- What is the contribution of the use of motorcycle helmets and occupant restraints in preventing serious injury or death?

Assuming safety agencies could answer such questions and were to develop countermeasure programs, they probably still could not determine the impact of individual projects. It may not always be possible to measure the effects of highway safety programs, but without quantifiable impacts to show, safety agencies cannot sell their concepts and programs to state legislatures, to the administration, and to Congress. In short, the system fails at the points critical to the continuation of highway safety.

WHY DOES IT FAIL?

State traffic records systems generally evolve in response to specific and varied demands and requirements. No one could have foreseen their extensive use in planning and evaluating highway safety programs. Consequently, the record systems are often out of date and lack the sophistication to deliver the complex data needed by highway safety researchers.

In addition, there is a lack of coordination between the efforts of the federal and state governments. The time has passed when records systems would have been most amenable to consolidation and change. To make these changes now would be prohibitively expensive.

Data inconsistencies result from differing definitions and lack of coordination between strategies, different reporting timeframes, and reporting errors on the part of source agencies. Because each agency designs its data files with specific uses in mind, few data can be integrated and much cannot be used for highway safety analysis at all. For example, under Colorado law, the Department of Revenue is charged with collecting and maintaining accident record, driver licensing, and vehicle registration files. These files are maintained for tax and fee collection, not for highway safety analysis. Hence, the data are not adequate for use by the Division of Highway Safety, and the manipulations that must be performed to develop useful files are time-consuming and costly.

Lack of timeliness in reporting data by some agencies affects the responsiveness of highway safety programs. Often, as a result of these delays, data are a year old before they are available for problem analyses.

Investigating officers are often responsible for the inaccuracy or incompleteness of data on accident reports. This is a situation that does not readily lend itself to correction. Although desirable, it would be extremely expensive to train every investigating officer in the state.

Most of these problems could be solved with enough money. Funding, however, is simply not adequate to correct most of these shortcomings, and the current national sentiment to reduce the cost of government does not make the future look promising.

WHAT CAN BE DONE?

Coordinating efforts of state and federal agencies could alleviate some of the duplication and inconsistencies in reporting. Ideally, one central agency should be responsible for data collection and dissemination. If this is not possible, then coordination between agencies must be established.

Innovative programs should be developed for on-site accident investigation. These programs could augment the Fatal Accident Report System (FARS) and National Accident Sampling System (NASS). Comprehensive management information systems should be developed for those areas of activity for which few or no data exist. Colorado is doing this with EMS. Data are not yet available to determine the impact of the program, but the system was designed with this in mind.

Intensive impact evaluations of selected programs could be performed on a national scale. The product of these evaluations would be observable, measurable impacts to demonstrate the effectiveness or ineffectiveness of highway safety programs. However, application of this approach to projects whose success depends on changes in human driver behavior is difficult. Past efforts at the national level have not resulted in products that are practical or possible to implement at the state level.

In many instances, these national efforts to quantify impacts have produced vague and inconsistent findings that have led state decision makers to question, perhaps prematurely, the value of established, existing programs. An obvious example of this is the motor vehicle inspection program. After more than 10 years and after the expenditure of millions of dollars, the crash reduction potential of these programs still has not been demonstrated conclusively. As a result, decision makers in several states have repealed or abolished inspection requirements, some of which had been in place for more than 40 years.

In many instances, NHTSA's research activity has been directed or influenced by political whim. Priorities established by federal administrators result in research and expenditures in areas that are of questionable value to the states. The result is the atmosphere of criticism characterized by U.S. General Accounting Office reports.

The absence of long-range research planning by NHTSA is an impediment to proper long-term planning for state highway safety programs. NHTSA research programs now drift with the constantly changing management decisions (or lack of them). When emphasis program areas are established in NHTSA, states should be an integral part of the process. States have the right to expect that such emphasis programs will be based on logic, that the programs will be supported by evidence of accident reduction, and that evaluation models containing data requirements and records system demands must be made available.

Today, driving in the United States is safer than driving anywhere else in the world. Much of this has been accomplished since the passage of the Highway Safety Act in 1966 and the establishment of a State Highway Safety Agency. Yet, despite these accomplishments, the Highway Safety Program remains the target of criticism—for which the lack of national leadership and lack of a unified national highway safety program are largely responsible.

ESTABLISHING THE LEVEL OF ANALYSIS REQUIRED TO ADEQUATELY ADMINISTER SAFETY PROGRAMS

Bennie R. Maffet, Kentucky Department of Transportation

We have come a long way since 1967 when we first started looking at traffic accident statistics. There have been many improvements in highway safety projects, and some of our programs to justify and evaluate these projects have become quite sophisticated. But federal support is shrinking. The question now is, What level of analysis is really necessary?

There is no set level. The National Highway Traffic Safety Administration (NHTSA) and the Federal Highway Administration (FHWA) have set minimal levels. New programs are being designed, and the rules of the game are changing. But with cuts in funding, states will not support a lot of these activities. It will be difficult to develop and use more sophisticated programs or to implement recommended improvements. States may even be asked to justify why they need to collect traffic accident data at all. Thus, the level of analysis needed cannot be prescribed. It will depend on what the states can afford and what will result in the greatest improvement. States all have basic tools for problem identification and establishing priorities. Better to use these than to be caught in an all-or-nothing situation.

When we leave this conference, we should go back to our states ready to support a coordinated effort. It does not have to be a governor's task force. We need to communicate with the people who make decisions and those who have input into decisions. The times ahead are going to be critical. The opinions on the level of analysis that we need cover a vast spectrum. Somewhere between the extremes is the level of analysis that we can afford and that we can use. We need to look at the resources we have in our own states. We need to see what level of analysis is necessary to support our highway safety programs and to make improvements.

USE OF ACCIDENT STATISTICS IN MICHIGAN

Thomas L. Maleck, Michigan Department of Transportation

The Michigan Department of Transportation has been storing and analyzing accident data in an automated format for more than 20 years. During this time, its analytic capabilities and data resources have steadily improved.

The department's systematic analytic tool was the SCREEN system. Operational in 1971, SCREEN provided tabular reports and an automated collision diagram. Its sole data sources were traffic volumes and accident reports. The automated collision diagrams required manual coding of the road geometry.

The Michigan Department of Transportation relied on minimum threshold numbers or rates of total accidents to identify roadway segments or intersections meriting engineering attention. The problem was that the system identified many of the same sites each year without showing a correctable pattern of accidents, while other locations that may have warranted improvement were not flagged for attention. The process was labor-intensive, and small projects were overlooked.

In 1969, work was begun to locate all accidents in the state (trunkline and local roads) with a uniform system. The Michigan Accident Location Index (MALI) was completed in January 1979 (the trunkline system was completed earlier in 1975). Principal features of the MALI system are the common accident report form used by all state and local agencies and the accident location system based on street intersections and street names.

In mid-1976, the department made a commitment to upgrade its ability to locate highway segments with correctable accident patterns and to widen its scope of analysis. The goal was to develop non-labor-intensive procedures for predicting the expected impacts of incremental alterations. A prototype model called the Michigan Dimensional Accident Surveillance (MIDAS) was developed for analyzing the state trunkline system (9000 miles).

MIDAS-I

The first generation model, MIDAS-I, may be described as a grouping of all roadway segments with identical physical and accident characteristics into dimensional families, each with its own unique distribution and statistical attributes. Physical characteristics used to group roadway segments included posted speed limits, presence of traffic signals, lane and shoulder widths, turns, and geometric data derived from the department's photolog (sequential 35mm color photographs taken every 52.8 ft along state trunklines and the Interstate system).

Although the photolog is the backbone for referencing all other data used in the project, the system has limitations. The precision of indexing the data has a maximum error of $\pm$52.8 ft; the film may be one to three years old; vertical curves, grades, and horizontal curves cannot be measured; and information on crossroads is difficult to obtain.

Only one alternative method was found to overcome the deficiencies. The degree of horizontal curvature and delta angle of deflection was obtained from right-of-way maps. Photolog and the right-of-way maps were then used simultaneously to establish mileage points at the beginning and end of each horizontal curve.

The location and magnitude of posted speed limits were obtained from paper files of departmental traffic control orders (TCO). The photolog was used again to determine a control-section mileage point for the end of each zone. Segments of roadway not covered by a TCO were defaulted to a 55-mph speed limit as provided by state law. The locations of traffic signals and special phasing and turn prohibitions were obtained from paper files. Because the width of shoulders along a roadway fluctuates, widths were established within the ranges of 0-4, 4-8, 8-10, and 10-12 ft.

With MIDAS-I, cells were rigidly structured by discriminating on all of the discrete variables. The dependent variables were the number of injury accidents (years) per segment for each type of accident. The result was a histogram showing distribution of accident frequencies for a set of constant variables. Recognizable patterns (usually a Poisson distribution) were evident.

A typical set of histograms for a family of intersections could show distribution of total, right-angle, left-turn, and nondaylight accidents. MIDAS-I produced 16 000 such histograms.

By analyzing each cell for the variance in the number of accidents per segment, outliers could be identified. An outlier is any segment whose dependent variable is of sufficient magnitude, when compared with its peers, that the probability of the event occurring by chance is remote. (In the histograms, the outliers are designated by an "O" as opposed to an "X" for the inliers.) The outliers are most likely a result of an unidentified variable.

At this point, MIDAS-I offered an objective, accurate means of identifying significant accident patterns, independent of the magnitude of accidents or accident rate. However, a system was still needed that would permit the evaluation of safety alternatives by predicting the expected number of accidents. The need for reliable accident predictive algorithms necessitated major changes in the methodology. Thus, MIDAS-II was developed.

MIDAS-II

With MIDAS-II, roadway segments were reestablished with variable lengths. A segment was created whenever there was a change in an independent variable.

Intersections were treated as dimensionless points with the same geometric attributes as the encompassing segments but with additional intersection-related attributes. A roadway segment could encompass zero to several intersections.

Also as part of MIDAS-II, considerable effort was spent in developing user-friendly software. No prior data-processing experience is necessary. The user enters the system with a simple command, and a menu of options is offered. The user interactively selects the analyses and the desired outputs. The end product of the process, which takes less than 5 min, is a stand-alone report complete with title page. The program is executed in a form displayed on the screen of the computer terminal.

Example outputs are

1. Intersection profile,
2. Directional analysis with a prediction of the expected number of accidents by type,