3. Overlay of a histogram of accidents with a histogram of volume by hours of the day,
4. Histogram of accidents by day of week,
5. Histogram of accidents by month,
6. Histogram of accidents by year,
7. One-line listings of each accident by approach,
8. Before-and-after analysis by year, and
9. Before-and-after analysis by approach.

The other principal enhancement of MIDAS-II is the development of a family of accident-predictive algorithms.

RESULTS

A number of conclusions were drawn from the Michigan MIDAS-II modeling experience. For intersection related accidents, the independent variables with the greatest impact on reducing the total variance were signalization, county, laneage, type of intersection, shoulder width, right-turn lanes, annual daily traffic, and lane widths. Posted speed limit does not have a consistent impact on reducing the variance (demonstrates nearly equal number of positive and negative relationships). Models for nonintersection accidents did not have good correlation coefficients. Laneage was the most important independent variable followed by county, posted speed limit, annual daily traffic, and activity density.

Meaningful modeling of nonintersection accidents is probably not feasible without improving the ability to locate accidents more accurately. Too many highway segments are of insufficient length. The reason for using a variable length segment instead of a uniform length of 0.2 mile is to create a longer analytic unit. However, by using a variable length actually reduced segment length from 0.2 mile to an average of 0.13 mile.

The procedure for predetermining outlying segments may require revision. A segment with a statistically significant number of rear-end accidents was considered an outlier when modeling was done not only for rear-end accidents but for all accident types as well (such as parking accidents). Although volumes were considered in the model-building process, highway (segment) capacity was not. Further investigation will be conducted into the use of volume/capacity ratios as a predictive variable.

A large amount of the initial variance was explained by the models. It appears that environmental factors may have a large influence on accidents—if a county is an adequate surrogate measure of population density.

The error rate of the MIDAS-II predictions is not known. The absolute standard error is not large, often about one accident per year. The percentage error, however, is large. Several factors contribute to the problem. First, most segments have no accidents during the study period (often dividing the standard error by a small mean). Second, the predominance of short segments limits the ability to assign nonintersection accidents accurately. (This may explain why the standard error for nonintersection accidents is higher than that for intersection accidents.) Third, accidents are a discrete function and thus may attribute to the error since the models predict a fractional number of accidents.

The anticipated use of the models is for predicting the expected change in accidents for each change in one or more independent variables. The relative error between predictions is unknown and may be considerably less than the absolute error.

The relations do not necessarily indicate cause and effect. Because of the lack of accessibility, many variables suspected to be important are not included in the model.

CONCLUSION

The object of this paper was to describe the process Michigan went through, not to defend it. If there is a better process, we will use it. However, we are getting extremely good results—much better than expected.

We found that modeling separately made a tremendous difference. But the model is already outdated. There are many procedures we want to apply to improve our ability to explain what is going on. Software life is about one month to six weeks. That is how fast it is changing. The process is dynamic. Software is marginally built so that any one element can be pulled out, changed, and plugged in. That is why Michigan gets concerned when the U.S. General Accounting Office says to wait four years to see what happens. In four years, the people who did the programming and maintain the system will be gone, and we cannot train replacements easily.

The biggest problem in implementing the process is not the data—they can be gathered if you use some imagination—and not the math—that is pretty simple. The biggest problem is people. A major problem in implementing this program was getting people who had both the ability and the dedication to put it together. Even then it took a year to get them trained.

Another problem is resistance to change. The people who maintained the previous system will be of little or no help. The problem is getting the users to accept the new system—to make them see that it is better and faster.

MODEL TRAFFIC RECORDS SYSTEM

Dan Kaufman, A. F. Austin and Associates

The Model State Traffic Records System (MTRS) is being developed by A. F. Austin and Associates, Inc., in cooperation with the Alabama Office of Highway and Traffic Safety (OHTS) and NHTSA. The four main objectives for development of the MTRS are

1. To integrate information now stored in different forms and on various systems throughout the state,
2. To integrate operations and information of various state agencies now operating in various parts of the safety system,
3. To reduce duplication of data and operations now maintained by separate political or organizational entities, and
4. To develop a model that can be transported to other states so that system technology and project experience can be shared.

Meeting these objectives will achieve the overall goal of the MTRS, which is to interrelate all traffic safety information and operations so that sound traffic safety programs can be developed, monitored, and evaluated.

Without a consolidated traffic safety system, management is taking a shot-in-the-dark approach to determining programs, priorities, and funding. The MTRS is being developed as a tool for management in traffic safety planning and evaluation. The MTRS consolidates all relevant information into a single source system capable of retrieving information on an as-needed basis.

The MTRS was developed by using a two-step process: the logical design—identification of what and how it is to be accomplished—and the physical design—the development of the data-processing system. The logical design ensures that the system is structured properly to support management.

The operational and management decisions identified in the logical design were consolidated into five major program areas:

1. The Driver, Pedestrian, and Passenger Safety Program implements safety activities concerning drivers, pedestrians, and vehicle passengers. The program includes procedures for the driver licensing (including driver history), law enforcement, law adjudication (courts), and driver education projects.

2. The Vehicle Safety Program implements vehicle safety activities including vehicle titling, registration, and inspection projects. The planning, coordination, and evaluation of these activities are included in the Planning and Evaluation Program.

3. The Post-Accident-Response Program is an operational program for emergency medical services (EMS) activities both before and after an accident. The program includes the decision-and-action procedures for the licensing of EMS personnel and organizations and the implementation of EMS program improvements defined in the Planning and Evaluation Program.

4. The Roadway Environment Improvement Program consists of the operational activities for designing, constructing, and maintaining highways when these functions are performed for safety reasons. The program includes the operational decision-and-action procedures for major roadway design and construction, spot roadway improvements, and roadway maintenance projects. All planning and evaluation activities are included in the Planning and Evaluation Program.

5. The Safety Planning and Evaluation Program is the nucleus of the MTRS. Planning, coordination, and evaluation of all programs and projects mentioned above are performed within this program. This program provides state officials with the means to make intelligent decisions on the effectiveness of the overall safety program and of the individual elements. The program also points out areas that need further attention.

The MTRS data base is implemented on an IBM 4341 by using the IMS data base management software. The data base consists of the driver, accident, citation, vehicle, and miscellaneous operational files. The EMS files and school bus files reside on microcomputers connected to the IBM system by high-speed communication lines.

Even though EMS, school bus, and roadway files are not physically resident on the IBM 4341 system, the data are accessible in an on-line environment and are linked to relevant mainframe data via key fields association. The IBM 4341 software is capable of accessing needed data from any of the distributed systems, and the distributed systems are also capable of accessing relevant data on the mainframe.

The MTRS data base contains the following major files:

1. Driver data base, which is used primarily for operational purposes. On-line statistical programs also use this and related data bases for safety program development, monitoring, and evaluation.

2. Accident data base, which is used primarily for operations and to provide detailed accident report inquiries and reports on request. On-line statistical programs are also available by using this and related data bases for safety program development, monitoring, and evaluation.

3. Vehicle data base, which is used solely for operational purposes in the on-line mode. Because the accident report contains vehicle data, the statistical process seldom uses these data except for vehicle inspection information.

These three data bases contain duplicate keys that facilitate analysis of accident frequency as related to (a) type of driver; (b) number of citations and frequency of driver; (c) age and type of vehicle; (d) roadway type, condition, and traffic volume; and (e) citation frequency for selected roadways. Information is extracted monthly to produce a series of accident inventory and analysis reports. The information is matched against the roadway environment file, and the combined data are used to update the statistical analysis data base and accident location master file.

At the end of each quarter, the monthly accident and UTC data extract files are merged to create quarterly accident and UTC master files. These files are then used to generate a series of scheduled reports. In most states, the accident file is extracted and an accident file is created for processing by some type of standard statistical package such as DART, RAPID, or OMNITAB. Although the MTRS uses this technique to create its standard statistical file, linkages to other information files allow MTRS to access driver files, UTC files, vehicle files, statistical table files, and roadway environment files to create an expanded record for each accident. This expanded accident record can then be processed by the statistical package in either an on-line or a batch mode.

Summary reports of the monthly and quarterly reports are prepared annually, and the MTRS history tape is created from the quarterly master files. A comparison report is prepared to show trends between annual tables on the MTRS statistical table files. Tables are purged as required, and each table is set up for the next year.

Cross-reference files, including the node/milepost, the node/railroad, and the milepost/node cross reference files, are updated as information is received and processed. Roadway environment data are updated as road inventories are taken.

In summary, the MTRS meets its objectives by solving the following problems:

- Integration of Information—The problem of fragmented and mismatched information is resolved by updating all related data from one input source and by linking related files by common keys.
- Integration of Operations—Communications and control problems are resolved by providing automatic system notifications when events occur that affect other operations.
- Elimination of Duplication—Duplication of data and operations is reduced by establishing the system on a function rather than an organizational structure. A single file of common data may be updated and shared by multiple agencies that perform similar functions.
- Comprehensive Planning and Evaluation—Highway safety problems are isolated by applying accident and UTC data supported by roadway environment, driver, and vehicle background information to (a) location analysis techniques to identify hazardous locations and (b) standard statistical analysis techniques to identify patterns that indicate possible problem areas.

ADAAS AND USE OF SAFETY-RELATED DATA FILES

James O'Day, University of Michigan

The Automated Data Access and Analysis System (ADAAS) is a set of computer files used at the University of Michigan for looking at a variety of highway safety problems. It is not a particularly portable system—the computer programs are, but the installation with all the data is not.

The system began because questions needed to be answered and the only way to get answers was to go into the files by hand. So we put together a relatively small data set in a computer system and used a modification of an existing system developed by the Institute for Social Research at the