TG-6 NATURE AND MAGNITUDE OF THE TRAFFIC ACCIDENT PROBLEM

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Background

In this paper we use the term "nature" to mean the description of accident problems including how the accidents happen, to whom, under what circumstances, and similar general items. By "magnitude" we mean the measurement or how big or small the problems are.

Determinations of the nature and magnitude of traffic safety problems do not seem to us to have received adequate attention. This has been due in large part to longstanding assumptions that we know what the problems are without a quantitative examination of the traffic records. This is a problem of management that can be solved through changing such assumptions.

Due to time constraints we have restricted our attention to the major issues relating to the initiation of traffic safety programs.

The primary objective of this paper is to discuss the role of traffic records in the determination of the nature and magnitude of the traffic safety problem.

The supporting objectives are:

1. To identify management's need for the determinations of the nature and magnitude of traffic safety problems,
2. To discuss methods of measuring magnitudes, and
3. To discuss technical considerations related to measuring magnitudes.

Management's Needs

Due to the nature of traffic safety programs, the management decision process encompasses executive policy and directives, legislation, and agency policy and procedures. All too often, traffic safety programs are based upon political or emotional pressures. However better decisions can be made when problems are defined objectively. In support of these objective decisions, it is also important to inform the public of the nature and magnitude of traffic safety problems.

Several levels of management need to be informed. Top management, such as the governor and the legislature at the state level, needs to receive less detailed information on specific problems to develop policy and enact legislation. On the other hand, lower level management requires more detailed problem definition to formulate programs for implementing traffic safety policy and legislation.

Different kinds of analyses are needed both for various levels of management and at different stages of program development. These levels include:

1. Basic problem identification
2. Detailed understanding of the problem, and
3. Designed, controlled experimentation.

Basic problem identification merely indicates the existance of a problem. It can be based on existing mass statistics and includes the determination of the who, what, where, when, and how many. For example, the mass statistics might indicate that X percent of the pedestrain accidents involve elderly pedestrians at non-signalized intersections.

Detailed understanding of the problem points toward possible solutions. More detailed data are required and therefore other traffic record files must be used. These analyses, which are usually conducted at the agency level, look for major causal factors. Also, it is desirable to look ahead toward the evaluation of the effectiveness of the solutions. For example, base line data are needed to conduct before and after studies of implemented solutions. The subject of evaluation is covered in detail by the Panel 3 report.

Designed, controlled experiementation is not always required, but should be used when potentially large and expensive programs are involved. Pilot programs can be used for this purpose. Since the analyses at this level are usually complex, it is desirable to consult with research specialists. The Panel 8 report treats the use of traffic records in traffic safety research in more detail.

Data systems need to be flexible. These systems must contain basic data that is routinely collected and provide for the gathering of supplemental information on a sampling basis.

The basic data provides direction in defining problems. These data are obtained from the routinely maintained driver, vehicle, roadway, and accident files. Too often these data are overlooked as a basis for problem identification because they contain some deficiencies.

Supplementary reporting provides data not contained in the routinely collected records. Supplementary reports are designed to provide additional information required to further define an identified problem. This should enable the proposal of possible countermeasures. Supplementary reports should be brief and used only until the needed data are obtained.

Measuring Magnitude of Traffic Safety Problems

The importance of measuring the magnitude of problems is demonstrated in the following example. Because of its emotional impact, school bus safety has maintained a position of prominence in recent years. Although basic data have indicated that school bus accidents are a very small part of the overall traffic safety problem, it was not until 1973 that a statement of the magnitude

was made. By this statement the school bus problem has been placed in proper perspective and been given balance against political and emotional pressures.

In addition to indicating how big the problem really is, expressions of magnitude are bases for measuring change in magnitude, as well as for objective decision making and the equitable allocation of resources. An especially valuable use of magnitude measurements is to compare them with like measurements from other areas, with national average, or with established criteria to detect significantly different characteristics. The Panel 2 report "The Identification and Surveillance of Hazardous Locations" addresses a specific comparison - that of roadway locations.

Magnitude can be measured in several ways:

1. Absolute numbers
2. Rates
3. Expert opinion
4. Compound measures

An example of magnitude expressed in absolute numbers is: "X persons killed in head-on collisions in one year". This number is readily understood but it does not indicate the relative importance of these accidents compared with all fatalities. Also, absolute numbers do not indicate the frequency of occurrence relative to the opportunities for accidents, i.e., exposure.

An example of magnitude expressed as a rate is : "Y persons killed in head-on collisions for every 100 million vehicle-miles travelled". This rate indicates the frequency of occurrence relative to the opportunities for accidents and thus permits comparison with other types of fatal accidents. Good exposure data are difficult to obtain and therefore rates are often not accurate.

The above methods do not include consideration of the potential for changing the magnitude of the identified problems. There are many methods available for combining actual experience with the probability for change. These measures provide better assessments of problem solutions and are more suitable for establishing program priorities.

In general, the major problems in measuring magnitudes arise from the following:

1. Accident reporting thresholds vary from place to place and time to time.
2. Accident reports are not always filled out completely,
3. Exposure data are not always readily available (some exposure data can be obtained from traffic records), and
4. Inaccurate data can misrepresent the magnitude of the problem.

Technical Considerations

Users need to be knowledgeable in the selection of proper statistical tools and to draw correct inferences from the statistics. A common incorrect inference occurs in "before and after" studies where a change in magnitude may be due to change but is attributed to an applied countermeasure. This phenomenon, known as "regression to the mean", is the tendency of the magnitude of a given problem having an extreme value in one sampling period to move closer to its actual mean in subsequent periods.

Another common misuse of data is the drawing of conclusions based upon too few data points. For example, safety officials frequently become alarmed on the basis of a comparison of this year's record with the previous year's record. Inferences become more accurate as more data points (one or more prior years) are considered.

The selection of the proper statistical distributions is too complicated to explain in this report. A recommended reference is NCHRP Report 17-2, "Methods for Evaluating Highway Safety Improvements" which contains useful information on distributions.

For many purposes, including setting program priorities, magnitudes need to be converted to relative values. Relative values are needed because:

1. Fatalities, although important, are too few in many cases to provide enough information for evaluation
2. Using the total of all accidents ignores severity,
3. It is desirable to emphasize severity.

The most common way of converting accident magnitudes to relative values is by assigning dollar costs to each severity level. Another way is to use index numbers or weighting factors. Using such numbers or factors avoids assigning a dollar value to a human life. Chapter 5 of NCHRP Report 17-2 presents a table of both index numbers and dollar costs. A number of pictorial damage scales, including those developed by the NSC Traffic Accident Data Project and the University of California's ITTE, can be used as indices of accident severity.

The above concepts can and should be integrated within the existing Annual Work Program and Comprehensive Plan concepts. Much can be done now with the existing traffic record systems. There will undoubtedly be improvement in the future, but these improvements will evolve more quickly in agencies which begin now to use what they have. Finally, the use of current data in problem definition has been shown to be greatly facilitated by safety management staff knowledgeable in both traffic safety and computer programming, having "hands-on" access to a computer.