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ABSTRACT

This paper proposes a "realistic" safety management system (SMS) in response to a requirement in the 1991 Intermodal Surface Transportation Act that states develop and implement SMSs. It considers the draft document entitled, A Management Approach to Highway Safety (a Compilation of Good Practices) offered by FHWA as guidance for state highway agencies designing SMSs. The proposed "good practices" are evaluated and modified to reflect the realities of competing needs and limited resources. The paper then describes a new process developed by the New York State Department of Transportation (NYSDOT) which ensures that safety is considered in project selection, development and design under other management systems. That process, begun with NYSDOT's "Safer Infrastructure Program", offers highway agencies the opportunity to accomplish two management system goals in the same project (e.g. safety and pavement, or safety and bridge). It serves to break down institutional barriers and makes the SMS a part of the comprehensive and coordinated highway management system called for in the FHWA guidelines. This is followed by a discussion of certain "key elements" described in the FHWA guidelines.

The paper concludes with an appeal to FHWA that, as it goes through the process of establishing minimum standards for SMSs, it avoid requirements that states undertake specific activities which reach beyond their ability to deliver and divert limited resources away from what are perceived as more productive endeavors. Instead, states should be required to demonstrate sound goals and a reasonable mix of policies and actions which accomplish them.

INTRODUCTION

A requirement of the Intermodal Surface Transportation Efficiency Act of 1991 mandates that the Secretary of Transportation issue regulations to the states governing the establishment and implementation of a system for managing highway safety. The degree of importance attributed to this provision of the new Highway Act is indicated by the seriousness of the penalty which could ensue if a highway agency fails to implement an acceptable system. After September 30, 1995, the Secretary may withhold up to 10% of all highway and transit funds apportioned to the state, if the safety and/or other management systems required by the act are not implemented.

FHWA GUIDANCE

It is not entirely clear what FHWA has in mind for a safety management system. For guidance, state highway agencies have received from FHWA a draft document entitled Management Approach to Highway Safety (a Compilation of Good Practices). The "Management Approach" is billed as providing general assistance in developing and implementing a management approach to highway safety. It outlines the principles which should characterize such a system. According to the "Management Approach" a Safety Management System should be coordinated and comprehensive. It should not be separate but part of a comprehensive and coordinated highway management system. It should be guided by long and short-term goals and should deal with existing and anticipated problem locations. Its performance should be measurable. It should involve training. It should be monitored and evaluated, and it should streamline tasks and processes and increase the effectiveness of future processes. The system should also be fueled by an integrated database with linked data files for accidents, roadway, roadside, traffic control devices, traffic volumes, vehicles, and drivers.

Unfortunately, while it mentions important management concepts, the "Management Approach" does little more than list those concepts together with desirable activities which might contribute to achieving system goals and objectives. It is, in fact, what it professes to be, "a compilation of good practices". It does not address the kinds of difficult choices that need to be made in designing and implementing a management system. More precisely, it does not grapple with the limited resources and competing needs which comprise the real world. A "realistic" safety management system must recognize and address those realities and the difficult choices.

PURPOSE

This paper proposes a "realistic" safety management system. It will begin by describing the central feature of a "realistic" safety management system, a management system goal. Once the safety goal is determined, policies and activities necessary to achieve the goal will be decided based on a measured application of the list of "good practices" offered by the "Management Approach" provided by FHWA. Those "good practices" will sometimes need to be modified to reflect resource limitations and considerations of cost effectiveness. Discussion of the applicability of the "good practices" to a realistic safety management system will be followed by an account of a process developed by NYSDOT to include safety considerations in project selection, development and design under other management systems. That process, begun with NYSDOT's "Safer Infrastructure Program", offers opportunities for agencies to achieve two management goals (safety and pavement, or safety and bridge) in the same project. By breaking down institutional barriers between functional areas within highway agencies, the safety management system becomes part of a comprehensive and coordinated highway management system called for in the FHWA guidelines.

The final section of this paper will discuss a number of the "key elements" described in the "Management Approach" as they relate to a realistic safety management system. Key elements are aspects of a safety management system which ensure that system goals and activities designed to achieve those goals are capable of being achieved and are in fact achieved. They ensure the existence of adequate information (integrated data base), skills (training), and communication (inter-intra agency coordination), to accomplish system goals. Furthermore, they ensure the existence of a process for evaluating goal achievement (accountability/monitoring and evaluation).

This exercise will, in part, be based on the experience at the New York State Department of Transportation. But there will be elements of the system which do not exist either at NYSDOT or elsewhere, as far as is known. The circumstances and considerations which shape this hypothetical safety management system will be explained as the paper progresses. This exercise will, above all, involve making choices, sometimes in the form of compromises, and setting priorities.

"REALISTIC" SAFETY MANAGEMENT SYSTEM

A realistic safety management system must conform with the elements of any other safety management system, i.e. it must be comprised of a regularly interacting or interdependent set of policies and activities, operating within a context of competing demands for limited resources, and directed, with a degree of skill, toward the achievement of a clearly defined purpose.

"Realistic"

Being realistic connotes a sensitivity to limitations - to what is practical or possible. As it relates to a safety management system, it suggests that agencies restrain themselves from reaching into policies and actions which may offer uncertain or clearly limited accident reduction benefits. Being realistic should never, however, be understood to discourage highway agencies from doing everything practical and possible to improve highway safety. To the contrary, being realistic should cause highway agencies to search continuously for new opportunities to improve highway safety within the context of a well defined goal and recognized fiscal and human resource limitations.

A realistic safety management system must recognize and respond to a number of factors which operate upon it. Some of those considerations are as follows:

- A realistic safety management system must reflect the existence of competing agency goals related to pavements, bridges, mobility, etc. Not only do those competing goals sometimes have greater access to agency resources - financial and human - but policies and actions associated with achieving them might actually offer opportunities to accomplish some part of the safety goal as well. For this reason, a safety management system should attempt to insert safety considerations into project selection, development and design criteria for programs and projects associated with other competing agency goals. However, in doing so, a realistic safety management system should be sensitive to the needs of other program areas and should avoid threatening the accomplishment of their goals. It is critical to the success of all agency management systems that functional barriers be replaced by an atmosphere of mutual assistance and trust.
- A realistic safety management system must recognize that whenever a highway agency takes some action which affects any portion of the highway system, it should seek to improve public safety. While that may not always be possible, an agency action should, at a minimum, never increase danger to the public. The degree to which potential or actual accident problems are treated will depend on the nature of the project and

the costs and anticipated benefits engendered by the project.

- A highway agency should also be aware of high accident locations and should have a policy to address them, even when no agency project actions are underway or planned for the affected locations. This implicit public responsibility is at the heart of the Federally mandated Highway Safety Improvement Program (HSIP). It requires that highway agencies systematically identify accident locations, study them, implement cost effective accident countermeasures when appropriate, and evaluate the impact of those actions.
- Finally, a highway agency is obligated to the public to conduct its activities in a fiscally responsible manner, i.e. it should use public funds wisely.

SAFETY MANAGEMENT SYSTEM GOAL

Based on the considerations listed above, the proposed realistic safety management system goal reads as follows:

The agency's safety management system goal is to provide and maintain a safe transportation system by identifying and addressing high accident locations and by ensuring that safety considerations are included in project selection, development, and design for all agency programs and projects, as part of the project selection process.

GOAL ACCOMPLISHMENT

Activities or actions required to achieve this goal could be construed to fall under the "four major areas" defining safety activities listed at the beginning of the FHWA endorsed Management Approach to Highway Safety (A Compilation of Good Practices). Each major area will be addressed separately.

1. Identify, investigate, set priorities, and correct hazardous or potentially hazardous roadway locations and features with existing or potential accident problems (includes planning, implementation, and evaluation).

The Highway Safety Improvement Program (HSIP) should continue to be an integral part of highway safety management systems. Use of computerized accident surveillance systems to identify high accident locations and to evaluate program and project performance should be encouraged. The most severe accident locations should be investigated and cost effective safety improvements should be implemented at those locations.

Most highway safety improvements implemented

under NYSDOT's HSIP consist of low cost signing improvements implemented with Department forces. At NYSDOT, only one in ten investigations results in a recommendation for an expensive capital project. Safety capital projects have proven to be very costly, costing an average of \$300,000 for each tenth of a mile treated with Federal safety categorical Hazard Elimination Safety (HES) funds. Accident reductions have also been fairly modest (approximately 27 percent overall). The Department found that low cost signing improvements at high accident sites have been nearly as effective. A realistic safety management system would, therefore, emphasize low cost accident countermeasures. Capital projects would be implemented only when lower cost alternatives would not effectively treat the safety deficiency.

A realistic safety management system would not emphasize the identification and treatment of "potentially hazardous" roadway locations until the agency's known high accident locations have been addressed. "Addressed" means examined to determine if a cost effective corrective action is feasible. It does not mean that all identified and investigated high accident locations will be corrected, since a cost effective solution may not be available. Still, even with this caveat, it is not likely that a highway agency will have the manpower or resources to address all of its high accident locations. This being the case, it is highly unlikely that an agency, operating under the proposed realistic goal, would seek out highway locations where accident potential rather than an actual accident history exists. Therefore, under this proposed "realistic" safety management system "potential" accident locations would not be likely to receive systematic consideration, except when those locations occur within the limits of agency actions undertaken for other reasons (e.g. maintenance or capital project actions).

2. Ensure early consideration of safety improvements in all highway projects (includes project development, design and construction).

As part of its responsibility to ensure that its actions do not endanger the public, and that those actions actually improve public safety when it is cost effective to do so, highway agencies, operating under this realistic safety management system, would ensure that its projects are designed in accordance with appropriate Federal and/or agency standards. Exceptions to those standards would be allowed. However, those exceptions would be subject to approval by appropriate agency or Federal authorities. If an agency were to decide to exempt a definable group of projects from existing

approved standards, it would need to establish a new set of standards for that category of projects. The new standards would be expected to reflect appropriate safety concerns.

An agency also has a responsibility to the public to continuously review its standards in light of changes which affect the transportation system and the existence of new highway safety related research findings. In part because most highway standards are safety related, a realistic safety management system would determine a reasonable level of activity in the area of updating standards in the face of those changes. In many states, the level of activity in this area is dependent upon the amounts of Federal Highway Research Funds available. The ISTEA has increased the proportion of HPR funding relative to overall Federal Highway and Transit funding indicating the high priority FHWA places on planning and research activities.

In designing capital projects, highway agencies should not limit safety involvement to consideration of applicable standards. The agency should also look at accident histories at all project sites. This is now being done at NYSDOT as it develops projects for its capital program. Under the Design Quality Assurance elements of the Program and Project Management process, the Department ensures that all capital project locations are examined for accident problems and whenever it is cost effective to do so, the projects are modified to treat those identified problems.

This practice not only ensures that safety problems, not accommodated by standards, are addressed, but it also allows an agency to implement more flexible standards. For example, at NYSDOT a more flexible set of standards for simple resurfacing is being developed. In order to qualify for the new standards, potential project locations must not have experienced patterns of certain classes of accidents including run-off-the-road accidents. Once those accident experience criteria have been met, the project location is authorized to be resurfaced in accordance with reduced standards - in this standards for delineation, signing superelevation.

3. Maintain and upgrade safety hardware, highway elements and operational features (includes deficiencies in roadside features, traffic signals, and maintenance and control of traffic at construction sites).

Signing

Properly installed and maintained traffic control, warning, and directional signs are cost effective roadside

safety treatments. NYSDOT before/after evaluations have shown that warning signs generate large accident reductions. Curve, arrow, and T intersection signs, in particular, yield accident reductions ranging from 32 to 41 percent at treated high accident locations. Even taking into consideration the estimated impact of the statistical phenomenon of regression to the mean affecting low volume, high accident locations, true accident reductions remain substantial (12 to 21 percent). These accident reductions are impressive, particularly for such low cost accident countermeasures.

A sign management system would, therefore, occupy a central position in an agency's realistic safety management system. A cost effective sign management system would establish standards for sign effectiveness, and maintain those standards through annual daytime and nighttime sign inspections. These systematic inspections could be combined with inspections of other highway and roadside features such as guiderail, striping, and delineation. Signing deficiencies would also be reported throughout the year in the course of normal maintenance activities. The sign management system would provide for the replacement or upgrading of deficient signs.

A procedure would also be established for the timely installation of new traffic, warning, control, or directional signing when requested by agency traffic or maintenance officials. A significant portion of new safety related signs would be generated by the agency's Highway Safety Improvement Program as a result of studies of high accident locations. Furthermore, new or replacement signing would be considered for all Department project actions as part of an agency's public responsibility to enhance safety as part of its actions affecting the highway system.

An inventory of all agency signs would not be part of a realistic management system. The design and maintenance of such an inventory would be costly. North Carolina, for example, has estimated that the cost of developing a computerized sign inventory with 25 pieces of data per sign would cost \$4.87 million for its 76,000 mile highway system. The estimated cost of maintaining the inventory is estimated at \$500,000 annually.

The fact is, no one has been able to demonstrate the advantage of a sign inventory over a simple annual sign survey which, after all, would be necessary to maintain such an inventory. Perhaps the strongest argument in favor of an inventory is that if an agency wishes to manage its signs, it must know what exists in the field. Unfortunately, this argument can not be translated into any material safety benefits. It might prove convenient to call up signing information on a computer screen as part of an accident study. But, in the final analysis, a site visit

would be necessary to confirm and clarify whatever information is gleaned from the computer, as well as to gain additional insight into the accident problem(s) being studied. Also, it is not likely that a highway agency would seriously consider replacing signs based solely on some average life expectancy calculated by a computer program. Sign life can be expected to vary and replacement decisions would better be decided by the annual survey which, again, should be the central feature of a sign management system.

Other Roadside Safety Features

Other safety related roadside features include clear areas, guiderail, roadside delineators and slopes. Existing guiderail would be maintained in proper operating condition through an annual survey of the agency's entire highway system followed by the repair or upgrade of impacted or otherwise damaged railing. The guiderail survey could be conducted jointly with the sign survey. As in the case of the sign management system, guiderail maintenance would also benefit from the reporting of system breakdowns resulting from routine maintenance activities conducted throughout the year. At NYSDOT, a program also exists for identifying motorists involved in accidents which result in damage to roadside features. The purpose of the program is to make it possible to recover losses from motorists' insurance companies. However, a spin-off from the program has been the notification of the Department's maintenance forces of damaged facilities in need of repair.

As in the case of sign management, before deciding upon extensive inventories of guiderail, utility poles, or other roadside features, considerable thought should be given first to the purposes of the inventories and second to the manpower and financial costs of developing and maintaining them, particularly as compared with the benefits the systems are intended to generate. Failure to account for appropriate uses and the long term costs of maintaining such systems has often resulted in their abandonment after considerable developmental costs. If a highway agency were to decide upon a limited or extensive inventory for the purpose of prioritizing the maintenance or upgrade of certain roadside safety features such as guiderail or utility poles, accident history should be considered together with the contributions of roadway/roadside and volumes to accident potential.

Under a realistic safety management system, roadside accident locations rather than roadside safety features would remain the primary focus of attention for highway safety officials. Locations experiencing high proportions

or rates of run-off-the-road accidents would be identified, studied, and treated. Options for treating those locations would vary from accident countermeasures such as delineation or slope improvements and relocating utility poles to the upgrading or installation of new guiderail depending on the nature of the accident problem being addressed and the relative cost effectiveness of appropriate alternatives.

Again, in response to its implicit public responsibility to seek to improve highway safety wherever it undertakes activities affecting its highways, a highway agency would ensure that guiderail, utility poles, and other roadside safety features are addressed as a part of all project actions. Since trees, utility poles, and guiderail are the three most frequently struck roadside objects, their removal (possibly accompanied by slope improvements) would be among options considered during project development.

Traffic Signals

In New York State, traffic signals, when installed for safety reasons, have been shown to substantially reduce right-angle and rear-end accidents from between 30 and 80 percent. It is, therefore, valuable from a safety point of view to maintain signals functioning properly. However, it is also true that some signals are more critical than others. A realistic safety management system would maintain signals within heavily traveled corridors at maximum operating efficiencies. This would involve short repair times for signal software and hardware problems (including detector failures). It would also mean that signals in those corridors would be upgraded to state of the art standards and that timing plans would be subjected to timely review to accommodate changes in traffic patterns. Signals in those areas would be monitored with computerized "closed loop systems" which would provide agency officials with instant information regarding system or signal breakdowns.

Maintaining signal systems within heavily travelled corridors at optimum performance occupies a special place in a realistic safety management system. It involves an agency activity which crosses functional areas within many highway agencies by serving the purposes of two management systems: congestion and safety. Serving the purposes of two management systems in the same project exemplifies a wise use of public funds toward the accomplishment of what NYSDOT views as its overall mission: the provision of a safe and efficient transportation system.

Maintenance and Protection of Traffic

Another activity critical to achieving the safety management goal of providing and maintaining a safe highway system is ensuring a safe construction site. This is being done in New York State through a well developed program involving the establishment of "typical" Maintenance and Protection of Traffic (MPT) plans, procedures for regular and exceptional monitoring of construction sites, and the collection and analysis of accident data for accidents occurring at construction sites. The material and human resource demands of these practices are substantial, but they are necessary for a realistic safety management system, because of documented increases in accident experience at construction sites.

4. Identify special safety needs of commercial motor vehicles in the planning, design, construction and operations of the highway system.

One of the leading benefits of the highway systems is its provision of a cost effective method for delivering goods. The safety implications of the transport of those goods by commercial vehicles of varying weights and configurations is currently being assessed. Although it is recognized that commercial vehicles require longer stopping distances, that they are less adaptable to changes in traffic patterns, and that accidents involving them are potentially more severe, little is known at this time about their susceptibility to accidents. This is largely because specific accident data relating to particular truck weights and configurations has not been available.

Under a realistic safety management system, commercial vehicle related characteristics would be included in its integrated accident information system. That information would be used to determine possible design standard changes which might benefit the safety of commercial vehicles (and possible smaller vehicles as well) without endangering occupants of smaller passenger vehicles. Considerations of cost effectiveness would be part of any decision to raise standards, such as those relating to stopping sight distance, to accommodate commercial vehicles.

SAFER INFRASTRUCTURE PROGRAM

In addition to addressing the "good practices" described in FHWA's guide for developing a safety management system, the proposed "realistic" safety management system would also pursue policies/programs which would integrate safety considerations into project selection for projects undertaken as part of other agency management systems. With this in mind, NYSDOT has recently introduced a new safety management initiative, the Safer Infrastructure Program. The purpose of the Safer Infrastructure Program is to ensure that safety considerations are made a part of selection, development, and design for projects undertaken as part of other management systems, particularly the Department's evolving Pavement Management and Bridge Management Systems.

The Safer Infrastructure Program is currently divided into two program elements one for pavements (SAFEPAVE) and the other for bridges (Snow/Ice Accident Reduction Program).

SAFEPAVE

The SAFEPAVE Program produces lists of wet weather accident locations which are candidates for treatment under the Department's Pavement Management System (PMS), and which would likely experience wet weather accident reductions following a simple resurfacing. The anticipated accident reductions are based on Department evaluation findings demonstrating large wet weather accident reductions (50 percent or more) following resurfacing at locations experiencing relatively high proportions of wet weather accidents (40 percent or more) in the before period. SAFEPAVE pavements receive priority consideration for treatment under the Pavement Management Program. Pavement Management system goals are not threatened, since SAFEPAVE pavements are first required to meet all other PMS selection criteria before being selected for treatment under the Pavement Management Program.

Snow/Ice Accident Reduction Program (SARP)

SARP is currently under development at NYSDOT. The Program will produce a computerized listing of state highway bridges which are experiencing high proportions of snow/ice accidents. The list will then be forwarded to the Department's Structures Division for consideration in the selection and design of bridge projects under the Department's evolving Bridge Management System (BMS). Bridge project managers will be encouraged to overlay the identified bridges with a top course containing Verglimit, a permanent deicing material. Department evaluations have shown that the use of Verglimit has resulted in large reductions in snow/ice accidents (50 - 70 percent) at bridges experiencing high

proportions of snow/ice accidents in the before period. Again, the Snow/Ice Accident Reduction Program (SARP) will not threaten the achievement of BMS goals, since SARP bridges would first be required to meet all other BMS selection criteria before being selected for treatment under the Bridge Management Program.

KEY ELEMENTS

Setting a safety management system goal and deciding upon actions appropriate for achieving the goal are not sufficient to define a safety management system. A safety management system is also a process by which activities are coordinated and directed toward achieving system goals. Key elements of that process are described in FHWA's Management Approach to Highway Safety (A Compilation of Good Practices). They include setting long and short term goals, accountability, training, monitoring and evaluation, an integrated data base, safety analysis, intra and interagency coordination, and technology transfer. Most of these key elements have been discussed earlier as part of the development of a realistic safety management system. What follows is a more concentrated discussion of three key elements of particular concern to a realistic safety management system.

Accountability

In the final analysis, the ultimate test of the success of a safety management system is measured in terms of impacts. These impacts should be measurable and the highway agency should be held accountable for some reasonable level of achievement. For a realistic safety management system, appropriate measures of effectiveness could be defined in terms of accident reductions, high accident locations addressed and treated, or some combination of both.

How well an agency is doing as it relates to accomplishing goal related activities and how those activities are contributing toward the achievement of the safety management system goal's measure of effectiveness is accomplished through administrative and impact evaluations. The level and quality of goal related activities is determined based on administrative evaluations. The impacts of those activities as they related to the safety management systems measure of effectiveness is determined based on impact evaluations.

A "Realistic" Measure of Effectiveness (MOE). Since the goal of this paper is highway oriented, the measure of effectiveness will focus on the roadway as a contributor to accidents. In order to address the categories of good practices proposed in the FHWA's guidelines for a safety management system, three separate measures of effectiveness are being proposed:

1. Include some percent of identified high accident locations within project limits in the agency's five year capital program. Treat those locations with effective accident countermeasures whenever it is cost effective to do so, such that accidents are reduced at treated locations by 25 percent.

Three thousand miles of NYSDOT's 16,000 mile highway system have been identified as high accident locations at the 90 percent confidence level. NYSDOT's Goal Oriented Capital Program Safety Goal contains a measure of effectiveness that calls for the inclusion of 15 percent of those identified high accident miles in the capital program. This MOE encourages Department decision makers to include a relatively high number of accident locations in the Capital Program. Once in the Program, the high accident locations have a good prospect of being treated, since the Department's Program and Project Management Systems requires that they be subjected to a safety analysis and that safety improvements be undertaken whenever it is cost effective to do so.

A realistic safety management system would evaluate the achievement of this MOE by determining the number of high accident location miles included in the program, assessing the quality of accident studies performed to determine appropriate accident countermeasures for those projects, and establishing the impacts of the project improvements on accident experience.

2. Undertake safety investigations at 100 identified high accident locations each year. Implement cost effective improvements at 80 of the studied locations. Accident reductions at treated sites should reduce accidents at those locations by 20 percent.

NYSDOT investigates approximately 100 identified accident locations each year as part of its Highway Safety Investigation Program. Approximately 20 of those studies result in recommendations for no action because of the unavailability of appropriate cost effective accident countermeasures. Approximately 10 percent generate capital projects yielding accident reductions of from 25 to 30 percent. Most of the remaining investigations lead to low cost accident improvements including signing, and delineation improvements which yield accident reductions in the range of 20 percent.

An administrative evaluation would be performed each year to establish the numbers and quality of studies generated by the program, and to determine its impact on accident experience.

3. Perform a visual survey of the entire highway system for the purpose of maintaining the operational integrity of highway safety features such as signs and guiderail.

An administrative evaluation would be performed each year to ensure that all state highway miles are surveyed. Also examined would be numbers and types of signs replaced or upgraded. An impact evaluation of signs installed for safety reasons as part of the HSIP would also be undertaken.

Evaluation

Unfortunately, since evaluation tends to be manpower intensive and since it is viewed as belonging at the "bottom" of the Highway Safety Improvement Program loop, it has often been neglected in agency highway safety programs. Actually, it belongs at the forefront of many highway safety activities. Not only does evaluation inform us of how well we have done, but it also suggests, at the beginning of the project development process, what we should expect to accomplish relative to costs under a variety of project options. An aggressive evaluation capability also allows an agency to examine the safety implications of its non-safety specific programs. For example, NYSDOT's evaluation system was used to compare the effectiveness of an open graded top course with the Department's high friction dense graded overlays. NYSDOT has also evaluated the general safety implications of resurfacing with roadside improvements and without roadside improvements. These kinds of evaluations have made it possible for the Department's highway safety advocates to influence the conduct of programs outside their immediate functional

At NYSDOT evaluation findings have served as a springboard for the initiation and implementation of a series of safety programs ranging from its Safety Infrastructure Program to its SAFE-TRAC Program. The Safer Infrastructure Program has already been described. The SAFE-TRAC program is designed to ensure that the Department's contract resurfacing does not lead to accident increases. This Program is NYSDOT's response to evaluation findings which indicated an increased risk of run-off-the-road accidents following a simple resurfacing without roadside improvements.

Integrated Data Base

Development and maintenance of an integrated data base locating accidents, categorizing them by accident type and contributory factors, and relating them to highway and traffic data is of critical importance to ensuring a viable safety management system. It is important that integrated data systems be user friendly, i.e. that data be easily and readily accessible for use throughout the agency, not merely from within the highway safety functional area. Systems should also be in place which can readily perform a variety of analytical studies, including comparisons with expected accident/accident type frequencies under various facility configurations, and tests of statistical significance.

It is important to keep in mind when developing or improving data systems that the ultimate test of whether a capability should be added, retained, or enhanced upon is whether the benefits of doing so outweigh the costs, particularly in terms of the human resources required to establish and maintain the "improvement". This judgement can only begin to be made after the usefulness or purpose of the capability has been clearly defined. This fundamental principle has been impressed upon NYSDOT by experience. Over the last twenty years, the Department has designed, developed and operated several computerized inventories, including sign, signal and roadside obstacle inventories. They have all since been abandoned, largely because the Department never had a clear conception of how they were to be used or what purpose they were to serve.

CONCLUSION

The strength and promise of the 1991 ISTEA mandate that state highway agencies develop a safety management system is that it requires them to think systematically about the overall role of safety in their highway programs, and to manifest that thought process in a set of clearly defined policies and actions. It is important that FHWA, as it goes through the process of establishing its minimum requirements for safety management systems, not confuse an appeal to realism with negativism or obstructionism. State highway agencies should not be asked to include in a safety management system policies and activities which reach beyond their capability to deliver and which divert limited resources away from what they perceive as more productive endeavors. Instead, Federal guidelines or requirements for safety management systems should require that states demonstrate sound goals and a reasonable mix of policies and actions which maximize the use of available resources toward the accomplishment of those goals.