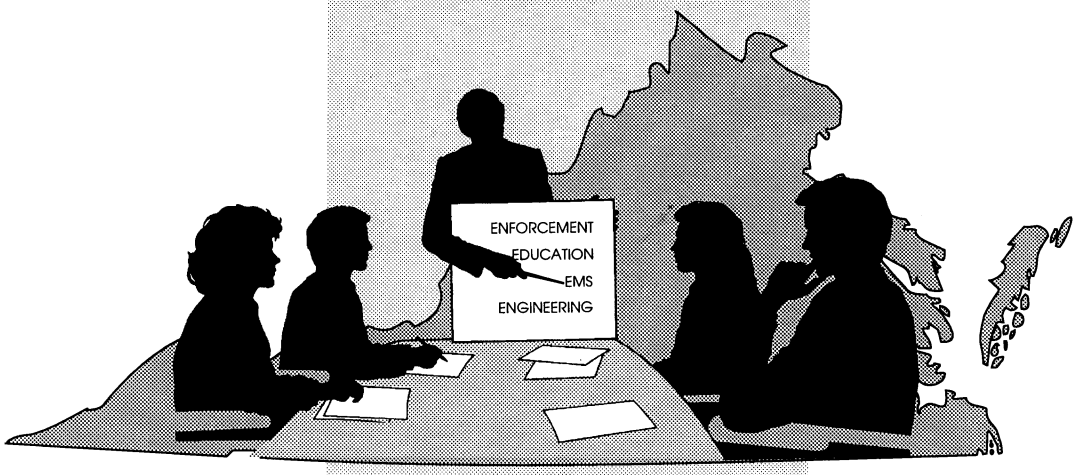
FINAL REPORT

OPTIONS FOR ENHANCING THE EFFECTIVENESS OF VIRGINIA'S SAFETY MANAGEMENT SYSTEM



JACK D. JERNIGAN
Senior Research Scientist

V · I · R · G · I · N · I · A
VTRC
TRANSPORTATION RESEARCH COUNCIL

VIRGINIA TRANSPORTATION RESEARCH COUNCIL

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/VA-96-R31		

4. Title and Subtitle	5. Report Date
Options for Enhancing the Effectiveness of Virginia's Safety Management System	February 1996
	6. Performing Organization Code
7. Author(s) Jack D. Jernigan	8. Performing Organization Report No. VTRC 96-R31
9. Performing Organization Name and Address Virginia Transportation Research Council 530 Edgemont Road Charlottesville, VA 22903-0817	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. Project No: 0193-040-940
12. Sponsoring Agency Name and Address Virginia Department of Transportation, 1401 E. Broad Street, Richmond, VA 23219 Federal Highway Administration, 1504 Santa Rosa Road, Richmond, VA 23229	13. Type of Report and Period Covered Final Report: July 1993 - February 1996
	14. Sponsoring Agency Code

15. Supplementary Notes

In cooperation with the U.S. Department of Transportation, Federal Highway Administration

16. Abstract

In 1993, Virginia began to formalize the relationships and organizational structure for its Safety Management System (SMS). Although the SMS is no longer a federal requirement, Virginia decided to continue its implementation. The Focal Point for the SMS is within the Virginia Department of Transportation (VDOT), the SMS Steering Committee in Virginia is composed of representatives of VDOT, the Department of Motor Vehicles, the Virginia State Police, the Office of Emergency Medical Services of the Virginia Department of Health, and the Commission on the Virginia Alcohol Safety Action Program.

This report outlines some options that have the potential to enhance the ability of Virginia's SMS to facilitate traffic safety in the Commonwealth. The report recommends that Virginia's SMS Steering Committee consider the following options: (1) establish an SMS coordinator position, (2) formalize a strategic planning process, (3) use the SMS to vitalize local traffic safety commissions, (4) encourage the use of the holistic corridor approach by community traffic safety programs, (5) provide for more integral involvement of the public health community in Virginia's SMS, (6) determine whether electronic communication would further Virginia's transportation safety goals, and (7) provide for the implementation of improved traffic records.

17. Key Words	18. Distribution Statement
ISTEA management systems, safety management system, SMS, traffic safety, transportation safety	No restrictions. This document is available to the public through NTIS, Springfield, VA 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

FINAL REPORT

OPTIONS FOR ENHANCING THE EFFECTIVENESS OF VIRGINIA'S SAFETY MANAGEMENT SYSTEM

Jack D. Jernigan
Senior Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

In Cooperation with the U.S. Department of Transportation
Federal Highway Administration

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the
Virginia Department of Transportation and
the University of Virginia)

Charlottesville, Virginia
February 1996

VTRC 96-R31

Copyright 1996, Virginia Department of Transportation.

ABSTRACT

In 1993, Virginia began to formalize the relationships and organizational structure for its Safety Management System (SMS). Although the SMS is no longer a federal requirement, Virginia decided to continue its implementation. The Focal Point for the SMS is within the Virginia Department of Transportation (VDOT), the SMS Steering Committee in Virginia is composed of representatives of VDOT, the Department of Motor Vehicles, the Virginia State Police, the Office of Emergency Medical Services of the Virginia Department of Health, and the Commission on the Virginia Alcohol Safety Action Program.

This report outlines options that have the potential to enhance the ability of Virginia's SMS to facilitate traffic safety in the Commonwealth. The report recommends that Virginia's SMS Steering Committee consider the following options: (1) establish an SMS coordinator position, (2) formalize a strategic planning process, (3) use the SMS to vitalize local traffic safety commissions, (4) encourage the use of the holistic corridor approach by community traffic safety programs, (5) provide for more integral involvement of the public health community in Virginia's SMS, (6) determine whether electronic communication would further Virginia's transportation safety goals, and (7) provide for the implementation of improved traffic records.

FINAL REPORT

OPTIONS FOR ENHANCING THE EFFECTIVENESS OF VIRGINIA'S SAFETY MANAGEMENT SYSTEM

Jack D. Jernigan
Senior Research Scientist

INTRODUCTION

In 1993, Virginia began to formalize the relationships and organizational structure for its Safety Management System (SMS), one of the management systems required by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 but made optional in 1995. Virginia decided to continue the implementation of the SMS. The Focal Point for the SMS is the Virginia Department of Transportation's (VDOT) Assistant Commissioner for Operations.

Five agencies signed a memorandum of understanding in which they agreed to serve as the Steering Committee to oversee the operation of Virginia's SMS: VDOT, the Department of Motor Vehicles (DMV), the Virginia State Police, the Office of Emergency Medical Services of the Virginia Department of Health, and the Commission on the Virginia Alcohol Safety Action Program. Agency liaisons were assigned for these five agencies and for the Department of Education, the Department of Criminal Justice Services, the Federal Highway Administration (FHWA), and the National Highway Traffic Safety Administration (NHTSA).

Task groups were established for the following areas: (1) data systems, (2) highway safety hardware, (3) emergency response, (4) drivers/human factors, (5) public information and education, (6) enforcement, (7) vehicles, and (8) evaluation. Committees were also formed to involve metropolitan planning organizations (MPOs), establish good practices within VDOT, and coordinate the development and implementation of all of the ISTEA management systems.

The SMS Steering Committee meets quarterly with the agency liaisons and chairs of the task groups and committees to examine opportunities for promoting transportation safety and coordinating transportation safety activities in the Commonwealth. Although Virginia has built a strong organization for its SMS, there are opportunities to strengthen its ability to function effectively.

PURPOSE AND SCOPE

The purpose of this report was to outline some options that have the potential to enhance the ability of Virginia's SMS to facilitate traffic safety in the Commonwealth. The SMS Steering Committee requested that the author draw from his knowledge of Virginia's SMS and that of several other states and recommend areas in which Virginia might benefit from the experiences

of other states. This report presents a series of options based on interviews the author conducted with key players from other states and readings concerning their SMS.

METHODS

In May and June of 1995, the author conducted a series of on-site interviews with key members of the SMS and a number of specific traffic safety programs for the states of California, Colorado, Florida, New York, and Wisconsin. These five states had been recommended by FHWA region and division offices as having strong SMS organization and processes or strong specific traffic safety programs that involve interagency cooperation.

The interviews involved open-ended discussion during which the SMS organization and processes and specific traffic safety programs were defined, and their strengths and benefits explained.

After the interviews, the author drew up a list of options for Virginia.

FINDINGS AND CONCLUSIONS

The interviews revealed a number of options that have the potential to enhance Virginia's SMS. These options involve the following issues:

- an SMS coordinator
- strategic planning
- traffic safety commissions
- corridor and community traffic safety programs
- injury prevention and control
- electronic communication
- traffic records.

SMS Coordinator

In many states, the SMS focal point is a relatively high-level administrator in a transportation or transportation safety office. Typically, these administrators have many other roles. They can lead the SMS but do not have the time to be involved in daily operations. Thus, some states have an SMS coordinator, whose role is to attend to daily system operations. These coordinators are typically entrusted with planning meetings, attending subcommittee and task force meetings, and preparing minutes. They can move the SMS forward because this task is typically their only responsibility or one acknowledged to take the vast majority of their time.

Although Virginia's SMS is structured much like those in many other states, it does not have such a coordinator. Everyone involved in Virginia's effort has other responsibilities that can easily overwhelm the SMS needs. Thus, Virginia might benefit from following the lead of other states with an active SMS and establish a coordinator position to facilitate daily operations.

Strategic Planning

Teams

New York's SMS is similar to Virginia's in that there is a core group assisted by specialized teams. The Technical Advisory Committee (TAC), similar to Virginia's SMS Steering Committee, oversees the implementation of the SMS. There are eight teams, which are similar to Virginia's task groups, that are responsible for identifying the strengths, weaknesses, and short-term and long-term opportunities for improvements related to the programs and data systems identified in their functional area. They also consider whether any programs or data systems should be linked or integrated. The criteria to be considered when recommending linking or integration include such factors as redundancy; improved program performance; more efficient use of resources; increased accessibility to information by users; and federal, state, and local legal requirements. The key objective is to eliminate duplication.

The teams also highlight highway safety programs/data systems that are performing particularly well. The criteria used in this effort include such factors as program effectiveness; the level of increased service; the costs associated with short-term and long-term initiatives; cost-effectiveness; the time associated with implementation; and the legal requirements, especially those resulting from either state legislation or regulations and ISTEA.

Strategic Planning Process

New York has a three-step strategic planning process to identify and assess existing highway safety programs and data systems, uncover and discourage unnecessary duplications of

effort, and encourage and support the development of new program and data system initiatives. The primary purpose of the formal strategic planning process is to prioritize the areas for improvement identified and facilitate the implementation of those improvements through improved communication, cooperation, and coordination. The TAC and the eight teams participate in this planning process.

Step 1: Establish appropriate mechanisms to facilitate communication, cooperation, and coordination of traffic safety programs and data systems among appropriate agencies and organizations.

This step is used to ensure that problem identification is conducted systematically and that mechanisms are established to evaluate the performance of existing programs and systems and encourage the development of new program and data system initiatives. The TAC is responsible for accomplishing this step.

Step 2: Establish an ongoing needs assessment process that will identify the strengths, weaknesses, and opportunities for improvements in the state's existing traffic safety programs and data systems.

The SMS is using annual surveys to gather information about agencies and organizations in New York that conduct traffic safety programs and/or maintain traffic safety–related data systems concerning highway safety. Two survey forms have been developed: one for highway safety programs and one for highway safety data systems. These forms collect information on the goals and objectives of the program or data system, its administration and operation, the evaluation strategies used to measure program or system performance, the interaction of the agency or organization with other such groups, and the ways in which the program or data system addresses the five major safety areas of the SMS.

These annual surveys are conducted with assistance from the members of the TAC, who are responsible for overseeing the completion of the survey forms for their organization. They are encouraged to distribute copies to all appropriate staff from their organization to obtain as comprehensive a description of the programs and/or data systems as possible. The eight teams review the information collected through this effort.

Step 3: Prepare an annual report describing and assessing the state's highway safety programs and data information systems, identifying their strengths and weaknesses, and recommending ways to improve highway safety.

After completion of step 2, an annual report is prepared describing the status of the SMS. Each team leader is responsible for preparing a report summarizing team findings, which

is submitted to the TAC for review and comment. Team reports, revised as warranted by the comments of the TAC, serve as the foundation of the annual report of the strategic planning process. The report summarizes the activities undertaken in the previous year and describes the progress made in implementing the SMS. It also includes information on any problems or concerns that arose during the year and a summary of the goals for the coming year.

The annual report discusses areas where highway safety could be improved, recommended improvements, problems associated with implementing the improvements, and the persons or organizations and time frames that would be involved in their implementation. The plan also describes in detail the mechanisms and/or processes developed to encourage the development of new initiatives, assess the performance and effectiveness of recommended improvements and new initiatives, and promote communication and cooperation among the interested groups.

For improvements or new initiatives that involve technology, the report discusses how the actual or planned use of the technology relates to the management process. It provides information on cost estimates for implementing recommended technological improvements and any new technological initiatives, including any cost savings that would result from their implementation and a time line for the implementation.

The report also includes a section that documents each innovation or technology recommended or already implemented. The documentation describes the problems encountered and/or solved by using specific technologies or innovations. The information is comprehensive and sufficiently detailed so that other agencies and organizations may use similar technology or innovations in upgrading their traffic safety data systems. To facilitate technology transfer, the plan identifies the agencies or persons to contact regarding the improvements or technologies involved.

Although New York's three-step planning process is intensive, formalizing Virginia's SMS processes and specifying the deliverables of the task groups might give these groups more direction.

Traffic Safety Commissions

Wisconsin's SMS has an effort underway to expand the SMS approach to improving highway safety to the local level by using an existing resource: county traffic safety commissions. In 1971, the Wisconsin legislature passed a law requiring a traffic safety commission in every county. Community organizations, businesses, and citizens are encouraged to meet and work with the commissions.

Guidelines for the commissions were developed by the Office of Transportation Safety. The commissions are to meet at least quarterly to review traffic crash data from the county, discuss other traffic safety–related matters, and make recommendations to their local decision

makers. The duties of the commissions require them to direct recommendations for any corrective actions in writing to the appropriate governmental official, such as the district highway engineer, the county highway commissioner, enforcement agency heads, traffic court judges, the Department of Transportation, the county board or county highway committee, and any other appropriate branch of local government.

Some county commissions are very active, and some are relatively dormant. However, Wisconsin is developing a plan to vitalize the commissions by making them coordinating bodies to act as mini-SMSs to exchange ideas at the local level. An ad hoc committee was formed to examine the current effectiveness of the commissions and recommend how their function and role could be improved.

Virginia might also benefit from vitalizing its local traffic safety commissions to identify problems and propose solutions. In particular, Virginia's local traffic safety commissions could be used to extend the SMS approach to improving highway safety to local roads and provide for local involvement in improving highway safety within a community.

Corridor/Community Traffic Safety Programs

The overriding philosophy of corridor safety improvement projects is that there is a need to take a more holistic approach to identifying and addressing traffic safety problems. Corridor safety projects operate under the philosophy that high crash and injury rates occur along specific stretches of highway—corridors. Once identified, the corridor is brought to the attention of a multidisciplinary task force of experts and interested parties to find the best ways to identify and address the problems experienced on the corridor. In recent years, FHWA has been a proponent of the implementation of the corridor approach, and a number of states, including Virginia, have at least pilot tested corridor safety improvement projects.

California

California's first corridor safety improvement project is an example of such an approach. It involved people at the local level who had an interest in the selected corridor and in emergency response, engineering, education, and enforcement. A task force with representatives of local, state, and federal government agencies and the private sector convened to study the corridor. Data were reviewed in great detail to determine the factors involved in the traffic safety problems on the corridor. The problems and their solutions were organized into four sections involving the engineering, education, enforcement, and emergency response. The task force developed an action plan to address their proposed solutions in the short and long term. Although the project was completed only in November 1994, many recommendations of the task force have either been implemented or initiated.

Several factors were cited by the California Highway Patrol (CHP), which administered the project, as keys to the success of the project. One was the fact that a local coordinator was selected to oversee the program. CHP had an interest in the program and was heavily involved in it, but they did not dictate the results of the project. Instead, they acted as support staff for the task force, providing data, facilitating the scheduling of meetings, and taking the minutes of the meetings. Thus, this was allowed to be a local program.

The cooperative spirit of the task force was also credited with the success of the project. The members were described as energetic, open, nondefensive, and dedicated to doing their best to develop a workable plan that had a chance to succeed. The expertise of each member was also acknowledged and respected by the other members. Likewise, the agencies represented on the task force were commended for being cooperative and supportive of the effort. Each agency supported the task force by sharing staff with the project, and many agencies contributed additional funding and staff resources to support the program.

Florida

Florida took the holistic corridor approach of using data and multidisciplinary task forces to identify and propose solutions to traffic safety problems a step further. The approach is applied to both corridors and communities in accordance with an approach developed by NHTSA. In fact, a significant feature of Florida's SMS is that Florida uses the Corridor/Community Traffic Safety Program (C/CTSP) process to implement the SMS statewide through local agency, state agency, MPO, and private sector involvement. Part of the rationale for doing this is that a C/CTSP can solve problems considered severe in the community. The top 20 high-crash counties in Florida account for 82% of the crashes. Florida's SMS has targeted these 20 counties as high priorities for the development of C/CTSPs. To date, C/CTSPs have been implemented in counties that account for 37% of the crashes.

C/CTSPs started in 1989 when Florida had a high fatality rate and localities looked to engineers to help decrease it. Problems are identified and countermeasures proposed through local multidisciplinary committees. FDOT plays a support role in helping locals start programs by having the district safety engineers act as catalysts to meet with locals.

To have a successful C/CTSP, some key players in Florida recommended the following:

1. *Have a driving force at the local level,* either one or more dynamic individuals.

2. *Bring engineering, enforcement, education, and emergency response together* in terms of people, organizations, and programs.

3. *Keep safety problems in perspective,* e.g., degrees of safety problems in the project area compared with that of statewide problems. Good data are needed to do this. Efforts must target a problem that needs to be solved.

4. *Define problems in terms of the local level so that the community will know what is in it for them,* e.g., less downtime for employees, fewer children injured, lower property damages, lower insurance rates. Develop a county/local profile, e.g., number and percentage of alcohol-related crashes, those due to speeding, lack of occupant-protection use, time and locations, age groups. Although highway safety is not a major concern of many people, the ancillary benefits may interest them. Thus, determine what the payoff is for the players.

5. *Develop good "after" data to justify and support C/CTSP efforts.* Well-designed and well-conducted evaluations are needed.

6. *Establish the attention and interest of local politicians and community movers and shakers.* C/CTSPs, through involvement of top level public, private, and public sector individuals, will generate this interest and support.

7. *Establish good cooperative relationships across all disciplines through active participation and involvement on the C/CTSP committee and through implementation of coordinated countermeasure programs.* Network the different disciplines. Having one or two key people who are trained in a short course on this topic is helpful.

8. *Leverage financial support,* e.g., engineering improvements through Statewide Transportation Improvement Plan and other seed money, help through 402 program funds, and help through private sector funds (e.g., insurance companies and civic organizations). This will also result in more efficient use of agency operational funds through cooperative programs.

9. *Evolve through expansion of a single countermeasure or specifically focused program,* e.g., corridor safety, Safe and Sober programs.

10. *Coordinate/broker at a central level* (highway safety office), e.g., to determine what others are doing, identify and provide for management and technical support when

needed, build coalitions, identify funding sources. This central level does not attempt to manage or control but acts in a clearly supportive role.

11. *Organize the C/CTSP to establish enough authority and clout within a project to make it work,* e.g., through police chiefs, traffic engineers, EMS managers, insurance leaders. Establish an organization structure with a chair, vice chair, etc., with subcommittees as needed.

12. *Do not rely on state or federal funding sources to sustain the C/CTSP in the long term.*

13. *Remember that the key is getting people to work together.* With a C/CTSP, players get to know each other and thus can work together better.

Virginia

Although Virginia has both corridor and community traffic safety programs, both might benefit from a broadened perspective. That is, the community programs might use the holistic corridor approach, and a corridor program might be expanded to include an entire community. An example of the merger of these two approaches exists in the Roanoke area, spearheaded by both DMV and VDOT.

Injury Prevention and Control

One of the most interesting and innovative aspects of California's traffic safety program involves the relationship forged between the Office of Traffic Safety (OTS) and the Department of Health Services (DHS). In 1989, DHS was awarded a 4-year capacity building grant from the U.S. Centers for Disease Control (CDC) to assist in developing a comprehensive injury and prevention control program. In 1990, a State Injury Control Advisory Task Force was convened to help guide DHS in achieving its goal. Because traffic crashes are among the leading causes of death and injury in California, and are the leading cause of unintentional deaths, OTS and other traffic safety experts were invited to participate on the task force.

The task force was specifically charged with developing a strategic injury prevention and control plan for California. The resulting plan (*Strategic Plan for Injury Prevention and Control in California, 1993-1997)* was targeted to address priorities for action, determine the most effective use of scarce resources, and recommend prevention strategies to reduce the number of injuries across the state. In effect, this document provides a policy framework for state and local decision makers, serves as a benchmark of progress, and can be used as an educational tool to increase awareness of the magnitude of injury problems. A section of this document deals

specifically with traffic safety. To date, about two-thirds of the objectives have at least been initiated.

The cooperative effort between OTS and DHS has produced results as well. Laws related to several of the legislative goals have been passed, including a ban on passengers in the cargo area of pickup trucks, a child safety seat law, a primary safety belt law, and a law requiring bicyclists under the age of 18 to wear helmets. Likewise, programs to provide child safety seats for low-income families have been initiated, and efforts to promote pedestrian safety have increased. Perhaps the greatest benefit of the cooperative relationship is that both sectors have a beneficial partnership. Virginia might also benefit from a more integral involvement of the public health community in the SMS.

Electronic Communication

Wisconsin's SMS Steering Committee established an ad hoc committee to investigate the ways the SMS might use electronic communication to facilitate its mission. One issue involved the ability of the traffic safety community to communicate directly with one another. Although many of the organizations in the traffic safety community have their own e-mail systems, communication across organizations is difficult. The ad hoc committee recommended the use of the Internet for direct communications. Thus, it was recommended that Internet access be acquired for the various traffic safety organizations.

Another issue involved the use of electronic communication to provide general information to the other members and the public. Specifically, the work group investigated the potential use of electronic bulletin board systems (BBS) and the use of World Wide Web pages on the Internet. The work group found that a BBS can be implemented on a PC with software that costs from $200 to $1,000. Once implemented, a BBS requires at least 8 hours of maintenance time per week. BBS vary from the simple to the complex, thereby providing many different options.

The use of any electronic technology in providing for communication requires a plan of action. That is, the indiscriminate use of this means of communication has led to the creation of poor or unnecessary information. Although BBS and the Internet can provide access to information, there is no assurance that the information will be accurate. Thus, decisions need to be made to ensure the credibility of safety information that is put out for public access. Likewise, much time could be spent preparing information that might not be accessed or be of use to anyone who accesses it.

The ad hoc committee concluded that several activities need to be completed before choices on the use of electronic communication can be made:

- A mission for such communication needs to be developed.

- Goals and objectives need to be developed.

- Expected users need to be considered (particularly who they might be, what their needs might be, and their ability to commit resources to the system).

- Potential material to be shared electronically needs to be considered (e.g., the highway safety plan, crash facts, SMS components, monographs, traffic safety commission activity reports).

- Resources to maintain the information need to be considered.

Once the decisions are made that define what is wanted by electronic communication, a state will be better equipped to recommend the course of action to take. Virginia might also consider whether enhanced electronic communication abilities would further the mission of the SMS.

Traffic Records

Data Linkage and Electronic Transfer

Within the past several years, many states have undergone traffic records assessments and developed strategic plans for traffic records. Virginia is currently undergoing that assessment and planning process. Two common problems noted from this process are that (1) data entry is often duplicated and (2) linking databases containing information on related topics is difficult, if not impossible. Electronic transfer of data is a potentially efficient means by which to eliminate duplication in the data entry process. Establishing common reference fields is, likewise, a potentially efficient means by which to link databases.

The SMS Steering Committee should consider how best to take advantage of the results of Virginia's strategic plan for traffic records.

Geographic Information System

Colorado began its Geographic Information System (GIS) program in 1986. The program is located in CDOT's Planning Division, which coordinates GIS applications development with the other divisions. The focus of the program is to build a decision support tool rather than data systems. There is one GIS platform, and other databases are being tied into that platform rather than having their own independent GIS platform. Thus, the autonomy of the various divisions in CDOT in using a variety of databases is recognized, but all GIS efforts must be linked to a single GIS platform. Data are being linked, but the various data systems are not being merged.

Rather than developing custom GIS software, Colorado selected ARC/INFO and ArcView platform, readily available GIS software, for its GIS. The software converts spatially related mapping information to a digital computer format that allows data to be represented visually on computer-generated maps. The unique aspect of the system is its ability to selectively represent various combinations of data on the computer screen as map points. The software is PC based and can be accessed through file servers.

CDOT has prepared an RFP to use GIS to support the SMS decision-making process. One of the underlying motivators for this RFP is that the problem identification process should be an integrated one. That is, rather than the various data related to crashes and crash risks being looked at separately, they should be looked at simultaneously. An integrated assessment would combine driver, roadway, and vehicle factors in problem identification and look for engineering, education, enforcement, and emergency medical service countermeasures. These problems and countermeasures could be compared based on relative risks and on benefits and costs to prioritize needs and solutions. In essence, CDOT's approach is to determine, based on probability, the factors associated with crashes and apply them to the roadway to determine the likelihood of occurrence and severity of crashes. They are looking to evaluate the risks of a particular portion of roadway as if they were insurers looking to underwrite it.

The RFP has two major action elements:

1. *Develop procedures for a comprehensive statewide safety problem identification process that would integrate roadway, traveler, and vehicle elements including conceptual level procedures applicable to city and county levels of transportation networks.* Ultimately, this element is to provide computerized analytic procedures using statistical analysis to diagnose principal contributing causes of crashes at the system and corridor levels and develop an evaluation methodology for assessing the effectiveness of countermeasures and compare the impacts of programs directed at the driver, vehicle, and roadway.

2. *Systematically incorporate safety considerations into a Long-Range Transportation Plan, a Statewide Transportation Improvement Plan (STIP), and Transportation Improvement Programs (TIP).* The purpose of this element is to develop systematic safety input into the plans and programs and recommend solutions to the problem of the optimal allocation of resources to maximize safety effectiveness.

Although this ambitious effort is in its beginning stages, this investigation is made more feasible by the integration of databases under the GIS platform.

In Virginia, the GIS is not as close to completion as it is in Colorado. It might be possible for the SMS in Virginia, however, to serve as a catalyst in moving Virginia's GIS forward. Considering a proposal as ambitious as that put forth by Colorado might then be feasible.

Railroad Crossing Inventory

Related to the GIS is the ongoing update of Colorado's railroad crossing inventory. The existing inventory is 16 years old, and the decision was made to update it and allow the data to be related to the GIS. ArcView software allows the crossing information to be referenced to the GIS. Further, the software permits digitized images of photographs to be stored and keyed to the GIS.

CDOT has about 3,000 crossings to inventory, and they have a goal of finishing the update in 2 years. To update the inventory, two CDOT employees are dedicated to traveling to each crossing. To facilitate quick and accurate collection, the employees are provided with the data from the last inventory. They either confirm the correctness of the data or document changes. They also have digital imaging cameras from which images can be directly transferred into the computer. Photographs are taken of the location from two angles. The location of the crossing is taken using hand-held global positioning system (GPS) locators, and the data are input into the GIS mapping system. Once at the site, it takes the CDOT employees 10 to 15 minutes to record the relevant data. Other types of inventories could use GIS software similarly, which could provide a number of benefits to Virginia if such a system were implemented.

RECOMMENDATIONS

Virginia's SMS Steering Committee should consider the following options:

- Establish an SMS coordinator position to facilitate the daily operation of the SMS.
- Formalize a strategic planning process for the SMS.
- Use the SMS to vitalize local traffic safety commissions to identify problems and propose solutions to those problems.
- Encourage the use of the holistic corridor approach by community traffic safety programs, thereby encouraging the use of data and multidisciplinary teams to identify and propose solutions to traffic safety problems.
- Provide for more integral involvement of the public health community in the SMS.
- Determine whether electronic communication alternatives available through electronic bulletin boards and the Internet would further Virginia's transportation safety goals.

- Provide for the implementation of improved traffic records, including data linkage, electronic transfer of data, and GIS.