some initial training is required).

In the past, FMCSA rarely interacted with commercial fleets, with the exception of compliance reviews. This review is a full-blown audit that results in a rating of satisfactory, conditional or unsatisfactory. Fines can result, and an unsatisfactory rating could cause the motor carrier to be shut down. FMCSA also conducted safety reviews, typically 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 agency, and the number of drivers and carriers was far greater than the number of compliance reviews performed each year (FMCSA, 2013).

The CSA Model

In 2010, FMCSA introduced the Compliance, Safety, Accountability (CSA) program (FMCSA, CSA). Its goal is to significantly reduce the number of large truck crashes and make this segment of highway transportation safer (Figure 1). The first phase of the CSA model is measurement. Violations are grouped into seven categories of similar violations, referred to as BASICs (behavioral analysis and safety improvement categories):

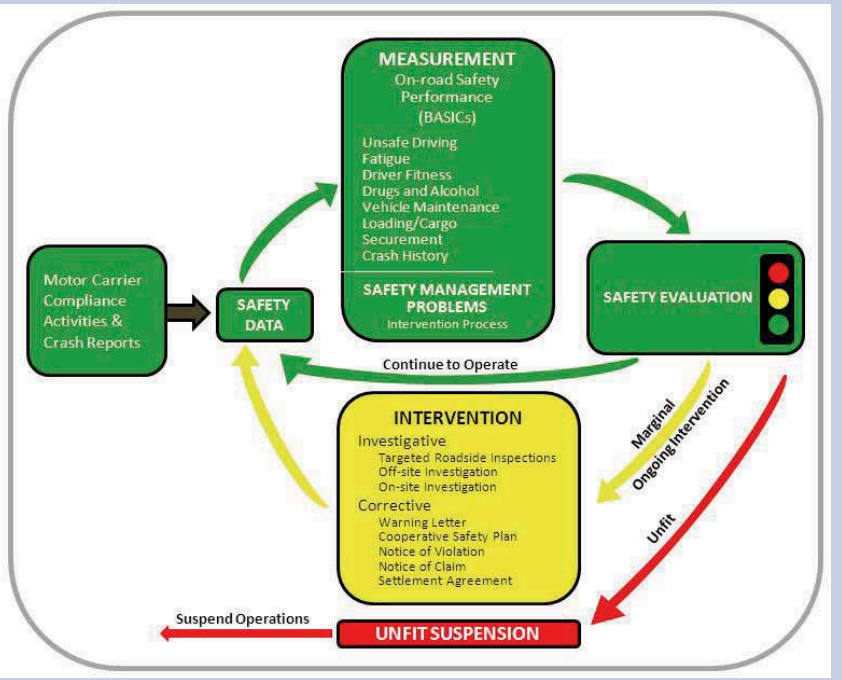
1) unsafe driving;
2) HOS compliance;
3) driver fitness;
4) controlled substances/alcohol;
5) vehicle maintenance;
6) HazMat compliance;
7) crash indicator.

These categories are assigned weights as to the probability of causing a crash. Since development of the original model, FMCSA has made several changes: fatigue is now HOS; the cargo category is now a dedicated hazardous materials category; and load securement violations are now in the maintenance BASIC.

The middle phase of the model, intervention, makes ANSI/ASSE Z15.1 directly relevant to commercial fleets. FMCSA envisioned a broader array of intervention tools that would be applied directly or in a progressive fashion to motivate fleet operators to be more proactive in their safety efforts. These intervention tools include:

- Early contact
  - warning letter;
  - access to safety data and measurement;
  - targeted roadside inspection.
- Investigation
  - off site;
  - on-site (focused);
  - on-site (comprehensive).
- Follow-on
  - cooperative safety plan;
  - notice of violation;
  - notice of claim;
  - operations out-of-service order (FMCSA, Intervention).

Figure 1
Original CSA Operational Model



Note. *From "CSA—Compliance, Safety, Accountability: How Does CSA Work?" by FMCSA. Retrieved from http://csa.fmcsa.dot.gov/about/csa_how.aspx (superseded by current model).*

Figure 2
Safety Management Cycle

Six safety management processes are the backbone of the safety management cycle: 1) policies and procedures; 2) roles and responsibilities; 3) qualification and hiring; 4) training and communication; 5) monitoring and tracking; and 6) meaningful action.

Note. *From "CSA—Compliance, Safety, Accountability: What Is the Safety Management Cycle?" by FMCSA. Retrieved from http://csa.fmcsa.dot.gov/about/smc_overview.aspx.*

FMCSA Safety Interventions Under CSA

Under CSA, FMCSA is seeking more interactions with carriers that have problems as indicated by the safety measurement system (SMS), but the agency wants to use methods that are less intensive than traditional compliance reviews. One early contact intervention, warning letters (which are generated based on SMS scores), has drawn much attention from commercial fleet owners. For example, Nationwide's regular customer service outreach includes a DOT compliance class that covers FMCSRs for motor carriers. Invitations were sent to a large number of carriers, but only a small percentage attended, unless they had recently received a warning letter.

Another 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 example, if the scores indicate that a carrier has HOS problems, agency investigators may visit a carrier's main office, review HOS logs and take action based on the findings. In such a case, the investigators will likely review only HOS records, not other safety-related documents such as maintenance records or driver qualification files. This approach allows agency personnel to have contact with more carriers and to focus only on identified problem areas. The rationale is that more contact or increased potential for contact will prompt carriers to pay more attention to SMS scores and to make improvements in order to avoid fines.

The cooperative safety plan is a follow-on intervention under CSA. In some ways, it addresses a shortcoming of FMCSA's approach: the lack of a model that allows the agency to work more cooperatively with carriers to reduce violations and improve performance. After intervening at a company, the agency may agree to withhold a notice of violation if the company can devise corrective action. FMCSA then either agrees or disagrees that the proposed actions represent a good-faith effort, and monitors progress.

This is where the gap in the federal regulations 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 a carrier will follow the cooperative safety plan in the absence of the policies and procedures needed for implementation and the documented training to show commitment and improvement. The answer is simple. To participate, a carrier must submit a written cooperative safety plan to FMCSA. Such a plan will need to be supported by a policies and procedures manual. Using Z15.1 as a guide will facilitate development of this manual.

The Safety Management Cycle

FMCSA offers the safety management cycle (Figure 2) as a guide to help motor carriers develop safety plan documents. The cycle starts with the concept that policies and procedures are needed to move forward. The agency has created a document for each of the seven BASICs to help companies develop policies and procedures for that category in accordance with the safety management cycle (FMCSA, What Is).

Safety Management Processes

Six safety management processes are the backbone of the safety maangement cycle. ANSI/ASSE Z15.1-2012 matches well with these processes.

1) **Policies and procedures** define the what and how of a motor carrier's operations. Policies establish the guidelines for how a motor carrier and its employees behave in a given situation. Procedures explain how to accomplish policies. The other safety management processes focus on how to implement these policies and procedures. 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 do not 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. An effective 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 recruit-

ing 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 development of driver qualifications, job descriptions, applications and background checks. A carrier should have a defined policy that lists minimum qualifications or disqualifying events (which should be concrete provisions that do not fluctuate with the job market) and have systems in place to conduct adequate background checks as required by statute. A carrier should also consider other processes that are not required, such as preemployment 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 functions. ANSI/ASSE Z15.1-2012, Section 3.2.1.5, covers orientation and training, and Section 5.3 covers driver training. Ideas from these sections should 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 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 employees execute their roles and responsibilities. Monitoring involves a motor carrier evaluating the operation's performance, while tracking entails 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 executed.

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

Merging ANSI/ASSE Z15.1 with federal guidance results in a thorough policies and procedures manual. The "Recommended Outline" on p. 52 lists additional elements to include in the manual.

A Systems Approach to Roadway Safety

The thinking about how to best achieve road safety improvements has gradually shifted over the past 2 decades. This shift is marked by a 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 infrastructure and vehicles (Organization for Economic Cooperation and Development, 2008).

Vision Zero & 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 continuously modifying the road system as situations in which human error leads to crash-related injuries are identified (Johansson, 2009). Traditional road safety approaches aimed at preventing crashes, while the Vision Zero goal is to eliminate death and serious injury. This model accepts that road users will inevitably make errors, so 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 calls for a management system at the organizational level that is responsible for modifying work conditions to reduce, if not eliminate, the potential for road traffic injury. A primary contribution of this model is its support for shifting responsibility away from the individual driver toward the company or organization that employs the driver.

Similar road safety initiatives have been adopted in other countries, most prominently in the Netherlands (Sustainable Safety strategy) and Australia (Safe System model) (Organization for Economic Cooperation and Development, 2008). In 2009, the U.S. began to move in a similar direction with the launch of Toward Zero Deaths (**http://safety.fhwa.dot.gov/tzd**), a strategy that conceptualized any injury or death on the road as unacceptable.

The ISO 39001 Standard

Another outgrowth of the safe system approach to road safety is ISO 39001:2012, Road Traffic Safety Management Systems—Requirements With Guidance for Use. Because the Swedish Standards Institute is secretariat for ISO 39001, this global consensus standard was strongly influenced by Vision Zero. This standard was designed for use by any public or private organization seeking 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 ANSI/ASSE Z15.1, ISO 39001's requirements are placed within a framework of roads, vehicles and users.

ANSI/ASSE Z15.1 as a Systems Approach

ANSI/ASSE Z15.1 is consistent with the safe system approach in several ways:

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

The global initiatives and ANSI/ASSE Z15.1 share common features that are especially relevant to the management of vehicles by companies and organizations:

•They value comprehensive management and communications structures that incorporate all stakeholders, including private- and public-sector groups that are key users of the road system.

•They see road safety as a responsibility shared among all these stakeholders.

Recommended Outline for Policy & Procedure Manuals

I) Safety Policy/Statement
A) Safety mission statement that is conveyed on a constant basis

II) Responsibility & Accountabilities
A) Policy setting forth who is responsible for what. Very important.
- 1) Assignment of safety functions
- 2) Assignment of auditing requirements
- 3) Chain of command on safety issues

III) Driver Recruitment
A) Assessment
- 1) Job description, with safety expectations
- 2) Road test
- 3) Written test (not required)
- 4) Background check
  - a) Work history documentation
  - b) Drug and alcohol checks
  - c) Criminal history, if required

B) Selection guidelines
- 1) Experience required
- 2) Medical examination
- 3) Motor vehicle record (MVR): what is acceptable
- 4) Preemployment safety screening program report/roadside history
- 5) If owner/operator, a review of DOT number

IV) Orientation & Training
A) New employee training and orientation
- 1) New driver checklist
- 2) Driver qualification files
  - a) Biennial review of file
  - b) Annual MVR checks
  - c) Review of driver qualifications
    - i) Hazmat
    - ii) Entry level
    - iii) Longer combination vehicles
    - iv) Tanker driver trainer
    - v) New driver ride-alongs
    - vi) Training on your equipment and configurations
  - d) Drugs and alcohol
    - i) Decision on allowing return to work
    - ii) Retention and storage of records
    - iii) Procedure for immediate removal

B) Employee retraining
- 1) Postcrash
- 2) Postincident

C) Recurrent training
- 1) HazMat
- 2) OSHA safety training

D) Specialized training
- 1) Tanker
- 2) Load securement
- 3) Longer combination vehicles

V) Organizational Procedures & Rules
A) General discipline procedure that can be applied to safety and operational violations
B) General safety policies
- 1) Required by regulations
  - a) Drug and alcohol testing procedures/policies (if you employ drivers with a commercial driver's license
  - b) Security plan (if you haul hazardous materials)
- 2) Company directed
  - a) Passengers
  - b) Personal use
- 3) Compliance with all traffic and motor carrier regulations and laws (general in nature)

C) Crash countermeasures/driving practices
- 1) Distracted driving
- 2) Weather/dispatch policy
  - a) General
  - b) Procedures to hold dispatchers accountable for dispatching drivers on runs that cannot be made legally
- 3) Speed policy
- 4) Following distance policy
- 5) Right lane/lane change policy
- 6) Safety belts
- 7) Hours of service
  - a) Adherence to the regulation
  - b) Log retention and submission
  - c) Procedure on how hours of service are audited

VI) Incident & Crash Review
A) Evidence retention
B) Black box retention policies
C) Files and photos
D) Purpose of incident and crash reviews:
- 1) Preventability determination?
- 2) Development of procedures/training to prevent future crashes?

VII) Rewards & Recognition
A) Does the company have a system to reward and recognize driver achievements?

VIII) Vehicle Specification & Selection
A) 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.

IX) Inspection & Maintenance
A) Does the company have a policy describing the system to:
- 1) Maintain records
- 2) Maintain system of preventive inspections
- 3) Roadside inspections reported
- 4) Driver vehicle inspection report

B) If company uses owner/operators (O/O), policy to review O/O equipment prior to allowing use? Policy on repairs of O/O equipment?

X) Management Program Audits
A) Is there a procedure specifying audit functions that management does to ensure that requirements are being met at all levels? Are they reported back to top management?

•They value continuous data collection and feedback, including cost and economic analysis to ensure that investments in road safety are effective and provide a favorable return on investment (Organization for Economic Cooperation and Development, 2008).

Develop & Implement a Motor Vehicle Safety Program With Z15.1

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, 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. Organizations can use the standard's basic structure at several points during program development and implementation: 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 & Implementing Interventions

The Haddon matrix is a tool that can be used in conjunction with ANSI/ASSE Z15.1 to identify program gaps. It was developed by American epidemiologist William Haddon Jr., a prominent advocate for crash prevention and injury control and the first administrator of National Highway Traffic Safety Administration. Haddon conceptualized injury prevention as a problem of reducing or eliminating the exchange of harmful mechanical energy (Haddon, 1968). The simplest version of the matrix is a 3 x 3 table (Figure 3, p. 54). The rows denote phases, or points in time when a hazard is present or an intervention can be put in place. The columns denote factors, or sources of risk or points of intervention to control the risk (Haddon, 1972).

Use of this 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 ANSI/ASSE Z15.1. Haddon (1968) showed how the human data cell could be separated into road user types such as drivers, pedestrians and motorcyclists, allowing a more refined assessment of risks and interventions.

For organizational users, research and policy documents have recommended the addition of columns to cover factors related to management and journeys (e.g., European Transport Safety Council). Addition of information on management reinforces ANSI/ASSE Z15.1, which covers the importance of leadership, management commitment and a strong administrative structure before discussing 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. Doing so promotes broad buy-in across organizational units and guards against the danger of entrusting the program to a single individual whose departure could threaten the program's future (Murray, Ison & Gallemore, 2009).

The Haddon matrix helps a company identify program gaps by asking these questions: "Which of these risks are we addressing?" and "Where are policies and procedures needed?" For identifying and implementing interventions, the matrix helps a firm to ask, What interventions can we put in place to reduce or eliminate these risks? Table 1 (p. 54) shows how the matrix might be used to assess program gaps or to check for compliance with ANSI/ASSE Z15.1 elements.

Several 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, Scurfield, Sleet, et al., 2004). In addition, the plan of action developed for the UN Decade of Action for Road Safety 2010-2020 is based on five pillars: 1) road safety management; 2) safer vehicles; 3) safer roads and mobility; 4) safer road users; and 5) postcrash response (World Health Organization and UN Road Safety Collaboration, 2010). These pillars mirror both the Haddon matrix and sections 3 through 6 of ANSI/ASSE Z15.1. Finally, fleet and safety managers, fleet service providers and researchers have reported successfully using the matrix to assess program gaps (Darby, Murray & Raeside, 2009; Murray, et al., 2009; Wallington, Murray, Darby, et al., 2012).

Organizations can use the standard's basic structure to identify gaps in an existing program, to ensure that policies and procedures are adequate and to develop key performance indicators.

Develop Metrics & Track Progress With Z15.1

The main portion of ANSI/ASSE Z15.1 requires an organization to follow a process of reporting, reviewing, analyzing and taking corrective action in response to individual motor vehicle incidents and collisions. It also prompts an organization to take a broader view by collecting data needed to track road safety performance over time.

Early in its deliberations, the Z15 ASC determined that the standard should not mandate that all organizations use the same outcome measures or the same reporting intervals. Thus, the standard contains appendixes with more specific but nonmandatory guidance in these areas to allow an organization to determine what is most appropriate. In the 2012 version:

•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 consider during incident/collision reviews. 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.

Rate Calculation Examples

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 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. Depending on its operating environment, a carrier may elect to report rates based on units of service such as the number of deliveries or loads. Selected rates included in Appendix H are discussed here.

An incident rate based on the number of vehicles is essentially the percentage of the vehicle fleet involved in an incident over some predetermined period. It can help an organization assess the percentage 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:

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

Rates based on vehicle miles traveled 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.

Figure 3
Haddon Matrix

	Human	Vehicle/equipment	Environment
Pre-crash			
Crash			
Post-crash			

The Haddon matrix can be used in conjunction with ANSI/ASSE Z15.1 to identify program gaps. The rows denote points in time when a hazard is present or an intervention can be put in place. The columns denote sources of risk or points of intervention to control the risk.

Table 1
Haddon Matrix Adaptation Example

Original elements of Haddon Matrix			Additional elements for occupational road safety	
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, 7.2.5)	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 appropriate (7.2.5)	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) Incident review report (7.2.3) Corrective action communicated throughout organization, if appropriate (7.2.5)	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)

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 afforded by ANSI/ASSE Z15.1. The numerator may be adjusted in several ways. At the outset, it is important to establish an organization-wide definition of an injury. Z15.1 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." By design, this definition does not dictate specific criteria; instead, an organization may choose its own threshold. Common 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, the numerator 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 & Using Key Performance Indicators

Basic rates listed in Appendix H of the standard are useful for summarizing an organization's road safety performance and tracking progress over time. The standard can also help an organization set targets and track progress toward specific program goals and objectives. Again, elements of the standard, organized within the Haddon matrix, help an organization select the most appropriate KPIs and ensure that data are being collected to calculate these indicators.

When considering data collection related to management of a motor vehicle safety program, an employer must not lose sight of which data elements are essential and which are merely good to know. Data collection should be linked to specific reporting requirements: those needed to calculate basic rates described above and those that contribute to calculation of KPIs. (There are many other reporting requirements related to financial, human resources and regulatory compliance, but these are outside the scope of this article.) 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 (e.g., a set level in reduction in crashes per million miles). The rates highlighted in the appendix are outcome measures.

Processes are also important because they represent milestones along the way to achieving outcomes, and they can pinpoint places in the management system where adjustments are needed to continue progress toward the desired outcome (Poister, 2004). A process indicator relevant to ANSI/ASSE Z15.1 might be the percentage of workers completing behind-the-wheel training within 6 months of hire.

The Haddon matrix example (Figure 3) can be a starting point for developing process and outcome KPIs for specific program areas. Figure 4 shows how an organization might determine what is needed to support a KPI related to distracted driving crashes. Some process-related measures are quantitative, while others will be based on more qualitative assessments and knowledge of the organization. It is important to note the distinction between a KPI and a target value for that indicator. A KPI is the measure, but the organization should also determine the value it wants to achieve for that KPI.

Figure 4
Example KPI Supporting Data

Sample KPI: % of "preventable" incidents in which the organization's driver was distracted

Relevant data elements:

- Total number of incidents (based on the organization's predetermined 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 the 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 the 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 communication strategies can be adjusted to increase compliance?

When considering data collection related to management of a motor vehicle safety program, an employer must not lose sight of which data elements are essential and which are merely good to know.

More on Z15.1

ASSE's technical brief on the Z15.1-2012 standard contains information on each section of the standard and includes links to other resources. Download it at www.asse.org/publications/standards/z15/docs/Z15_1_Tech_Brief_4_2012.pdf.

Conclusion

ANSI/ASSE Z15.1-2012, Safe Practices for Motor Vehicle Operations, provides minimum requirements for workplace motor vehicle safety programs. Although the standard was initially conceived to fill 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 as well as FMCSA's CSA initiative by providing a critical framework for developing 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 within 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. **PS**

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