project as part of the evaluation phase of all projects. In addition, each state has been required to conduct at least one detailed impact evaluation each year. The requirement for the detailed evaluation has been dropped in the new guidelines, and the states are being encouraged to conduct minimal effectiveness evaluations on all their impact projects. Where the state requires analytical assistance to conduct an impact evaluation, NHTSA will perform analyses after accident data have been collected.

State program evaluation includes a general review and a program summary emphasizing accomplishments, particularly those of innovative and impact projects. Annual and semiannual reports have always been required; however, requirements for semiannual reports will be eliminated, and annual reports will be simplified. Annual reports are expected to be 10 to 20 pages long and they will be issued by the states each year on January 1.

DATA ANALYSIS AND INTERPRETATION PROBLEMS

James Nugent, Indiana Division of Traffic Safety

There are two sides to the problem identification process: the managerial side, which pertains to the way problem identification interacts with the overall state management process, and the technical side, which pertains to the statistical procedures and constraints in data analysis. It is the technical side of problem identification that concerns us here.

In practice, the technical aspect of problem identification involves the empirical techniques used to reveal correlations among accident variables. Correlations, however, do not necessarily relate to causality. A theory or hypothesis must be constructed and tested to explain the correlations, the extent of their association, and how they interact to produce accident conditions.

There are, then, two steps in technical problem identification. First, from the current research available, a hypothesis is made of the problems that exist, the circumstances under which they develop, and how they can be measured. Second, the data gathered from statewide accident records are used to test the hypothesis and to determine the magnitude of the problems in each locality.

At the state level, a number of problems limit the usefulness of accident records as the primary data source:

- Accident data are often gathered from a single data-gathering instrument that must serve many needs and agencies.
- Accident reports are often unreliable or invalid.
- Adequate exposure data are often lacking.
- The real significance of overrepresentation is often difficult to establish.

TECHNICAL CONSTRAINTS TO PROBLEM IDENTIFICATION

Accident Reports As the Sole Data-Gathering Instrument

Highway safety agencies often must rely on data from accident report forms that must serve the needs of several agencies. Even when they have input into the development of procedures, the safety agencies still cannot get all the information they require. Recently, Indiana redesigned its central accident records system. As a part of that process, a committee of representatives from several agencies met to develop a new accident report form that would serve their diverse needs. To prevent the form from becoming unmanageable, each agency was required to justify each data element and report that would be required. The Division of Traffic Safety, the only agency interested in research requiring a broad-based information system, found such justification difficult. Consequently, the report form that emerged was a compromise. Although far better than the previous form, it fell short of being an adequate instrument for research.

Data Validity and Reliability

Data gathered from accident reports is often incomplete and unreliable. Indiana, which is not an especially large state, has 225 000 accidents annually; these accidents result in more than 440 000 records on vehicles, drivers, and injured occupants. Roughly two-thirds of the reports on these accidents are generated by an investigative agency, and the remainder is reported by the public. There is little quality control, and it cannot be assumed that the inherent bias of such reports is randomly distributed.

Even with training, police often give inaccurate and incomplete reports. Indiana requires every new state and local police officer to be formally trained in accident investigation. A report by the Institute for Research in Public Safety, however, demonstrated that police frequently misidentify descriptive data, omit relevant information, and exhibit a low sensitivity to accident causation factors. According to one study, even such a simple factor as driver age was incorrectly identified in 11.6 percent of the accidents reviewed. In descriptions of the accident environment, police performance did not exceed the chance level of any factors cited. If these are the results of disinterested and professional police officers, it is reasonable to question the reliability of reports from accident participants.

Accident data may be highy unreliable for some particular subpopulations. In some states, data on motorcycle and moped accidents are combined. Because the characteristics of the two operators have been shown to be quite different, this mingling of statistics hinders proper assessment of the problem and selection of countermeasures. Similar problems are involved in obtaining separate data on trucks (and pickups), school buses, and off-road vehicles. Any attempt to refine these kinds of data is constrained by a large error factor.

Exposure Data

Exposure data used to normalize accident data are based on time, travel, events, vehicle attributes, vehicle type, and driver attributes. No one measure can serve all analytical needs; appropriate data are determined by the hypothesis being tested. For example, motorcycle exposure data are virtually nonexistent. Without exposure data, however, prioritization and comparison become problematic.

Exposure data are difficult and sometimes impossible to obtain. In Indiana, for example, annual vehicle miles traveled are obtained from gasoline tax revenues, but such broad data are obviously of low statistical value. The Department of Highways conducts special studies throughout the year, but these do not provide exposure data by age, sex, vehicle type, vehicle defect, or political subdivision.

The lack of exposure data poses severe problems in the identification of target groups. Young drivers, for example, are thought to be overrepresented in accident samples because the proportion of young drivers involved in accidents is greater than the proportion of young licensed drivers. However, the data are not controlled for vehicle miles traveled by young drivers, miles driven by sex, or the time or area in which the miles are driven. It may be

possible to assume that exposure is a constant if comparisons can be made among similar groups, for example, young drivers in certain classes of urban areas controlled for population, registered vehicles, and socioeconomic factors. However, this kind of comparison is frequently impracticable. Indianapolis, for instance, is demographically unlike any other city in Indiana.

The lack of data also makes it difficult to test hypotheses. Gasoline supplies most likely affect accident rates, but the effect of fluctuations probably will not be uniform among all groups. Discretionary travel probably is the most dramatically affected, while commuting patterns may prove relatively inelastic, at least in the short run. Fatality rates, which are thought to be more sensitive to discretionary travel, may fall. In Indiana, the total number of reported accidents rose by more than 31 000 during 1976-1978, while the number of fatal accidents increased by only 50. However, since the state has no reliable estimate of vehicle miles by type of travel, it is not known if the smaller proportional increase in fatalities was the result of a drop in discretionary travel.

Adequate exposure data are essential in identifying countermeasures. A problem group may have a high absolute number of accidents, but if it also has a high exposure rate and, hence, a low accident rate, effective countermeasures may involve inordinate expense.

Some studies can be conducted without exposure data. For example, the effect of repealing a state's mandatory motorcycle helmet law may be determined by comparing the ratio of fatalities to injuries or accidents before and after the law was repealed. If helmets had reduced fatalities, the ratio would be expected to increase over time. Unfortunately, not many highway safety problems lend themselves to this kind of analysis.

Significance of Overrepresentation

Even assuming that groups overrepresented in accidents can be statistically isolated, the significance of the figures must still be determined. The problem is that comparisons must be made with similar populations, not the total population. For example, the number of moped accidents has risen over the past four years in Indiana. But because there is no population with which to compare Indiana's sample, a goodness-of-fit test cannot be made, and the significance of the rise cannot be determined. In addition, the isolation of an overrepresented group may or may not indicate causality—even if a statistical relation among a set of variables can be demonstrated.

DIRECTION OF HIGHWAY SAFETY PROGRAM

Many highway safety agencies are not major forces in developing state highway safety policy or in implementing highway safety programs. The difficulty of the state agencies in directing highway safety efforts effectively is probably the most serious problem in the national program. Highway safety agencies must be strengthened within their organizational and political milieu. Their statutory authority must be increased and their technical staff must be upgraded. Unified federal guidance is needed in problem identification, program management, and evaluation.

As a first step, the federal government should conduct the research to develop accident causation methodology, exposure data, and analytical techniques. This research is properly the province of the federal government and research institutions, while the application of that research should be that of the states. Without federal assistance and cooperation, there is little chance that highway safety agencies will increase their effectiveness.

MANAGEMENT USE OF ACCIDENT TRAFFIC STATISTICS AND SAFETY-RELATED DATA: A STATE PERSPECTIVE

John A. Pachuta, Pennsylvania Department of Transportation

Pennsylvania, like most states, is suffering from the shrinking tax dollar—revenues are down, expenses are up. We had experienced a considerable decline in fuel tax and associated revenues even before the current administration's federal budget reductions. To consolidate our resources and increase effectiveness in directing Pennsylania's Highway Safety Program, we have combined our operational and program personnel into a single department. As a result, Pennsylvania now has in place a responsive accident-reporting system that provides useful management information for implementing a statewide highway safety program.

HIGHWAY SAFETY ORGANIZATION

Until two years ago, Pennsylvania's Section 402 Highway Safety Program was managed by the Highway Safety Group (HSG) of the state's Department of Transportation (Penn DOT). The program manager, as head of this group, reported directly to the secretary of transportation, who was designated the governor's highway safety representative. Although idealistic in design, this structure was impractical. The HSG was independent of operational areas, but support from these areas was often difficult to enlist. In addition, HSG was only one of many responsibilities of the state's Secretary of Transportation, and consequently could command little of the secretary's attention.

Early in 1980, Transportation Secretary Thomas Larson approved a reorganization of Penn DOT. The HSG was combined with the former Bureau of Accident Analysis and other related, formerly independent groups to form the Bureau of Safety Programming. The new bureau was placed under the deputy secretary for safety administration (SA)—one of five deputates reporting to the secretary—and Deputy Secretary John J. Zogby, as head of SA, was designated the governor's representative. In essence, this reorganization placed the accident data collectors and users together at the operational level.

As in any reorganization, establishing new lines of communication, redefining responsibilities, and physically realigning work areas made the work flow awkward at first, but the benefits became apparent almost immediately. The new organization has resulted in one of the finest problem identification efforts to be found in the highway safety plan process, and Pennsylvania is now in a position to devise a performance-oriented highway safety program.

ACCIDENT RECORD SYSTEM

The Pennsylvania Accident Record System (ARS) compiles information on 150 000 reportable motor vehicle accidents (including about 2000 fatal accidents) each year. Up to 657 data elements that relate to the driver, vehicle, roadway, conditions, and circumstances of the crash are recorded on each accident record. Accident information is maintained in a "live," year-to-date file accessible for analysis; a three-year, fixed accident record file provides the basis for highway safety problem identification and program management.

The ARS provides a two-way exchange of information with the operator license (OL), vehicle registration (VR), and Pennsylvania roadway information system (PARIS) files. The creation of an accident record updates the driver record on the OL file, and the OL checks the validity of driver information on the accident record. Roadway information on the ARS report is checked against the PARIS data base, and incorrect data on the accident location are noted and corrected.