

# SAFETY BY DESIGN

## Federal Highway Administration

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### SAFETY MANAGEMENT SYSTEMS: GOOD PRACTICES FOR DEVELOPMENT AND IMPLEMENTATION

#### I. PURPOSE

The purpose of this document is to provide general guidance to managers and safety specialists on the formulation of a SMS. It is directed to the State level, but can be adapted to political subdivisions and others. This guidance is flexible because each State has its own unique institutional and organizational arrangements which must be considered. Further, the development and implementation of a SMS is an evolving process. Good practices will also evolve over time.

#### II. DEFINITION

The SMS is a systematic process that has the goal of reducing the number and severity of traffic crashes by ensuring that all opportunities to improve highway safety are identified, considered, implemented as appropriate, and evaluated in all phases of highway planning, design, construction, maintenance, and operation, and in the development of safety programs relating to vehicles and people and by providing information for selecting and implementing effective highway safety strategies and projects. The SMS would be designed to assist decisionmakers in selecting cost-effective strategies/actions to improve the safety and efficiency of the nation's transportation system.

### III. BACKGROUND

Highway safety managers have continually looked for better ways to make decisions on their highway safety programs. These efforts were brought to the forefront by several activities and publications of the Transportation Research Board (TRB)<sup>1</sup> and the American Association of State Highway and Transportation Officials (AASHTO)<sup>2</sup>. These activities were directed at increased emphasis on recognizing the impacts of decisions which affect safety in the planning, design, construction, maintenance, and operations of the highway transportation system. The need for better management of safety activities by the organizations involved in highway safety were identified and recommendations advanced.

Congress also recognized this need to establish better management procedures to address the unacceptable level of lives lost on the Nation's highways and to maximize the use of the limited resources. The first major legislation to focus on this issue was the enactment of the Highway Safety Act of 1966. This Act established comprehensive highway safety requirements for the States. This comprehensive approach to highway safety included provisions for the States to address the safety issues associated with the vehicle, roadway and human elements. Specific responsibility for administration of the program was directed to the Governor of each State. Congress has since enacted a number of transportation bills which provided further responsibilities to the States and Federal agencies, along with appropriation of funds directed toward highway safety. Thus, the 1966 Act basically served as a catalyst and foundation for implementing the Safety Management System requirements of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.

The ISTEA of 1991 was signed into law on December 18, 1991. Section 1034 of this Act required States to have a SMS by October 1, 1994. The issues associated with implementing a SMS, therefore, were addressed through the regulatory process of public meetings, an Advanced Notice of Proposed Rulemaking, and a Notice of Proposed Rulemaking. Because a number of issues related to the data requirements for the various management systems needed to be resolved, an Interim Final Rule was published in the Federal Register on December 1, 1993.

Prior to the publication of the Final Rule, the National Highway

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<sup>1</sup> Enhancing highway Safety Through Engineering Management in an Age of Limited Resources.

<sup>2</sup> A Guide For Enhancement of Highway Safety Directed to Agencies, Programs, and Standards

System (NHS) Designation Act of 1995 was signed into law on November 28, 1995. Under Section 205 (Relief from Mandates) of this Act, a State may elect, at any time, not to implement, in whole or in part, one or more of the management systems required under the ISTEA of 1991.

Subsequent to the signing of NHS Designation Act, Transportation Secretary Federico Peña, in response to a directive from President Clinton, issued an action plan to ensure that highway safety would continue to receive importance; and one of the action items was the promotion and support of safety management systems.

There are a number of reasons why the development and implementation of a SMS is important. These include the following:

Too many needless tragedies on the Nation's highways  
While the nation is experiencing the fewest number of people killed on the highways in over 30 years, there are still too many preventable tragedies.

Health care has become a national issue.  
Highway safety is an important part of this issue since motor vehicle crashes contribute \$14 billion annually to health care costs. A comprehensive process that brings together engineering, enforcement, education, and emergency response disciplines and the medical establishment is needed to help address this issue.

Resources are declining and demands are escalating.  
Agencies must therefore ensure that maximum effectiveness is achieved in the utilization of these resources. Past practices have resulted in too many lost opportunities and too many wasted resources because of uncoordinated efforts.

In this regard, the need for improved coordination of highway safety programs becomes more imperative. Thus, one of the most important aspects of a SMS is to bring people with different safety responsibilities together to determine what each may have to offer to improve overall highway safety.

#### **IV. DEVELOPMENT**

A successful SMS would ensure communication, coordination, and cooperation from the various governmental and other organizations

within the State which have highway safety roles, responsibilities, or interests for the roadway, human, and vehicle safety elements of highway safety. Highway safety functions reside in a number of different State and local agencies. Within individual agencies, specific responsibilities that impact safety may be assigned to various subunits, divisions, bureaus, or to individual employees. In addition, there may also be prominent private safety organizations which have a significant impact on highway safety.

Responsibility:

An important initial step is the designation of a lead State agency and "focal point." This focal point is charged with coordination of the development, establishment, and implementation of the SMS.

One of the responsibilities of the SMS "focal point" typically would be bringing the various individual agencies/organizations together, getting organized, and coordinating the activities of the group. In many States, suitable coordinating groups (formal or informal) already exist, and it may be desirable to utilize such existing groups for this purpose, or as a starting point to establish a SMS coalition. However, the SMS development/implementation mission needs to be formalized.

With this in mind, the next critical step is the identification of the key agencies and organizations to be brought together to form the SMS coalition. The coalition, or working group, will include players which have major highway safety roles and responsibilities. This group would ensure that safety is appropriately considered in all phases of highway planning, design, construction, maintenance, and operations, and in the development of safety programs relating to vehicles and people, and that all are working in a coordinated effort toward a common mission to improve highway safety.

Examples of organizations and agencies that have highway safety roles within the State which may be represented on the SMS working group include the State Highway Agency, the Governor's Highway Safety Representative, the Department of Motor Vehicles, the Public Health Department, Metropolitan Planning Organizations, and various private organizations. A more comprehensive list of these organizations, and their typical safety roles, is shown in Appendix A.

Organizational structure and assigned safety roles vary from State to State. Thus the make-up of the SMS working group will vary. However, the SMS group should include

representatives of the key organizations/agencies in the State that have responsibility for highway safety.

Major Areas and Components of a Safety Management System:

There is no one correct way to develop and implement a SMS.

Every State is unique. There are many elements of a SMS already in place and working in most States. States should take advantage of, and build on, those highway safety organizations and processes that already exist and work well.

In structuring a SMS, the following major areas should be considered:

1. Coordinating and integrating broad based safety programs such as motor carrier, corridor, and community based management approach for highway safety.
2. Developing processes and procedures to ensure that the major safety problems are identified and addressed. This would include identifying and investigating hazardous or potentially hazardous highway safety problems, roadway locations and features, including railroad-highway grade crossings, and establishing countermeasures and setting priorities to correct the identified hazards or potential hazards.
3. Ensuring early consideration of safety in all highway transportation programs and projects.
4. Identifying safety needs of special user groups such as older drivers, pedestrians, bicyclists, motorcyclists, commercial motor carriers, and hazardous material carriers, in the planning, design, construction, and operation of the highway systems.
5. Routinely maintaining and upgrading safety hardware (including highway-rail crossing warning devices), highway elements, and operational features.

Within each of these five major areas, the following elements should be incorporated, as appropriate:

1. Establishment of short- and long-term highway safety goals to address both existing and anticipated safety problems as well as substandard highway locations, designs, and features, and to allocate resources;
2. Establishment of accountability by identifying and defining the safety responsibilities of units and positions;

3. Recognition of institutional and organizational initiatives through identification of disciplines involved in highway safety at the State and local level, assessment of multi-agency responsibilities and accountability, and establishment of coordination, cooperation, and communication mechanisms;
4. Collection, maintenance, and dissemination of data necessary for identifying problems and determining improvement needs. Data bases and data sharing should be integrated as necessary to achieve maximum utilization of existing and new data within and among the agencies responsible for the roadway, human, and vehicle safety elements. These records, as a minimum, should consist of information pertaining to: crashes, traffic (including number of trains at highway-rail crossings), pedestrians, enforcement activities, vehicles, bicyclists, drivers, highway, and medical services;
5. Analysis of available data, multi-disciplinary and operational investigations, and comparisons of existing conditions and current standards to assess highway safety needs, select countermeasures, and set priorities;
6. Evaluation of the effectiveness of activities that relate to highway safety performance to guide future decisions;
7. Development and implementation of public information and education activities to educate and inform the public on safety needs, programs, and countermeasures that affect safety on the nation's highways; and
8. Identification of skills, resources, and current and future training needs to implement the State's activities and programs affecting highway safety, development of a program to carry out necessary training, and development of methods for monitoring and disseminating new technology and incorporating effective results.

Although all eight elements are important, all of them may not be applicable to each major area. For example, after review, one State may determine that the seventh element "...public information and education activities..." may not be pertinent to its program supporting major area five: "routinely maintaining and upgrading safety hardware...". However, another State may determine through its review that

it is important to educate the public on why a traffic signal or stop sign has been modified or removed.

A further discussion of the five major areas with suggestions on utilizing the key elements, as well as State specific examples, is included in Appendix B.

### "Taking Stock"

Before decisions can be made as to what is needed to develop and implement an effective SMS, it is essential that existing highway safety related procedures and activities be critically appraised. The SMS working group needs to take stock or assess what currently exists and determine what is functioning well, where there are weaknesses or missing elements, and what needs to be modified or added in order to have an effective and efficient SMS.

A suggested starting point for this "taking stock" activity is to consider the five major areas and eight key elements.

The working group should assess how each of these activities or functions is currently accomplished, such as:

- What are the existing laws, regulations, and written policies and procedures as they relate to the major areas and key elements? What are the existing highway safety goals?
- Which organizational units or positions are assigned responsibility for the various safety functions? Is accountability adequate? Is there sufficient skilled staff? Is training needed?
- How do the responsible agencies currently interrelate? What are the existing coordination mechanisms, both formal and informal? Is there coordination of safety activities with the Metropolitan Planning Organizations (MPO's)? With local highway and safety agencies?
- Are there any institutional barriers, between agencies or within individual agencies, which hinder cooperative or coordinated safety activities?
- What are the existing processes or procedures for identifying safety issues or problems and what programs or procedures are in place to address the identified issues and problems?
- What safety processes or activities are working well? What are the obvious gaps, weaknesses, missing

functions, or overlapping responsibilities as related to the major areas and key elements?

- What Federal, State, local and private resources are available to develop and implement the SMS?
- What information is needed to identify, target, and evaluate countermeasures?
- What safety related data exists and where is it housed? Are safety related data computerized statewide? Are these data routinely linked to medical and financial outcome data? What is the quality of the data? Are the files complete and up-to-date? Are the data readily accessible to users? What needed data are not available?
- What standards/health status indicators exist to determine unmet needs for highway safety?

This assessment would identify areas where improvements can be made, functions added or reassigned, and processes instituted or modified to develop an effective, integrated SMS.

#### Work Plan

In order to determine what needs to be accomplished and to proceed in developing and implementing a fully operational SMS, States should develop a work plan. The plan will vary from State to State because of different organizational structures as well as differing safety needs. The work plans may differ among States as to the level of detail required to provide a document that is useful to the individual State. However, the work plan should be flexible to allow for changes based on unforeseen circumstances and feedback from implementation of the plan itself. Also, the work plan should not focus on individual countermeasures for specific safety problems, but rather be directed at organizational and program activities to address safety issues on a systematic basis.

Appendix C contains a list of suggested items for inclusion in the work plan.

#### **V. IMPLEMENTATION**

Once a work plan is developed and endorsed by the working group and/or agencies, the challenge becomes one of carrying out the identified tasks/activities to achieve the desired



results. This requires a process for activity management, coordination, and oversight, including periodic task monitoring of progress, reporting of such progress, and regularly scheduled meetings of the work group and/or its subgroups to generally manage program implementation.

Examples of implementation activities in each of the major areas are shown in Appendix B.

## **VI. SELF-ASSESSMENT OF A SAFETY MANAGEMENT SYSTEM**

The agencies should have an internal quality control system and review procedure. The agencies should establish, maintain, and utilize a system that assures continuous improvement and compliance with the goals of the Safety Management System. The system should include the methods, procedures, controls, records and maintenance of the system to provide continual progress toward the goals.

### **A. Philosophy**

Continuous improvement in reducing the number, severity, medical, and financial consequences of crashes is the primary goal of the SMS. The self-assessment process should not only measure the level of effort but what is actually being accomplished as a result of that effort. It is important not only to assess in relationship to the stated goals but to identify processes that can be improved. Often these improvements can be implemented at limited or no cost.

The procedures used in the self-assessment process should be appropriate in scope to the characteristics of the processes or services being assessed.

### **B. Components**

1. Reviews SMS programs and operations to assure consistency with the SMS's policies, goals, and objectives.
2. Initiates, coordinates, reviews, and evaluates efforts that deal with programs both internal and those which cut across organizational lines; for example, evaluates the effectiveness of cross-cutting programs such as community/corridor traffic safety programs.
3. Develops and submits to top management officials findings and recommendations resulting from the

aforementioned reviews.

4. Maintains a follow-up system to assure appropriate and timely implementation of approved recommendations.

APPENDIX A

EXAMPLES OF ORGANIZATIONS AND AGENCIES WITH HIGHWAY SAFETY ROLES

ORGANIZATION/AGENCY	TYPICAL SAFETY ROLE
State Highway Agency	State Highways-Planning, Design, Construction, Maintenance, & Operations; Federal 10% STP Set-aside Safety Improvements Railroad/Highway Grade Crossing Program
Governor's Highway Safety Representative	Highway Safety Programs, including Federal 402, 403, 408, 410, and 153 Programs, Legislative Initiatives, Safety Belt, Helmet, Alcohol, Drugs
State Police, Police Chief's Crash Data Collection	Enforcement, Motor and Sheriff's Associations Carrier Safety Programs,
Office of Emergency Medical	Emergency Medical Services Services, Education, Data Collection
Dept. of Motor Vehicles	Driver Licensing, Vehicle Registration, Regulations, & Safety Inspection
Public Health	Child Safety Seats, Alcohol Safety Education, Injury Control, Epidemiology, Statistics/Evaluation
Metropolitan Planning Organizations (MPOs)	Transportation Planning, and Highway Safety Improvement Projects and Programs
ORGANIZATION/AGENCY	TYPICAL SAFETY ROLE
Department of Criminal Justice	Prosecution of Highway Safety violations, Training
Public Utility/Regulatory Commission	Regulation of Utilities, Buses, Trucks, Railroads

County/Municipal Roads Departments	Local Highway Management
State Education Department	Safety Education, Driver Training, Alcohol/Drug Education
State/Local Agencies Responsible for Data Files	Managers (or keepers) of key data files not included above
Safety Advocacy Groups  Associations)	Public Information/MADD;AAA; Trucking Education; Lobbying  for Safety Legislation.

## APPENDIX B

### STATE EXAMPLES OF THE FIVE MAJOR AREAS

Discussion of the five major areas follows. Suggestions on utilizing the key elements, as well as State specific examples are included.

1. **Coordinating and integrating broad base safety programs such as motor carrier, corridor, and community based traffic safety activities into a comprehensive management approach for highway safety.**

A coordinated comprehensive approach involves the highway safety players under the leadership of a "focal point" and the use of highway safety management processes. The processes include:

Planning - (Program Assessment, Problem Identification, Establishment of Goals and Objectives, etc.)

Programming - (Program Development, Allocation of Resources)

Implementation - (Project Initiation, Review of Data Collection Provisions)

Monitoring and Review - (Project and Program Monitoring)

Evaluation - (Review of Evaluation Planning, Collection of Data, Feedback to other phases of Management Process)

#### Example

One State DOT, through leadership of the Office of Transportation Safety is building a management process within SMS which establishes decision points within project management tasks and sub-tasks. This assumes that managers have both the opportunity and responsibility to consider safety implications of activities. Not only is there a decision point, but also a mechanism to furnish pertinent, broad ranging alternatives from which to choose.

#### Example

A "Safe Community" (SC) program was implemented to reduce traffic injuries within the community. The

program was initiated through the participation of multiple hospitals and medical centers within the community. With the involvement of the hospitals, the SC program had access to multiple databases including the hospital based trauma registry, a pediatric trauma registry, an emergency department surveillance system as well as crash records. Analysis of data revealed that the community had the highest rate of crashes and injuries per 1,000 population in the state. While the leadership of the SC resided in the medical centers, executive support for the program was broad-based including: law enforcement, nursing associations, safe driving advocates etc. The SC program was primarily structured around educational training and informational programs focused on five major areas. The areas included: youth programs, substance abuse, enforcement agency support, occupant protection and a community resource center that provided traffic safety information to the community. An evaluation of SC program activities revealed a greater rate of decline in fatalities and injuries within the community than in the rest of the state. The use of child restraints was up almost 15% over non-targeted communities..

#### Example

A County implemented a community based traffic safety program that involved government agencies, political leaders, private business, and advocacy groups that had roles, responsibilities and interests in highway safety. Representatives of these groups included health department representatives, law enforcement, county and city traffic engineers, city planners, a school district superintendent, the emergency medical service director, the mayor, alcohol beverage control agents, advertising agency representatives, media representatives, physicians, nurses, representatives of SAFE KIDS, MADD, SADD, and more. This broad based group analyzed the traffic crash data for their county and identified the major highway safety problems, the victims, the target groups, the causation factors and strategies to improve the identified problems. The problems found to be most significant were: 1) lack of occupant restraint use, 2) single vehicle run off the road crashes on rural roads with no edge markings, 3) deep drop offs, and 4) no improved shoulders. Alcohol was also a factor in many of the night time crashes.

The diversity and scope of the group was well suited for planning and implementing the strategies needed to improve the crash problems that existed in the County,

and the group was sufficiently authoritative to commit and reprogram county resources.

2. **Developing processes and procedures to ensure that the major safety problems are identified and addressed. This would include identifying and investigating hazardous or potentially hazardous highway safety problems, roadway locations and features, including railroad-highway grade crossings, and establishing countermeasures and setting priorities to correct the identified hazards or potential hazards.**

Useful information for developing the roadway component of this area is contained in 23 CFR 924. It sets forth a means of developing a comprehensive highway safety improvement program to identify and correct hazardous or potentially hazardous locations and elements on existing highways. Three components are identified:

- a. Planning - identify, investigate, analyze and set priorities. Intra- and inter-agency coordination should be conducted to include consideration of roadway, vehicle and driver countermeasures.
- b. Implementation - schedule, implement, and monitor projects.
- c. Evaluation - conduct crash analyses to determine project/program effectiveness to improve future safety decisions.

In addition, the DOT Action Plan for Rail-Highway Crossing Safety includes a number of proposals for improving safety at rail-highway crossings. These include upgrading or eliminating at-grade crossings on the National Highway System (NHS), giving priority to the long-term goal of eliminating (through closure or grade separation) NHS intersections with Principal Rail Lines, and ensuring that the DOT/AAR Inventory is updated on a systematic basis.

#### Example

The Traffic Improvement Association (TIA) of a local government, a non-profit organization, has guided the County's traffic safety initiatives for over 25 years.

The TIA uses five operating principles:

- (1) The identification of traffic problems and needs by local authorities as a continuing process.

- (2) The selection of traffic crash countermeasures for prioritized needs.
- (3) The application of a "systems management" approach in program planning.
- (4) Direct participation of traffic authorities in all program phases.
- (5) Thorough program evaluation.

On a day-to-day basis, TIA's Traffic Management System provides training, coordination, public support, advocacy, public information and education, clearinghouse functions and serves as a vehicle for countywide master planning in traffic.

**3. Ensuring early consideration of safety in all highway transportation programs and projects.**

This area ensures the early consideration of safety needs, goals, and priorities throughout the development and construction of all projects and activities. The identification and assignment of safety responsibilities to specific units is important, particularly when projects are developed by various units in the central office, field offices, and/or consultants.

a. Pre-Design. Responsibilities include identifying safety needs, analyzing potential enhancements and allocating resources.

- (1) Project/Program specific
  - (a) Identify Safety Needs
    - Analyze crash history
    - Compare current standards with existing conditions
    - Analyze ROW needs, design exceptions and environmental constraints
    - Identify and consider needs of all user groups
  - (b) Select safety Improvements
    - Identify alternative countermeasures
    - Estimate and compare costs and benefits
  - (c) Prepare preliminary plans for traffic control in construction areas and selective program



countermeasure activities.

- Traffic management
- Incident management
- Public information
- Enforcement

(d) Allocate resources to assure estimate sufficiently includes needed safety work.

(2) Develop necessary statewide and/or area wide plans to address special user needs, such as National Truck Network, hazardous materials routing, and bicycle/pedestrian facility plans.

#### Example

A State Department of Transportation (DOT) has a staff member who coordinates projects and activities associated with bicycle/pedestrian related transportation. Through participation on the DOT design standards committee, the coordinator raises awareness department-wide of bike safety issues. The coordinator has also established effective outreach to relevant interest groups, including bike clubs, law enforcement, and the corporate sector, which provide input and material support for the efforts. Finally, the coordinator works with local communities and universities to establish working committees to address the issues at the local level. Efforts have resulted in designs for wider shoulders (both urban and rural), and movement of bike traffic off of roadways onto independent bike paths.

b. Design. Design provides consistent and effective application of safety enhancements. Activities initiated in the pre-design phase can be expanded to include subsequently identified safety needs.

(1) Standards and Policies - The following is to provide the designer with essential design information:

(a) Geometric design criteria for each functional classification of highway.

(b) Roadside design criteria including clear zone and barrier policies.

(c) Traffic control devices and warrants; This should include policies to address durable, high quality pavement markings and signs and control of traffic through work areas.

(d) Guidelines for addressing commercial motor vehicle, bicycle and pedestrian facilities.

(e) Ongoing feedback processes incorporating changes in program policies and procedures, design manuals, standard drawings, specifications and corresponding agency documents to assure obsolete details are upgraded or removed on a timely basis.

(2) Identification of Safety and Traffic Needs - The following procedures will assist the designer to identify safety and traffic needs and use this information in the design of individual projects.

(a) Investigate and analyze project crash histories and other data sources.

(b) Identify potentially hazardous roadway, roadside, and operational features located on and adjacent to the proposed project, or program potentially using an on-site field review with multi-disciplinary personnel.

(c) Identify roadway, roadside, and operational features not to current standards within the proposed project and discuss methods to be used in evaluating substandard features.

(d) Identify, compare and select alternative safety enhancements.

(e) Maintain records of design exceptions including all evaluations and decisions.

(f) Review all program strategies and activities, project plans, specifications and estimates for compliance with current policies, standards and specifications just before advertisement.

c. Construction/Implementation. During the construction/implementation phase, adequate and proper measures should be taken to provide for the protection of the workers and the highway users. This includes the proper location and installation of safety and operational features. The construction stage provides the opportunity to visually assess safety design and to assure that safety improvements are incorporated. Public awareness campaigns and enforcement programs can be effectively utilized in conjunction with construction or program activities. The following procedures are suggested in providing construction and implementation personnel with the necessary decision-

making information.

(1) Initiate early and continual coordination of work zone traffic safety with other agencies, such as fire protection, emergency medical services, railroad companies, and traffic law enforcement, throughout the life of the project. Also discuss the handling of possible safety enhancements identified during construction/implementation.

(2) Provide for work zone traffic safety as required in applicable Federal and State regulations. A highway work zone safety program as recommended by the Federal Register Notice implementing Section 1051 of the ISTEA will provide a good framework for improving work zone safety. Immediate evaluation and resolution of crashes and operational problems are essential. In addition, routine day and night inspections should be conducted and modifications should be made when needed.

(3) Field review to ensure safety hardware is appropriate for existing field conditions.

(4) Close coordination should be maintained with design and traffic personnel when making additions or changes in location or application of safety hardware or features.

(5) Communication should be maintained between field and office personnel to facilitate input, feedback, and information transfer for modifications to standards and future projects/programs.

(6) Newly constructed or installed safety hardware and features should be checked to ensure proper installation, type, size, and location.

#### Example

A Council of Governments incorporates a comprehensive regional safety analysis into its planning activities.

Its safety goals were adopted by them in 1990 and clearly spell out directions for safety planning in the area of traffic safety engineering, enforcement, motor vehicle law amendments, emergency medical services, occupant protection, specialized safety problems (e.g., pedestrians, elderly, bicyclists, and work zones), traffic crash data collection, and coordination and communication among agencies involved in safety planning.

4. **Identifying safety needs of special user groups such as older drivers, pedestrians, bicyclists, motorcyclists, commercial motor carriers, and hazardous material carriers, in the planning, design, construction, and operation of the highway systems.**

A means to identify and correct specific hazards on existing highways is a continuing need. There should be a process established to address safety needs associated with older drivers, pedestrians, bicyclists, motorcyclists, and commercial motor vehicle operators.

Example

A State has developed a process to analyze crash data for problem areas involving special user groups. They looked for, and found, problem corridors involving older drivers. This effort was then linked to their development of the first major area (Coordinating and integrating broad base safety programs...) so that a diverse approach could be taken to develop appropriate countermeasures.

Example

Another State has developed a Pedestrian Education and Driver Safety (PEDS) project that will increase motorist and pedestrian awareness of the State Pedestrian Safety Law. This program will provide for public information and education, the placement of bright orange traffic cones with signs at crosswalks, and include enforcement of the law. Busy downtown crosswalks and all school crosswalks were repainted to provide visible reminders of the law.

Example

Another State considers pedestrian and bicycle safety to be of major concern. Pedestrian involved crashes for the 1987 to 1990 time period were geocoded using the TRANSCAD GIS software. The crash geocodes were integrated into a database to produce a GIS-based pedestrian crash location database. The GIS database will be extended to include bicycle crashes for the 1987-1990 time period. This information allows the Highway Safety Office to identify pedestrian and bicycle crash rates based on exposure to traffic and then develop programs to address the problems.

Example

A conscious effort to look into crash problems associated with commercial motor carriers is being made in another State. They have put together a diverse group of specialists to consider all possible

countermeasures for the problems identified.

**5. Routinely maintaining and upgrading safety hardware (including highway-rail crossing warning devices), highway elements, and operational features.**

Maintenance and operational activities provide an opportunity to enhance safety. This can be accomplished by maintaining and upgrading hardware, highway elements, and operational features. Operational features include traffic control devices. Public awareness campaigns can be effectively used in conjunction with these types of activities. As an example, one State uses its changeable message signs to caution motorists about speeding, wearing safety belts, and special enforcement efforts.

a. Maintenance. To make the necessary decisions, maintenance personnel should have certain information. The following procedures are suggested for providing that information:

- Identify and report hazardous shoulder drop offs.
- Identify and report vegetation in highway rights-of-way such as large trees and shrubs that limit a driver's view or present isolated obstacles at roadway intersections and at railroad-highway grade crossings.
- Identify and report degraded signs and pavement markings.
- Identify and report damaged or missing safety hardware, highway elements, and operational devices and features.
- Identify, locate and report obsolete, substandard or nonfunctional hardware, highway elements, and operational features.
- Establish priorities and response times for inspecting, repairing, upgrading or replacing damaged hardware, highway elements and operational features.
- Develop temporary or emergency actions to mitigate the effects of damaged hardware, highway elements, and operational features.
- Provide and implement work zone traffic control plans for all maintenance activities.
- Provide timely response for low cost safety improvements.
- Conduct routine inspection and maintenance of hardware, highway elements, and operational features to assure proper performance.

b. Operational. Operational activities provide an opportunity to enhance safety by detecting and correcting unsafe traffic operations. These unsafe operations may be caused by deficiencies in geometric design features, traffic control devices, or other related factors. The following operational procedures are suggested:

- Issue permits for utility work and changes in access control with appropriate consideration of safety aspects. Policies and procedures for utility accommodations and access controls may assist in addressing the safety aspects.
- Identify and mitigate operational hazards, including environmental elements such as fog, etc.
- Provide traffic engineering expertise to develop traffic control plans and programs.
- Monitor and adjust traffic control devices.
- Monitor and improve commercial vehicle operations (permits, weigh-in-motion, etc.).
- Provide traffic engineering expertise to assist in planning to route and control traffic for special events.
- Develop and implement incident management systems.



## APPENDIX C

### SUGGESTED ITEMS FOR THE WORK PLAN

1. Discuss objectives and overall approach for development and implementation of the system.
2. Identify the designated SMS focal point and the various State organizations/agencies responsible for the major safety elements. Identify the roles and responsibilities of ALL involved agencies.
  - a. Describe the formalized interactive processes for communication, coordination, and cooperation among the various safety organizations. For example, a SMS working group, committee structure, or other process planned for the necessary interaction and SMS development, and an indication as to how it will function.
  - b. Identify procedures for cooperation with MPOs, transit operators, cities, counties, and other affected agencies; and identify any agreements/contracts that need to be negotiated with these outside agencies to complete each major task.
  - c. Identify procedures that will be used for cooperation with Federal lands highway agencies and responsibilities for coverage of Federal lands highways and other federally owned facilities.
  - d. Identify the organizational characteristics that will be established to insure the collaboration of highway safety with the health communities.
3. Identify and discuss the information needs of the SMS including data collection, analysis and dissemination (existing vs. proposed). Identify what data systems will provide for these needs and the organizations that will be responsible for routinely providing and updating the data. Explain how and by whom this information will be used to identify specific safety problems to be addressed in the State's work plan. Also, discuss oversight procedures to ensure the use of data bases with a common or coordinated reference system and methods for data sharing.
4. Identify processes for setting or reaffirming planned



short- and long-term goals to be accomplished by the SMS (ex. plans for upgrading and eliminating at-grade railroad crossings on the NHS and plans for the long-term goal of eliminating NHS intersections with Principal Rail Lines through closure or grade separation).

5. Identify processes for setting or reaffirming planned performance measures that will be used to evaluate the efforts of the SMS (ex. fatality/incident statistics, EMS response time to crashes, % of people using safety belts, etc.).
6. Discuss existing programs, processes, and activities and how they relate to the 8 key elements and the 5 major areas.
7. Identify weaknesses, missing elements, and needed organizational, procedural, or program revisions to address the regulation requirements as well as other State safety concerns for an effective, systematic SMS. List proposed activities/actions for addressing the identified process and program weaknesses and safety needs (including training needs).
8. For each major work plan activity to be accomplished, identify the time frames allocated to the completion of the activity including specific deadlines. (This could be in the form of a time-phase chart.)
9. For each major work plan activity to be accomplished, as appropriate, identify organizational or operational changes needed and resources to be used for the effort. Identify the oversight procedures that will be used by the State to assure that adequate resources are available for timely implementation of the work plan activities.
10. Identify the process(es) that will be established for evaluating the effectiveness of activities that relate to highway safety performance and short and long term goals. The results of these evaluations should guide future decisions.
11. Identify the oversight procedures that will be used by the State for assuring coordination of the SMS with other management systems and for assuring statewide compatibility of systems and performance measures of subsystems developed by MPOs, transit operators, local governments, or other agencies.

12. Provide an overall discussion of how the proposed SMS will function on a continuing basis when fully developed and implemented. For example, will there be a SMS operational work group and if so, what will be its role and authority? How will the many safety programs, responsibilities, and activities of the various agencies be coordinated and/or integrated into a systematic process?

APPENDIX D

EXAMPLES OF IMPLEMENTATION ACTIVITIES

Major Area One:            Coordinating and integrating broad base safety programs.....

Intra- and inter-agency coordination such as a Community/Corridor Traffic Safety Program is critical for a multi-disciplinary approach to a particular problem. Coordination is also critical to ensure the available funds are utilized in the most cost-effective manner. Working with MPOs and other local jurisdictions can lead to a useful process providing many returns on the dollars invested at the local level.

Major Area Two:            Developing processes and procedures to ensure that the major safety problems are identified and addressed...

Many States are implementing programs in compliance with 23 CFR 924, Highway Safety Improvement Program. The key elements become an integral part of that program. For example, the "safety analysis" is a formal part of that program which would lead to consideration of driver, vehicle, and roadway environment causative factors. As coordinated, MPOs and local jurisdictions would share their crash data with the State (if not already on the State crash system). Crash locations could then be ranked statewide according to crash numbers, severity, and cost of countermeasures. This allows projects and programs to be prioritized on actual need, crash reduction potential, and cost-effectiveness.

Major Area Three:        Ensuring early consideration of safety  
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An example of implementing this area is in the development of a landscaping project. Without full consideration for safety, a layout may be designed to plant trees 30 feet from a freeway. Although the 30 feet was used for safety reasons, a safety specialist may recommend against installing a new hazard that close to the roadway. With input from safety specialists, the landscape architects would have laid out a preliminary design using more forgiving vegetation closer to the roadway.

Another example is during the construction phase. Using the "training" key element, it is essential that construction personnel be trained in the basics of roadway safety. They

should be able to recognize a safety-related design deficiency. They would then initiate a process to check with the designer and ensure the correct design is constructed. Perhaps a proposed guardrail is shown on the plans to shield a culvert end. The construction manager may know that it would be safer to treat the culvert rather than install the new guardrail hazard. The construction manager would call the designer and discuss available options.

The key element "coordination" is vital for this major area. For example, the local law enforcement agency may have a problem with enforcement of trucking issues on a stretch of highway that is being designed for reconstruction. If this is known to the State Department of Transportation roadway design section, a truck pull-out may be designed to assist in the enforcement effort. The emergency medical personnel should also be consulted. Highway redesign with deletion of existing shoulders could adversely effect the EMS operations to a degree that would warrant a reexamination of the design.

Major Area Four: Identifying safety needs of special user groups.....

A "shopping list" of countermeasures, sorted by potential impact on identified problem areas and special user groups, along with the responsible agency, has been developed in one State. Use of this tool permits managers to make a quick sort of activities which could be considered to address identified problems with specific components relating to identified special user groups. NHTSA provides annual information on specific projects that target special user groups through the Administrator's Highway Safety Program of Excellence award program and by providing specific materials that provide ideas on ways to target special populations (National Drunk and Drugged Driving Awareness Month sampler and Occupant Protection Idea Sampler).

Major Area Five: Routinely maintaining and upgrading safety hardware.....

As an example of routine safety maintenance, several States have implemented sign management systems. An inventory of all signs was conducted. The inventory identifies needed improvements. It is also used in forecasting sign replacement costs to address retroreflectivity.

Opportunities to improve or upgrade a safety appurtenance may occur when it becomes necessary to repair or replace a damaged or deteriorated device. In these situations, a cost-effective analysis often favors upgrading or

replacement with a state-of-the-art device. For example, if a deficient guardrail end terminal has been destroyed, it would be desirable to upgrade to a state-of-the-art end terminal in lieu of replacing in-kind.

Other States have implemented safety hardware inventories. These inventories have assisted maintenance efforts by systematically addressing deficient hardware features. The inventory is updated as devices are modified and after periodic inspections. The inspections ascertain the safety readiness of highway features and alert responsible personnel of corrective actions that may be needed.

Four key elements related to this major area stand out. The first is "identification of skills and resources, i.e., training." Maintenance employees should be knowledgeable on how safety features should be installed and maintained. They should also be knowledgeable on the importance of safety features and be able to recognize potential problem areas.

A second element, "monitoring and evaluation of effectiveness," can be addressed by performing reviews of maintained devices. The review should look for problem areas. This can lead to modifications of processes to address the identified problems. Additionally, efforts should be made to monitor the cost-effectiveness of a State's maintenance program generally for opportunities to enhance performance.

The "recognition of institutional initiatives or coordination" element is also important for this area. Maintenance managers coordinating with law enforcement can improve safety in many ways. One case involves the enforcement agency needing a space for a pull-out area along a stretch of roadway. There was no room due to continuous guardrail. After maintenance forces analyzed the situation it was concluded that the location would be safer without the guardrail. The guardrail was removed which allowed space for the needed pull-out. This resulted from recognition and understanding by the highway agency personnel of enforcement agencies' need to perform their mission within a safe roadside environment

The fourth element, public information, is a less traditional player in this example. While many drivers recognize the significance of color and pattern of road striping, few are aware of the significance of roadside reflectors as indicators of change in condition. Widely known, this information could potentially enhance driver awareness of conditions and minimize problems with "driver

inattention".