A3B01: Committee on Transportation Safety Management
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Transportation Safety Issues

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The Committee on Transportation Safety Management is concerned with the development and coordination of integrated safety management programs to reduce death and injury on transportation systems. It focuses on (*a*) the advancement of safety management systems, (*b*) research and technology to improve safety, and (*c*) models of safety delivery systems. Currently, the committee has three subcommittees working in these focus areas. They are Transportation Safety Management Systems, Truck and Bus Safety Research Management, and Road Safety Audit. In the following paper, the state of the practice of each of these focus areas is reviewed.

STATE OF THE PRACTICE OF SAFETY MANAGEMENT SYSTEMS

States were required by the Highway Safety Acts of 1966 to develop a highway safety plan that was intended to be a systematic approach to the resolution of highway safety problems. In this regard, the United States has 33 years of experience with safety management systems, and there has been much success. The Highway Safety Acts of 1966 set the framework for safety initiatives that reduced the highway death toll from more than 5 deaths per 100 million vehicle miles of travel to fewer than 2 deaths per 100 million vehicle miles of travel today.

The acts required an organized planning approach to the administration of federal highway safety grants by state safety officials. Recent federal transportation legislation has progressively enhanced the planning approach and introduced the systematic underpinning that encouraged integrated planning and implementation of highway safety initiatives. This progression was most evident in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which required the states to adopt a systematic management approach to highway planning, design, and construction as they affect pavements, bridges, safety, congestion, transit facilities, and intermodal transportation facilities and equipment. The Transportation Equity Act for the 21st Century (TEA-21) continues this program approach and the necessary funding.

An honest assessment of the "practice" of safety management is more realistically one of status quo. Traffic engineers practice their trade and apply and refine the tools that are traditional within their discipline, and only occasionally are involved with safety partners from other transportation disciplines. This is also true of the other transportation disciplines, such as traffic law enforcement, driver safety, vehicle safety, and injury prevention.

This method of practice is the result of a philosophy that prevailed among transportation chief executives who were most instrumental in removing the mandatory requirements of the management systems. They did not want to be held responsible for results that required actions outside their sphere of control. They cited, in their argument against the mandatory provisions, the burden of implementing costly data systems. Yet most of the information systems that support transportation management existed to some degree in most states then and have been enhanced since.

The irony is that most transportation chief executives today are implementing performance management systems that are more burdensome on the most critical of governmental resources—human resources—and that still require information systems to collect data and track performance. This is not an argument against these initiatives, but a suggestion that they were opposed for political reasons because most of the country was against unfunded mandates. A review of publications representing public administration indicates that management at state and local government levels has progressed significantly. The publications cite several government agencies applying total quality management and Baldridge assessment criteria to their management performance structures.

Management and funding of transportation programs appear to be devolving to the state and local levels of government. Recent federal legislative action indicates a trend toward a diminishing role for federal agencies in programs that must be implemented at the state and local levels. The traditional role of federal agencies in state and local programming, in a supporting role, and as an agent for disseminating information, appears to be increasing. The states and local agencies must become more aware of the products and services they provide and to whom they are provided. Strategic planning has been introduced to augment the traditional planning process in many cases, with strategic management as the administrative implementation mechanism. Transportation managers are more aware of their customers and customer demands than ever before. This awareness is evolving from a better appreciation of their business (transportation) and all its implications.

Many safety officials look to intelligent transportation systems (ITS) as the future mechanisms for appreciable gains in highway safety. Whereas ITS hold much potential for improvements in safety, quantum gains will not be realized until highway safety practitioners from all disciplines understand their interdependence and form an alliance to share information and talents. The alliance should collectively develop countermeasures that address the driver, the vehicle, and the road to improve highway safety. Safety management systems, as they were envisioned in ISTEA and continued in TEA-21, are the framework for partnerships to accomplish the safety gains that the public expects.

At TRB's 1998 Annual Meeting, a task force of the Committee on Transportation Safety Management developed a suggested framework for a safety management system (SMS). The framework was to serve as a foundation for safety officials to assess the viability of their safety management process. The concept was developed on the premises that (*a*) SMS is a complex adaptive system; (*b*) two ingredients—prediction and feedback—are necessary to prosper; and (*c*) to manage the SMS, models that allow anticipation of its performance must be built.

The following process was agreed upon as a tool to help jurisdictions set up an SMS and measure progress toward successful implementation:

1. Partnerships: An accepted characteristic of an SMS is that several stakeholders in the highway safety community work together in the development, implementation, and administration of a highway safety program for their jurisdiction. The partnership can be

extended or limited on the basis of the jurisdiction's political, organizational, and management climate.

Partnering suggests that the many safety programming efforts currently existing in a jurisdiction can be coordinated to optimize resources and program results. Several factors may prompt this type of networking. Among them are the federally funded safety planning activities that occur at the state and local levels of government. These activities form core partnerships that help optimize resources and coordinate programs. One requisite of the partnership is a strong commitment from each partner to support coordinated initiatives and to provide resources to execute and administer the highway safety program.

2. Common vision and mission: A major task of the safety stakeholders' committee is to develop a mission statement from which the program goals will emanate. The mission statement should be based on the jurisdiction's statutory requirements to provide a safe highway environment.
3. Goals are the vehicles that take a program from the mission statement to the action plans that eventually achieve the envisioned mission. The stakeholder partners should set the goals.
4. Decision-making process: A structured decision-making process will be the mechanism to develop strategies to achieve the goals. The strategies should be developed on the basis of appropriate highway safety information.
5. Performance-based action plan: The formal decision-making process is the foundation of the strategic action plans. The action plans, in turn, provide the basis for developing the highway safety program budget for a jurisdiction. The action plans should be performance-based.
6. Progress reporting system: A progress reporting system should be developed to monitor progress and provide the link to the preceding steps for feedback and modification. The progress reporting system should include a tracking mechanism to measure the status of the strategies selected and implemented. A regularly scheduled stakeholder committee meeting should review the progress of the strategies to determine whether they are achieving the stated goals. The progress reporting system should provide enough information to allow the stakeholders to make decisions to modify, delete, or adjust strategies as warranted.

Figure 1 is a high-level conceptual process map of an SMS. Each symbol represents management processes at a lower level of activity. Note the interconnectivity of the major safety program areas.

STATE OF THE PRACTICE OF TRUCK AND BUS SAFETY MANAGEMENT

The Truck and Bus Safety Research Subcommittee of A3B01 focuses on safety management issues relating to commercial motor vehicles (CMVs)—large trucks and buses. CMV operations in the United States account for nearly $400 billion in annual

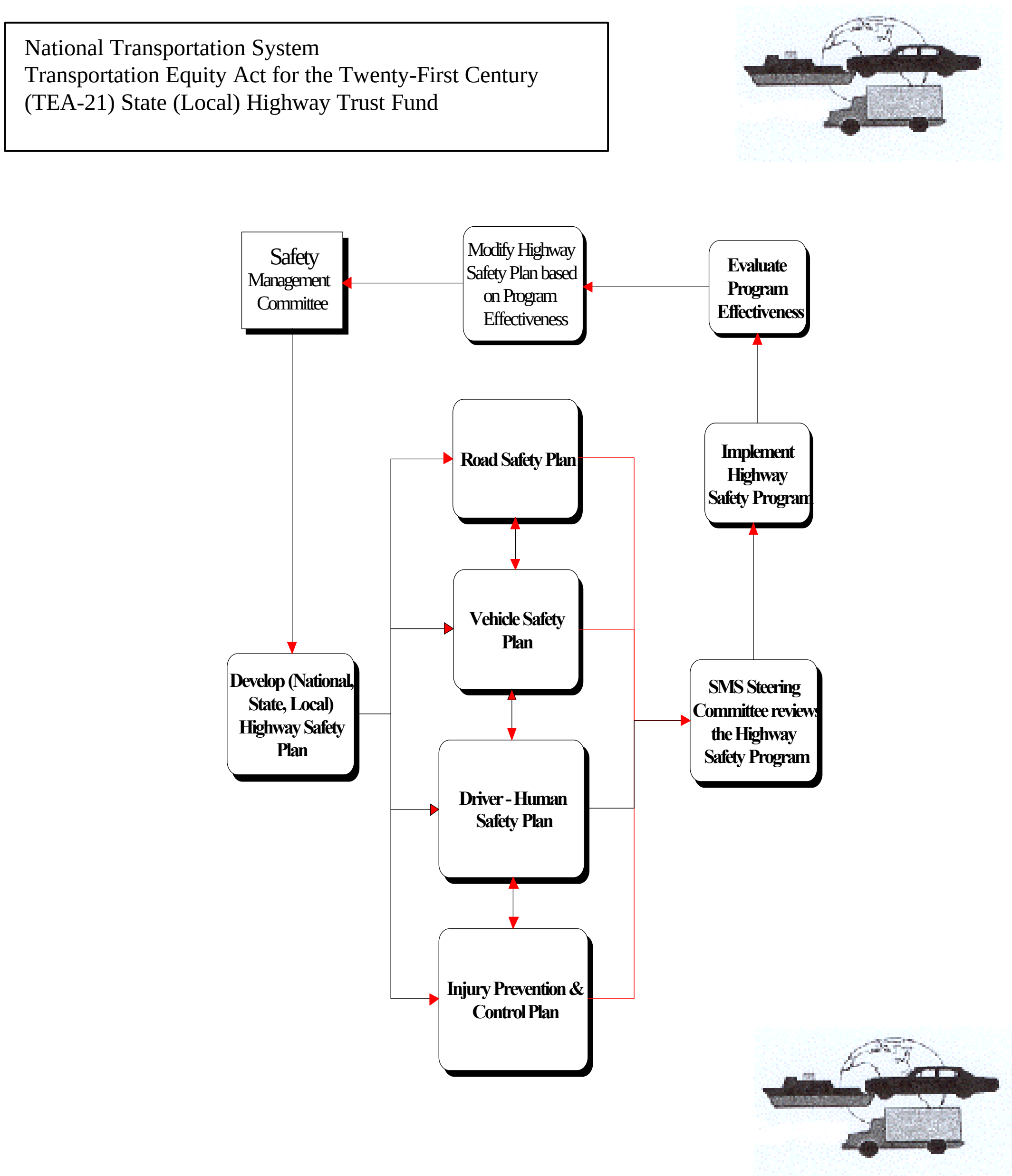

FIGURE 1 High-level conceptual process map of an SMS.

revenues, representing more than 80 percent of the nation's freight bill. Commercial trucks and buses represent nearly 10 percent of all registered motor vehicles, and the industry employs 10 million people, including 3 million drivers.

Commercial drivers are generally good drivers. The crash involvement rate per mile traveled of combination-unit truck (tractor-semitrailer) drivers is less than one-half that of noncommercial drivers. Commercial drivers are less likely than noncommercial drivers to seriously violate speed limits or engage in aggressive or risky driving behaviors. Moreover, the majority of car-truck crashes are related more to the errors and misbehaviors of car drivers than to those of truck drivers. However, because of the high mileage exposure of trucks and the often severe consequences of their crashes, there is a premium on making trucks, and truck drivers, safer. Total life-cycle crash costs (all causes, all involved parties) are more than four times greater for a combination-unit truck than for a passenger car. The public importance of truck safety is highlighted by the fact that approximately two-thirds of all "harm" from combination-unit truck crashes and approximately 85 percent of fatalities occur "outside of" the truck (i.e., to other vehicles and vehicle occupants involved in crashes with trucks). Most of these crashes are due to human error—either of a noncommercial driver involved in the crash or of the truck driver.

Operational Influences on Commercial Driver Performance

CMV driver performance is a complex issue and can be viewed in several different ways. Figure 2 shows a holistic model of CMV driver performance. Drivers perform their tasks in a vehicle functioning within the physical environment of a highway; in this respect, driving a truck or bus is similar (though certainly not identical) to driving a car. A principal difference, however, lies in the *operational environment* of CMV transportation. That is, commercial drivers work against the backdrop of a complex operational environment that includes work requirements (e.g., customer delivery schedules); company management practices (including selection, training, scheduling, and incentives for safe performance); labor policies and traditions; and government regulations; including penalties for violations. To the greatest extent possible, the operational environment must optimize safety while sustaining productivity. Truck and bus safety research must focus on the CMV operational environment and all its players: fleet managers, dispatchers, shippers and receivers, trainers, testers, enforcers, regulators, and, of course, drivers.

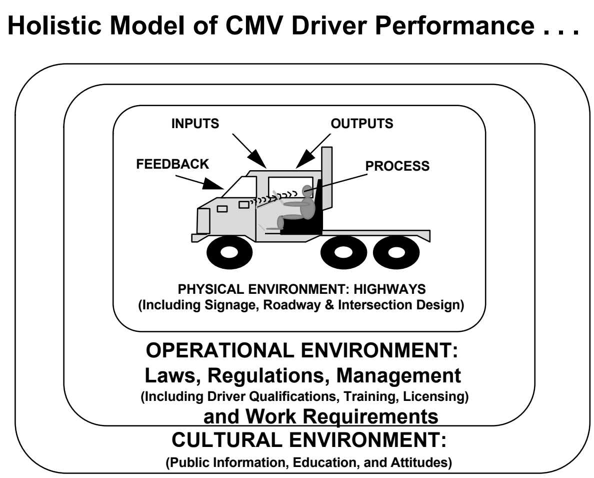

FIGURE 2 Holistic model of CMV driver performance.

Taxonomy of Truck and Bus Safety Management Research

Truck and bus safety management research encompasses many types of studies, including the following:

- Regulatory evaluation and reform: regulatory assessments and evaluations to promote effective and uniform Federal Motor Carrier Safety Regulations (FMCSRs) and other government regulations.
- Compliance and enforcement: studies directed toward improving carrier compliance with and enforcement of existing FMCSRs and other government regulations. This category includes studies of roadside inspection criteria and procedures, compliance reviews, application of penalties, and development of systems to facilitate compliance and enforcement.
- Driver performance enhancement: research on commercial driver recruiting, selection, training, testing, licensing, and safety performance management—the entire spectrum of human resource management practices for commercial drivers.
- Driver alertness and fatigue: commercial driver fatigue management issues, including hours-of-service rules, fleet management practices to minimize fatigue, and technologies such as sleep monitoring and in-vehicle alertness monitoring for improved driver self-management of alertness.
- Driver physical qualifications: examination of specific physical and medical conditions in relation to CMV driving safety, and the development of licensing guidelines.
- Car-truck proximity: studies of the interaction of trucks with other road users (cars, light trucks, vans, etc.). This category includes "no-zone" research, as well as studies of large truck conspicuity, visibility, and truck lane change/backing maneuvers and crashes.
- Crash causation and profiling: in-depth profiling of crash-involved CMVs and their operations for the purpose of problem identification and quantification. This category may also include in-vehicle observational studies to elucidate driver errors associated with crashes.

Emerging Directions, Challenges, and Opportunities

The following are examples of the cutting-edge truck and bus safety management research and technology development likely in the next decades.

- Vehicle inspection technology: sensor technologies to enable the roadside inspector to determine whether vehicle brakes and other safety systems are functioning, and data systems on carrier safety performance to identify vehicles belonging to high-risk carriers, without stopping the vehicle.
- In-vehicle driver safety performance monitoring: deployment of existing and emerging in-vehicle performance monitoring technologies (e.g., speed, acceleration, braking, headway, alertness) as the basis for a quality-of-driving approach to improving CMV driver safety assessments.
- Performance-based physical qualifications: development, validation, and deployment of dynamic, performance-based physical qualifications tests, including vision, hearing, and sleep apnea.
- Lane-change crash prevention: research on the application of technology, driver training, and industry outreach to reduce lane-change crashes, the area of greatest large truck overinvolvement in crashes.
- CMV driver human resource management: comprehensive application of human resource management science to develop more sophisticated practices and tools for

recruitment, selection, training, safety management, and evaluation of CMV drivers; identification of the personal characteristics and practices of safety-effective fleet managers.

- Individual differences in driver risk: studies of individual differences in driver risk, which could explain why a relatively small percentage of CMV drivers account for a large percentage of incidents, ways to measure differences in driver risk, and appropriate interventions.
- CMV industry operational and safety profile: development of a validated, reliable operational profile of the industry, which does not exist because of the variety of commercial vehicle operations and the ever-changing nature of the industry. Such a profile would include associated crash risks and other safety-related characteristics of various industry segments.
- CMV crash causation and driver error research: crash investigation/reconstruction and direct observational studies of instrumented vehicles to identify causal and contributing driver errors and other factors in CMV crashes.
- Shipper/receiver practices relating to CMV safety: research to identify and develop policy or educational approaches to prevent shipper and receiver practices (including both delivery schedule demands and workplace procedures) that result in commercial driver fatigue or other safety risks.

STATE OF THE PRACTICE OF ROAD SAFETY AUDIT

Road safety audit (RSA) is a process for examining a road or traffic project using an independent, qualified, and experienced team reporting formally on the safety issues of that project. RSA involves a specialist review of relevant designs or of the existing road network against safety principles. It is more than a compliance check against standards. It is a proactive approach that needs to be part of the design process from start to finish, the earlier the better. It is complementary to other reactive initiatives such as accident investigation and high-incidence location review programs.

This approach originated in the United Kingdom in the 1980s, and is widely used in Australia and New Zealand. In 1996, FHWA sponsored a scanning team consisting of a multidisciplinary delegation of U.S. highway engineers, safety specialists, and educators representing all levels of government to tour New Zealand and Australia to review the RSA process. The team’s conclusion was that RSAs hold promise for maximizing safety of roadway design and operations and should be piloted in this country. The final report (*FHWA Study Tour of Road Safety Audits*—Parts 1 and 2) was published and is available by downloading from the Office of Motor Carriers and Highway Safety Web page (www.ohs.fhwa.dot.gov) under Safety Management Systems.

Currently, FHWA is partnering with state departments of transportation and local government transportation agencies to pilot the RSA process. A workshop was held in May 1998 for pilot participants. An evaluation of these pilot participants is under way, and a report evaluating the RSA process should be available in 1999.

In the United States, several states and local agencies have conducted or plan to conduct RSAs. The process continues to gain momentum as agencies find the RSA process a useful tool to maximize the safety potential of roadway construction and existing roadway reviews. Implementation strategies vary between agencies; however, the basic principle of establishing the importance of incorporating safety in all roadway work and review remains the same. Current and emerging RSA initiatives include the following:

- Austroads International Road Safety Audit Forum was held in Melbourne, Australia, on May 11 and 12, 1998. The forum attracted more than 175 delegates from 14 countries; a summary report of the forum is being prepared, including a 10-point policy position on the RSA process. The forum endorsed the position as the basis for promoting and advancing road safety management.
- WRA/PIARC—Committee 13 on Road Safety will sponsor a conference session at the World Road Congress in Kuala Lumpur in October 1999. The proposed agenda includes presentations from representatives of Denmark, Australia, New Zealand, France, and the United States.
- The Institute of Transportation Engineers and FHWA are partnering in the development of a Web site for those who want to learn more about RSAs. The Web site will begin October 1, 1999 (http://www.roadwaysafetyaudits.org), and will contain (*a*) a searchable database containing RSA-related bibliographic records and selected full text documents of RSA articles and publications, (*b*) other appropriate road safety audit links, (*c*) a searchable database of RSA contacts (public agency and consultants with experience in conducting road safety audits), (*d*) information related to RSA conferences and seminars, and (*e*) links to an e-mail discussion group where practitioners can post questions on RSAs.
- The Institute of Transportation Engineers and FHWA will develop a good practice guide on the basis of evaluations by the RSA pilot states' reports.
- A "toolbox" is being planned by FHWA to promote and assist in the implementation of the RSA process.