easy to overcome, the fact that most states have overcome these to some extent indicates that computer software systems do exist to make this possible. Also, numerous statistical software packages are currently in use to provide a wide range of statistical analyses (i.e., SPSS, DART, RAPID, SAS and others).

Problems Associated with Evaluations

Any discussion of police data problems should end with a discussion of why the data that are collected are not used in better evaluations. Even with their problems, the existing data could be used to give researchers answers to many of the questions that we face. Review of the states' systems indicate that perhaps the main reason for the lack of good evaluations is the fact that evaluation is usually given a low priority by most highway agencies. In some cases, this low priority may stem from the fact that the engineer is not anxious to find out what projects have "failed" in terms of accident reduction. Second, there are problems with utilizing the data, since most states do not maintain a computerized data base that is readily suitable for performing evaluations. Currently, however, some states have developed or modified software packages that will allow for systematic and economical project evaluations using computerized systems. The Michigan system, for example, makes the use of the previously described before/after with comparison group design quite simple, in that characteristics data are stored by homogeneous sections and, after certain sections are treated, comparison sections can be drawn from the remaining untreated pool by the computer itself, matching on certain roadway and traffic variables.

In summary, better police data and better use of police data can result from careful planning on the part of the engineering researcher. For better location information, the researcher should look to better reference systems, to increased and improved training for the police officers and office data coding techniques and, possibly, to computerized highway networks. In relation to the problem of improving the quality of the data elements themselves, the researcher should understand what data items are actually required and then select the best available data bases to meet those needs. The collection of roadway data may be better achieved through photologging or other techniques, compared with costly field surveys. The researcher should always attempt to simplify and standardize the definitions used and insist on using valid statistical techniques and experimental designs. In any merged systems, extra attention must be placed on handling special locations, such as interchanges, bridges and gore areas. In addition, increased emphasis should be placed on improving edit programs such that the computer itself can detect some of the errors in the data. In terms of routine collection of accident and roadway data, the cost of collecting the data must be weighed against the benefits to be gained from it before the collection of any variable on a wide-scale basis. Finally, the researcher must decide how best to use the data that exists in answering the question at hand, and after the research is completed, it should be disseminated widely so that we can learn from each other's mistakes and successes.

POTENTIAL USE OF THE NATIONAL ACCIDENT SAMPLING SYSTEM (NASS) IN STUDYING ACCIDENTS INVOLVING ROADSIDE OBJECTS

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In any discussion of the potential use of the NASS system in studying accidents involving roadside objects, one must have some understanding of the system itself in terms of the accidents that are to be sampled, the accident elements that are available and the data collection methods used. NASS itself is a sample of all police-reported accidents. It is designed to provide nationwide estimates of selected accident statistics and to support design and evaluation of safety countermeasures. The sample is designed to provide these national estimates; however, the sampling error may be unreliably large for certain estimates. When this occurs, special studies can help overcome small sample sizes and can help collect special data not otherwise collected.

The data are collected by small teams of trained persons (2-4), most of whom are college graduates. Data collected include information collected at the accident site, inspection of involved vehicles, interview of drivers and information from police reports, medical records of injured persons and driver history from license files. Photographs are taken by the team and are retained for future study. The data are subjected to an extensive review and edit procedure to ensure quality and consistency.

The sample design is based on a two-stage selection of accidents. The first stage involves the selection of "lists" of police reported accidents by choosing cities or counties among groups of 1280 such "lists." These lists are called Primary Sampling Units (PSU). Because we do not have a master national list of accidents, we assume that the relative size of these lists and, consequently, their probability of selection is proportional to the population in this associated county or city. Currently, 75 PSU's are planned for NASS including large central cities, suburban areas, cities, towns and rural areas. The second phase of the selection involves selection of accidents within the list of a city or county. This is done by random selection within groups or strata defined by accident type (pedestrian, truck, motorcycle and passenger car) and by injury severity (fatal, A-injury or minor injury and property damage). Each of these accident selections is based on a known probability of selection whose inverse is the "weighting factor" for the selected accidents. These weighting factors are used to expand the sample to national estimates. The selection of a given accident occurs approximately four days after the accident itself has occurred.

This scheme can be demonstrated to work well for certain phenomena including number of involved persons by level of injury, age, sex and vehicle type, etc.; number of involved vehicles by vehicle type and size; injury rates to occupants by crash type (percent of serious injury in head-on accidents).

The data are also useful in determining incidence of injury associated with seat belt use, helmut use, contact with vehicle components such as steering wheels or windshields, reported alcohol use, prior driving records described by convictions, and other factors. Because there is no associated exposure or "opportunity to crash," data available to compare with the accident data being collected, use of these data in studying accident prevention questions is somewhat limited. However, the data will be useful in studying such measures when joint efforts in NHTSA and FHWA to collect companion exposure data reach fruition.

Of interest to this group is the use of the

NASS system in the collection of roadside hardware data. The NASS data can be used to estimate the number and characteristics of impacts with roadside hardware and objects. However, without a roadside inventory, it is difficult to assess the reliability of the off-road environment in the 75 NASS PSU's as a sample of the national picture. Because guardrails, median barriers and bridge rails are prevalent in the roadway environment, it is likely that these objects are reasonably represented. Unusual types of objects may not be so well represented. For example, because breakaway poles and crash cushions are less often in the environment and thus less often in the sample of accidents collected, true national totals may be unreliable for these hardware. As shown in Table 4, the yearly total of crashes involving certain hardware is very limited.

NASS, as currently designed, is best suited for study of the performance of roadside objects when struck by vehicles. This would include measures of outcome to occupants (i.e., injury rates given impact) and observations of special features such as rollover, vaulting, undesirable interaction between vehicle and structure and any other feature whose attributes can be specified in the data collection protocol. Some of these data are not now collected. However, the fact that NASS is in place and that the teams can be trained to collect data in special collection processes means that data such as these could be included in the system. (Data that might be collected in the support of a study of off-road objects and roadside hardware are type of guardrail; height of guardrail; location of impact in relation to guardrail end; length of guardrail; end treatment on guardrail; post spacing and post type; location of guardrail relative to roadway; length of contact between vehicle and guardrail; angle of impact; performance--vault, penetration, override, redirection; vehicle rollover; scene sketch with vehicle trajectory; and photographs of vehicle, guardrail damage and surrounding roadway and roadside. Similar data could be obtained on median barriers, breakaway poles, crash cushions, bridge rails and other roadside hardware.) Indeed a special study on this subject, funded by FHWA, is now underway.

In summary, while modification of the system would be required to collect specific roadside-hardware-related information, and while there is a need for exposure data to be used in conjunction with the accident data now being collected, the NASS system can in the future provide useful information to the highway researcher.

Table 4: Frequency of Impacts to Roadside Hardware and Other Objects and Motor Vehicles in Police-Reported Towaway Accidents[a/]

OBJECT	PRIMARY IMPACT		SECONDARY IMPACT	
	NO. IN SAMPLE	NATIONAL ESTIMATE[b/]	NO. IN SAMPLE	NATIONAL ESTIMATE[b/]
Poles	176	172,900	47	36,600
Breakaway poles	6	5,900	2	4,000
Guardrails	53	56,800	49	49,500
Median barriers	7	10,700	11	13,600
Bridge rails	5	4,800	5	4,000
Abutments and overpass supports	20	18,500	8	5,900
Crash cushion	2	1,900	-	-
Impacts with other objects	721	773,000	552	540,000
Impacts with motor vehicles	2,696	3,176,000	491	480,000
Impacts with non-motorists	191	203,000	22	21,700

[a/] 1979 NASS data from 2,623 accidents (approximately 20 percent system design) observed in recording data on no more than 2 impacts per involved vehicle. The 2,623 accidents include motorcycles and cars and trucks in towaway accidents.

[b/] These estimates may be unreliable because of small sample size.