Evaluation of Accident Reporting Histories

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Research was undertaken to identify jurisdictions in Alabama whose accident reporting histories do not match the anticipated trends of the community and to suggest reasons for deficiencies in accident reporting. Correction of these deficiencies is expected to result in improved data analysis for all future safety investigations and evaluations. The sequence of research actions included a literature review, selection of variables for detailed study, statistical analyses, and site studies of several cities found to deviate from the expected accident pattern. The field studies (along with an examination of accident records) served as the basis for the recommendation of guidelines and policies to improve the quality of Alabama traffic accident data. Thirteen specific recommendations were developed to alleviate existing problems in reporting accidents and to guard against the recurrence of these problems. Implementation of these recommendations will result in a more reliable accident data base for use in safety studies. This in turn will result in more efficient use of safety funds.

Historical accident data are a significant source of information used by engineers to establish safety programs and implement safety countermeasures. Local governments, through their law enforcement agencies, gather these data during accident investigations. The State of Alabama has adopted a standard accident reporting device and has mandated accident investigation training for all enforcement officials. In spite of these uniformity measures, differences exist in accident report data due to differences in the policies and procedures of local enforcement agencies.

Reliability in both the quality and the quantity of accident reports expected from any jurisdiction greatly increases the value of the data base used for safety studies. On the other hand, data discrepancies or deficiencies reduce the credibility of such studies and hinder the effort to make the best use of safety funds. This paper and the paper by Turner and Mansfield in this Record discuss research undertaken to identify jurisdictions in Alabama whose accident reporting histories do not match the anticipated trends of the community and in turn to suggest reasons for deficiencies in accident reporting. Correcting these deficiencies is expected to result in improved data analysis for all future safety investigations and evaluations.

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LITERATURE REVIEW

A literature review was an ongoing, continuous element of the research project. The preliminary portion of the literature review had three purposes:

1. To document the nature of the existing problem,
2. To identify previous research of a similar nature, and
3. To identify and designate variables to be considered in the statistical analysis.

The reasons for conducting a literature review are obvious. Such a process can eliminate the duplication of effort and can also be used to guide the research in that previous research efforts can be used to identify those procedures that should be developed further and those that should not be considered further.

This review was concentrated at two levels: First, contacts were made with government agencies such as the U.S. Department of Transportation (DOT) and the Alabama Highway Department and within various agencies in the State of Florida (due to the location of the available project staff). The second level involved an intensive screening of current technical literature and periodicals applicable to the transportation field.

Nature of the Existing Problem

There are inherent weaknesses in traffic accident data. Council and others (1) cite examples including collection practices, reporting methods, data bias, and the nature of accidents. The collection and reporting problems are of interest to this research effort. The first specific example focuses on inconsistent reporting due to reporting threshold variation. The 1961 Alabama law that governs accident reporting is as follows:

> Section 7. WRITTEN REPORTS OF ACCIDENTS. Every law enforcement officer, who in the regular course of duty, investigates a motor vehicle accident, either at the time of and at the scene of the accident or thereafter by interviewing participants or witnesses shall, within 24 hours after completing such investigation, forward the necessary completed written report or copy thereof of such accident to the Director on the uniform accident report form supplied by the Director.
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> Section 8. ACCIDENT REPORT FORMS. (a) The Director shall prepare and upon request supply to police departments, coroners, sheriffs, garages, and other suitable agencies or individuals, uniform accident report forms required hereunder. The required written accident report to be made by persons involved in accidents and by investigating officers shall call for sufficiently detailed information, to disclose with reference to a traffic accident, including but not limited to location of accident, probable cause, injuries to persons, property damage, deaths of persons, registration of vehicles involved including license numbers, name, address and driver's license number of operator, highway design and maintenance (including lighting, markings, and road surface), and names and addresses of witnesses. (b) Every accident report required to be made in writing shall be made on the uniform accident form approved and supplied by the Director and shall contain all available information required therein.
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> Section 12. DIRECTOR TO TABULATE AND ANALYZE ACCIDENT REPORTS. The Director shall tabulate and analyze all accident reports, and shall publish annually or at more frequent intervals statistical information based thereon as to the number and circumstances of traffic accidents. The Director shall make available to the State Highway Director all accident reports so that he may obtain sufficient detailed information so as to provide data for surveillances of traffic for detection and correction of high or potentially high accident locations.

The law establishes criteria for reporting and processing but does not establish a quantitative value that mandates reporting. According to information from the International Association of Chiefs of Police, in Alabama all accidents resulting in $50 or more in property damage are usually reported. The $50 value is a generally accepted rule-of-thumb based on insurance reporting requirements.

This is a very low value in comparison with those of other states. The low threshold calls for reporting of practically all accidents and can lead to the flooding of accident files with data on minor (often insignificant) collisions. At the same time, the very low threshold can lead to abuse and disregard for the reporting level. Repair values are often estimated at the accident scene by investigating officers, and it is not unusual for the cost to be underestimated to spare the driver the trouble of filing a report if no injuries are encountered. This leads to a consistency problem in that scores of low-cost incidents are reported at one location and very few at another.

A second consistency problem in reporting arises from a failure to investigate accidents properly. Researchers know that only a portion of the accidents that actually happen are reported (2). Only 89 percent of insurance-reported accidents were reported by police in one case and only 47 percent of motorcycle accidents in another (3,4).

This compares with other researchers' estimates that as many as three out of four accidents go unreported (5). An investigation of accidents in Sweden raised serious doubts about the accuracy of road accident statistics in the reporting of fatalities and injuries (6). A study in Virginia (7) found that accident data were not suitable for a detailed study due to (a) problems in format, (b) insufficient information, and (c) inconsistencies in coding.

A prominent reason for lack of proper reporting is the secondary importance of accident investigation in comparison with the multitude of other law enforcement duties. At least one study has been conducted to determine whether off-the-scene sources could supply accident data and thus reduce the officer's time at the site (8). A number of reliable off-scene data items were identified; however, the technique was not shown to be cost effective and has not been widely adopted. Accident investigation must still compete for the officer's time and attention.

There are several other common reporting difficulties, including (a) cross-jurisdictional differences in investigation or processing due to varying criteria and (b) management that may place minimal emphasis on accident reporting. Another important factor may be lack of proper training of enforcement officers. There is evidence that simple items such as the interviewing style of the investigating officer have a pronounced effect on the accuracy of the data (9).

To summarize the nature of the existing problem, there are a number of documented reasons for discrepancies in highway accident data. There are reasons to suspect that some of these deficiencies exist in Alabama accident records. Routine safety studies have uncovered cases in which Alabama data did not seem to represent accurately the situation under investigation. In several cases, consultants have called discrepancies to the attention of the Alabama Highway Department.

Similar Previous Research

At the federal level, the literature review first concentrated on FHWA and, within that agency, on the Office of Research. This office was identified as one that would have current information on similar research efforts, published and unpublished, that have received federal funding.

The contacts resulted in the identification of very few previous research projects similar to this effort. Some work was found in the same broad area. A number of research efforts were identified in which causal effects of accidents have been isolated. In general, however, these efforts were designed to relate particular types of accidents at a specific location to their causal effects.

One study that was conducted by the University of Maryland was typical of the type of previous research efforts that were uncovered in this phase of the literature review. In that study, the objective was to determine in a number of corridors in Maryland whether differences in accident rate could be related to changes in the speed limit on Maryland highways or whether other causal effects could be identified. The result of the research was that the noted decline in accidents was related primarily to an increase in overtime work by safety officials and secondly to the reduced speed limit. Neither of these items appears to be directly applicable to the current study.

The objective of the research effort discussed in this paper is to relate historical accident trends to some characteristics of the jurisdiction that reports the accidents. This would imply that gross measures of socioeconomic activity that could be identified at a county or city level should be related to the accident experience. The results of the contacts at the federal level were that at this time no similar research could be identified that would assist this effort. Contacts within the Alabama Highway Department and the Florida DOT did not disclose any evidence of pertinent research efforts.

Personnel within FHWA pointed out that automobile insurance companies apply different rate structures in different cities. With this in mind, contacts were made at the Office of Research of the Insurance Institute for Highway Safety. These contacts did not produce records of any research efforts that could be directly related to the stated objectives of this project.

Contacts were then made with a number of insurance companies and insurance regulation agencies in both Alabama and Florida to discover whether data available from the insurance companies in Alabama could be used to satisfy the objectives of this research. The contacts in the insurance industry led to the conclusion that in Alabama insurance rates are determined within geographic boundaries based on the experiences and dollar losses resulting from the accidents in that area. The larger companies in the state determine these rates based on the records of their own customers, whereas the smaller companies depend on independent rating offices to provide sufficient data to make the ratings. Typically, the rates are determined based on dollar losses per customer. The Farm Bureau firm, for example, uses five different ratings within the state.

Although the rating system used by the insurance industry does not directly relate to the objectives of this research, it does provide an alternative means of analysis. Specifically, some relation should be expected between a high accident rate for a city and the insurance rating that the city might be assigned. In other words, in those cities where either unusually high or low accident reporting trends have been noted, the insurance rating should indicate the same trend. The rating could be reviewed to determine whether there is a correlation between the reported accident history and the data used in determining the insurance rating.

To summarize this portion of the literature re-

Table 1. Variables used in regression analysis.

Data Item	Source
Population	
1970-1977	Alabama Municipal Data Book (21)
1980	Alabama Municipal Journal (22)
Law enforcement officers[a]	
Uniformed	Crime in Alabama (23)
Civilian	Crime in Alabama (23)
Traffic accidents, 1975-1979	Alabama Highway Department (24)
Total miles of paved highway	Alabama County Data Book (25)
Miles of state and federal route	Alabama County Data Book (25)
Miles of Interstate highway	Alabama County Data Book (25)
Miles of county road	Alabama County Data Book (25)
Square miles of land area	Alabama County Data Book (25)
Urban and rural land	Alabama County Data Book (25)
Urban, agricultural, and other land	Alabama County Data Book (25)
Automobile registrations, 1978	Alabama County Data Book (25)
Driver licenses, 1978	Total licenses issued (renewals and new applications), 1977, 1978, 1979, and 1980, Alabama Department of Public Safety
Gasoline tax allocation, 1979	Gasoline tax distribution spread: Oct. 1, 1978-Sept. 30, 1979, Alabama Treasurer's Office

[a]Sheriff's office employees and city police department employees were separated and placed in the appropriate data sets.

view, no suitable work of a similar nature could be located. Neither the literature review nor contacts with various government agencies identified previous research that could be used for specific guidance in the current study.

Accident Prediction Variables

The bulk of previous research into accident-related factors has been oriented toward isolating the effect of specific items at specific roadway locations. Geometric features, traffic control devices, and other items were studied extensively. Some of these studies suggest pertinent techniques for investigation of areawide accident rates, however. One variable that could be used is the volume of traffic. Kihlberg and Tharp (5) pointed out that average daily traffic (ADT) is one of the best indicators of accident potential for the various categories of highways. Other researchers echo their findings and have been able to establish very specific relations between ADT and accidents, especially for intersections (10-12).

Other areawide variables were harder to locate. Cooper (13) suggested that the level of law enforcement activity could be a major factor in reducing accidents, but the Alabama Office of Highway and Traffic Safety has found that there are not enough enforcement officers in the state to continuously monitor the known hazardous locations (14, p. 10). Thus, reductions in accidents achieved by assigning officers to specific locations are probably temporary and could disappear when the officer moves to a new location.

Byun, McShane, and Cantilli (15) suggest that societal and other forces exert influence on the number of accidents in a given area. They indicate that the current trend of population aging will increase accidents. They also see the urban-rural split as important and point out that a significant change in the mode of travel can alter accident patterns and rates.

In summary, only a few variables have been shown to be applicable to accident prediction on an areawide basis. These are traffic volume, population characteristics, rural-urban split, and transportation mode. This does not mean that other variables are not related to areawide accident rates but that such related factors have not been identified to date.

RESEARCH PROCEDURES FOR THE STUDY

The statistical procedures used in this investigation were regression and confidence band analyses. Both techniques are accepted and commonly used by the traffic engineer. Regression techniques are presented in many engineering textbooks, and computer-assistance packages have been developed to make application easier (16-18). For example, Belmont (19) developed a regression equation to predict the accident rate based on ADT and roadway median width. Turner, Fambro, and Rogness (20) developed regression equations in Texas to warrant addition of paved shoulders to two-lane roads based on accident rate. Regression equations were developed in a similar manner during this research to predict the number of accidents associated with Alabama cities.

The second statistical technique used was the confidence level analysis. This technique was used to identify cities whose accident levels fell outside of expected limits. High-rate and low-rate accident cities could be identified during the research by denoting data points that fell outside of specified confidence bands.

SELECTION OF REGRESSION VARIABLES

A list of desirable data items to be used in a regression analysis was prepared. These data items include variables that are associated with accident histories and are related to population characteristics, driver characteristics, and roadway characteristics. It became apparent that some of the most desirable data items were not available for the individual cities. However, many of these variables were applicable to counties and were found to be readily available.

At this point, the data were placed in three categories: county, city, and rural. The county classification was used for variables applicable on a countywide basis, including both urban and rural areas. Examples include the number of vehicle registrations and the number of driver licenses. The city classification was restricted to data applicable to incorporated cities in the state. One example is the census data used to establish the population. The final classification, rural, was used to handle data items that were only applicable to areas outside incorporated cities. For example, the rural population for a specific county would be the county population minus the population of all incorporated areas.

After the data analysis was finished, the city data classification contained only three data items (see Table 1). These were population, the number of law enforcement officials, and the number of traffic accidents for each year from 1975 through 1979. The number of law enforcement officers was for 1979, and was subclassified as uniformed or civilian members. The population figures for 1977 were estimates prepared by the Bureau of the Census, based upon extension of 1970 census data (21). These figures were compared with more recent estimates (26) and with 1980 census figures (22) when they became available later in the investigation. Where necessary, the original 1977 population estimates were adjusted to reflect the growth trend shown by the most recent data. It would have been convenient to use 1980 population; but 1980 accident data were not available at this stage of the study. The 1977 population figure was used because accident data were available for that year and because there were several sources of population data that could be used to cross check and verify the estimates.

The rural data file was similar to the city file in that very few variables were available. The only two items included in the final data set were 1977 population and the number of traffic accidents for the same year.

The most comprehensive data set was for entire counties. There were at least seven variables with strong potential for use as accident predictors. Several of these variables included excellent subclassifications, such as the breakdown of highway mileage.

EVALUATION OF FIVE-YEAR RECORD

After the data were gathered, the consistency of year-to-year accident reporting was investigated for various jurisdictions. The initial research technique involved a manual screening of accident records for the five most recent years. The objective was to identify those jurisdictions with erratic accident reporting patterns.

Classification Criteria

To quantify any discrepancies noted during the review of accident data, subjective criteria were formulated and placed in the three categories described below.

Category 1

Category 1 was reserved for the mildest types of erratic accident histories. In general, a city with some unusual occurrence in accident reporting would be placed in this category whether the city had any control over the erratic reporting or not.

It is important to remember that accidents are random events governed by the laws of probability and that unusual patterns are possible and normal under the laws of probability. Therefore, a city could receive a category 1 accident history rating due to one year with an unusually large number of accidents even though random chance rather than the city's reporting procedures caused the erratic pattern. Not all of the cities on the category 1 list could be termed deficient in reporting practices.

Category 2

The next classification applied to cities with more erratic accident reporting than the first category. Although there was the possibility that such deviations were the result of random chance, it was much more likely that improper reporting caused the problem.

Category 3

Cities that experienced the most severe deviations and the most erratic patterns of accident reporting were placed in category 3. The patterns are so unusual and pronounced that they are almost certainly due to variances in reporting practices. This type of pattern is obvious from the number of accidents occurring in consecutive years.

Results of the Manual Evaluation

The 67 county rural areas and all 423 cities were subjected to manual review based on the criteria outlined above. Since the criteria were subjective, two independent reviews were conducted to offset any bias on the part of the reviewer. A summary of the findings is presented in Tables 4 and 5 and shown in Figure 2 in the paper by Turner and Mansfield in this Record. These findings are summarized as follows:

1. Approximately one-fourth of all Alabama cities displayed erratic patterns in the number of reported traffic accidents during the period 1975-1979.
2. Five percent of all Alabama cities had very serious discrepancies in the number of accidents reported over the five-year period.
3. During the 1975-1979 period, 8.5 percent of all Alabama cities had serious accident reporting discrepancies.
4. Approximately one-fourth of Alabama county rural areas displayed erratic accident reporting patterns during the period.
5. County rural accident reporting was less erratic than city accident reporting. Although the percentage of jurisdictions with erratic patterns was the same for both groups (28 percent), there were no severe discrepancies in the county rural classification.
6. Traffic engineers and others performing safety studies must be very careful in using accident data for a specific location since one-seventh (5 percent + 8.5 percent) of all Alabama cities have seriously erratic accident histories. It is recommended that several years of data be checked to ensure that data were reported uniformly and that they accurately represent a specific location.
7. Erratic reporting of traffic accidents does not seem to be strongly linked to the size of Alabama cities.

In addition to the manual review, a statistical technique (coefficient of variation) was used to identify cities with erratic year-to-year reporting patterns. The analysis confirmed the presence of many jurisdictions with substantial variation in reporting. Although most of these cities were small, at least four of them were large enough to report more than 100 collisions/year.

REGRESSION OF 1977 COUNTY AND RURAL DATA

A comprehensive research procedure was developed and applied to the data in the county and rural files. Various combinations of variables were tested to determine the strongest possible model. Outliers (locations whose data values behaved unusually) were removed from the analysis to isolate their exact effects. The regression of county and rural data is discussed in detail in the paper by Turner and Mansfield in this Record.

REGRESSION OF CITY DATA

1977 Data

One of the primary objectives of the project was to identify a relation between accidents in Alabama cities and some predictor variable. Toward that end, a regression analysis was performed on the city data set by using the same comprehensive techniques that had been applied to rural and county data previously. Pertinent findings include the following:

1. Most Alabama cities are small; more than 80 percent of them have less than 5000 people. The few large Alabama cities dominate the numerous small cities during a normal regression analysis.
2. Prediction equations for small cities were improved by using disjoint population groupings rather than the entire population of Alabama cities. Five population groups were established: 0-1000, 1000-5000, 5000-10 000, 10 000-50 000, and > 50 000.
3. Population was used as the independent variable based on the findings of previous regression of rural and county data sets.

Table 2. Designated regression results by population group for cities.

Population Group	Regression Equation
0-1000	Accidents = 0.010 47 x population + 0.5134
1000-5000	Accidents = 0.035 82 x population - 39.234
5000-10 000	Accidents = 0.041 33 x population - 66.834
10 000-50 000	Accidents = 0.053 18 x population - 212.284
>50 000	Accidents = 0.058 52 x population - 540.770

Table 3. Regression summary for 1980 accident data.

Population Group	No. of Cities	R^2	SE	Intercept	Slope	t-Statistic
All cities	424	0.989 52	110.589	-65.490	0.051 27	199.616
1-1000	211	0.060 29	11.441	+0.666	0.011 48	3.662
1000-5000	133	0.310 82	43.581	-21.365	0.027 24	7.687
5000-10 000	42	0.223 12	119.560	-107.046	0.047 48	3.389
10 000-50 000	33	0.848 13	217.618	-144.609	0.046 36	13.157
≥50 000	5	0.994 67	359.220	-712.208	0.055 43	23.653

4. Because several cities were known to report accidents in an erratic manner, regression studies were performed on average five-year reporting levels in addition to 1977 reported levels.
5. Outlier cities were removed from the data set to improve the regression and were not included in the final regression formulas.
6. After a comprehensive analysis, predictive formulas were developed for each of the population groups (see Table 2). The independent variable was population, the dependent variable was average five-year accidents, and outliers were omitted to produce the best-fit equations.

1980 City Accident Data

At the point in the research project when 1980 data became available, the scatterplot and regression analysis was repeated for each of the five population groups by using the 1980 accident reports and 1980 census population data. The 1980 data were not greatly different from the 1977 data.

The regression of 1980 data is summarized in Table 3. The regression equations are comparable to those specified previously in Table 2. The five-year-average equations in Table 2 are preferable to the single-year formulas in Table 3.

CONFIDENCE BAND INVESTIGATION

Once the regression models were adequately fit, a second statistical technique was used to construct the equation of the surface that describes the mean number of accidents for a city of selected characteristics. For linear regression, this surface approximates symmetrical lines straddling the designated regression curve. It is possible to associate a designated level of confidence with given values above or below the regression curve by determining whether the values fall within the confidence bands. Confidence bands were constructed for the various population groups by using the following equation:

$$\hat{Y} \pm [t(df, \alpha/2)(SE)\sqrt{(1/N) + [X_o - \bar{X})^2/dx^2]} \quad (1)$$

where t(df, α/2) is taken from the appropriate t-table and

$\hat{Y}$ = predicted mean value at point X_o,
df = degrees of freedom = N - 2,
α = 1 - confidence interval,
SE = standard error from the regression,
N = number of cities in the sample,
X_o = population at the point in question,
$\bar{X}$ = mean of the population values in the sample,
dx^2 = (N - 1) Sx^2, and
Sx = standard deviation of population values in the sample.

A computer-assisted confidence interval analysis was performed on each of the five population groups. Confidence intervals of 80, 90, and 95 percent were applied during these analyses. Data for 1977, 1975-1979 (five-year average), and 1980 were scrutinized by using the equations developed for five-year-average data, as summarized in Table 2. In addition, 1980 data were subjected to a study based on 1980 regression equations. In summary, the five population groups were subjected to four separate analyses of three confidence levels each. This three-way tabulation resulted in 60 separate applications of the computer program.

The extremely thorough study was undertaken for several reasons:

1. It was necessary to examine each of the population groups because grouped data yielded the best regression results.
2. Multiple confidence levels were used to rank Alabama cities in relation to accident overreporting or underreporting. The cities that lay outside of the highest confidence levels exhibited the most severe reporting problems. Those at the next level were not quite as severe, and so forth. The ranking of cities allowed the project staff a great deal of leeway in identifying trends and selecting cities for further study.
3. Regression equations developed for various years were compared with several years of data to remove the overriding influence of one bad year and to identify those jurisdictions that exhibited poor reporting practices year after year.

The results of the multilevel approach indicated that 65 cities fell outside of 90th percentile confidence bands during one or more applications of the computerized procedure.

DETERMINING REASONS FOR DEFICIENCIES

After the designation of certain Alabama cities as chronically underreporting or overreporting accidents, attempts were made to categorize and isolate the reasons for the reporting abnormalities. These efforts included a telephone questionnaire administered to a select group of police chiefs, a comparative analysis of accident records, and site visits.

Telephone Survey

The telephone survey was conducted prior to the field visits to identify problem areas common to underreporting (or overreporting) jurisdictions. The problem areas could then be subjected to intensive scrutiny at each field site rather than being identified after the study had closed. The telephone survey would provide insight into the type and amount of data to gather during field studies in order to maximize the project results.

A questionnaire was prepared to allow an examination of items that were likely to influence the number of reported accidents. Items such as changes in the city's administration or policies, traffic volumes, training of the police chief or police

force, the chief's perception of the accident situation, the city's investigating and reporting practices, handling of private-property collisions, and identification and correction of high accident locations were addressed by the survey.

Sites were selected from outlier cities by using the confidence band analysis. Where possible, four overreporting cities and four underreporting cities were selected from each of the population groups used in the regression analysis. No cities with more than 50 000 people fell outside the confidence bands, so the largest population group was excluded from the study. Four outlier sites were not available in all cases, so only 25 cities were selected instead of the desired 32. Another group of 25 cities were selected as control sites. These sites fell along or near the regression curves. For each population class, the number of control sites was balanced against the number of outlier sites.

The police chief for each city in the study was contacted via telephone. The objectives of the project were explained and the interviewer posed questions to the chief. In the larger police forces with well-defined functional divisions, the head of the traffic division was also interviewed. The respondent was allowed a great deal of freedom in answering because of the variety of city sizes and police department organizational structures. As the interview progressed, additional topics were introduced as necessary to expand the material contained in the original questionnaire or to explore situations unique to the city being studied. Where pertinent, the chief's comments were recorded for amplification. The results of these contacts are summarized below:

1. A great number of cities have changed mayors or police chiefs in the last five years, as evidenced by a 70 percent turnover rate for small cities. The change of administrators undoubtedly caused some changes in policies, which contributed to irregularities in accident reporting patterns.
2. Control cities had the most stable administrators. There were fewer changes and consequently fewer irregularities in reporting.
3. The majority of police chiefs had received some form of accident training, and approximately 90 percent of their police forces had received accident investigation training within the past five years. Law enforcement personnel would appear to be sufficiently trained to handle accident reporting adequately.
4. The unknown factor in accident training is the scope and intensity of the curricula offered by Alabama law enforcement academies. An investigation of the material offered by the academies may be in order.
5. The police chiefs in cities that underreported accidents appeared to be less knowledgeable of the local accident situation than their counterparts in overreporting cities.
6. The police chiefs in overreporting cities had the strongest grasp of the local accident situation.
7. Many small cities tend to depend on neighboring cities or the local Department of Public Safety (DPS) for assistance in investigating and reporting accidents.
8. Forty percent of the underreporting cities responded that they withhold some or all of their accident reports instead of forwarding them to the DPS.
9. A large number of cities, of all sizes and in all three reporting groups, fail to mail completed accident reports to the DPS within 24 hours after completing the investigation.
10. Almost all cities in the study maintain their own files of completed accident reports.
11. Very few private-property accidents are reported to the DPS.
12. There are many different policies for investigating private-property accidents and much concern on the part of police chiefs. Many progressive departments have developed their own form for such investigations. Usually, this form is provided for drivers to swap information.
13. Standardization of private-property accident policies would appear to be highly desirable. For example, "semipublic" areas such as shopping center entrances could be treated by use of a standard form for drivers to use in swapping information at the scene.
14. Comments compiled during the survey indicated a high degree of group uniformity within each of the three separate reporting levels used in the study (underreporting, overreporting, and control).
15. Common factors for control cities seemed to be (a) good cooperation with neighboring jurisdictions; (b) a knowledgeable, well-trained staff and an interested, aggressive police chief; and (c) a well-defined system for handling private-property accidents.
16. Common factors for underreporting cities seemed to be failure to mail all reports to the DPS and a lack of emphasis on the part of police chiefs.
17. Common factors for the overreporting cities included (a) high traffic volumes, (b) a system for private-property accidents, and (c) an aggressive program to abate the accident situation.

Field Studies

After certain cities had been identified as chronically overreporting or underreporting accidents and after the telephone survey had provided some insight into reasons for atypical reporting, a program of site visits was conducted to identify specific deficiencies.

A questionnaire was devised to standardize the questions asked during field visits and to provide consistency in the manner in which the questions were asked. The questionnaire was designed to provide a comprehensive picture of the total accident reporting operation at each of the field visit locations. Three general areas of interest were addressed by the interview form:

1. Questions asked of the police chief--Questions that expanded on the telephone interview were asked to assess the police chief's knowledge of the causes of local accidents (high traffic volumes, new developments, commuting patterns, etc.) to determine investigative policies and to examine accident record processing.
2. Alabama Uniform Traffic Accident Report (AUTAR) processing system--The interviewer observed actual processing of accident records at the field study sites. Questions were directed to the police dispatcher and file clerk, who are heavily involved in overseeing accident investigation and processing of AUTARs.
3. Questions asked of an investigating officer--Questions asked of an investigating officer were designed to supplement the responses of the police chief and to provide another view of departmental policies.

Candidate cities for field visits were designated in a meeting of the project principal investigator and the Alabama Highway Department project monitor. A classification matrix was created with four population groups (0-1000, 1000-5000, 5000-10 000, and

10 000-50 000) and three accident reporting classes (underreporting, control, and overreporting). One city was selected for each cell of the matrix. Because one of these cells was empty (underreporting with a population of 5000-10 000), only 11 cities were designated to receive visits. Cities were notified in advance of the proposed visit of the general nature of the interview and of the personnel who should be made available for the interview. Each of the 11 cities selected for field visits was in the sample previously used for the telephone survey.

The field visits were accomplished between October 14 and October 30, 1981. In general, the procedure consisted of an interview with the police chief in which the 36 questions were asked from the questionnaire. The interviewer then met with the dispatcher and the file clerk to ask the questions specified for these personnel. An important part of this portion of the interview consisted of observing the procedures used in recording and filing accident records. The final phase of the field visit involved interviewing an officer actually involved in investigating accidents.

The responses obtained during the field visits were compiled by both reporting characteristic (underreporting, overreporting, or control) and by city size grouping. The relatively small number of cities in the sample limits the degree of confidence that may be placed in any statistical inferences drawn from the data. Because of the small sample sizes, it is not possible to arbitrarily ascribe observed characteristics to the entire population of Alabama cities. Care should also be taken in ascribing results to the city population for various reporting characteristics or population groups.

In spite of the limitation imposed by the small sample sizes, the field survey performed a valid function by documenting various details of accident investigation and reporting for a wide range of conditions. A number of interesting trends and results were observed. The responses received during the interview can be summarized as follows.

1. The high turnover rate among administrative personnel was documented. The field visits indicated a higher rate of change for overreporting cities than had been disclosed by the telephone survey.
2. Police chiefs were found to have less accident training than street officers. A high percentage of all policemen have received accident training, but the quality of this training is unknown.
3. Street officers were generally unaware of how accident data are used for engineering purposes and did not gather data with such uses in mind.
4. Many police chiefs were not aware that accident summary reports are prepared by the Alabama Highway Department. The majority of the chiefs did not know how to use such reports to alleviate hazardous roadway situations.
5. Chiefs in overreporting cities seemed to have a clearer knowledge of the accident situation than chiefs in underreporting cities.
6. Reporting thresholds were discovered in several cities. Although departments may not have formal thresholds, some officers report that they decide at the accident scene whether or not the collision is worth reporting.
7. Not all cities were in compliance with requirements to mail all AUTARs to DPS within 24 hours of completing an investigation. Some cities simply do not mail in the reports, whereas other cities delay their mailings.
8. Police chiefs and other departmental employees were not always in agreement regarding departmental policies. Conflicting responses were given concerning the presence of written instructions at the site, investigating private-property accidents, threshold values, and how rapidly AUTARs were forwarded to DPS.
9. Instances were documented in which population was not an appropriate factor to use in predicting accidents. Three of the overreporting cities were found to have accident problems based on other factors.
10. Little contact was observed between DPS and local police departments. It appears that a feedback mechanism is necessary to edit and control the quantity and quality of local accident reports.

RECOMMENDATIONS

An extensive research effort was conducted to identify jurisdictions that reported accidents in an abnormal manner. At the conclusion of the study, such locations had been identified. The following list of recommendations has been prepared to alleviate existing problems and guard against their reoccurrence:

1. Those cities designated by this research as chronic atypical reporters should receive individual visits in the near future to identify specific causes for overreporting or underreporting.
2. The regression/confidence band analysis should be repeated at regular intervals as reliable population data become available. This study has proved that regression based on population is a good way to identify cities that need to improve their reporting.
3. A follow-up study should be conducted on those cities with erratic five-year reporting histories. The reason for variability should be identified in each case, and countermeasures should be suggested.
4. A program should be developed to evaluate the quantity of annual accident data submitted by the various jurisdictions. The mechanism should identify year-to-year variance. For example, a simple computer program could edit each year's accident reports and flag cities that show a large change in the number of reported accidents.
5. A mechanism should be developed to evaluate the quality of each item of accident data submitted by the various jurisdictions. For example, a simple computer program could edit reporting characteristics (such as percentage of injuries and wet or dry pavement) and flag those jurisdictions with abnormal patterns.
6. Before accident data are used for future safety studies, the number of accidents reported by any jurisdiction should be compared with tabulated values to determine the validity of the data.
7. An abnormally large number of cities report no accidents or very few accidents. These jurisdictions fall within the confidence band and are statistically satisfactory; however, they should be examined to determine whether they are properly reporting all accidents that actually occur.
8. Law enforcement academy curricula should be reviewed in the area of accident investigation and reporting. Officers should be aware of how data are used in engineering work and of the necessity for data to be of uniform quality.
9. Police chiefs are not totally aware of the accident situation or of the summary reports and other devices available to assist them in identifying and alleviating hazardous situations. A training program should be instituted to improve their knowledge of the overall accident situation, high accident locations, summary reports, and abatement of the accident problem.

10. Almost all cities expressed concern about private-property accidents. A full-scale study should be conducted to establish a statewide policy to provide uniformity. Perhaps a "driver swap" form might be provided for use by all cities.

11. Reporting of accidents in the police jurisdiction should be standardized. All law enforcement officials should be aware that rural street codes and location codes should be used for accidents within the police jurisdiction.

12. Reporting thresholds, both official and implied, were found to exist. A uniform treatment is necessary if accident data are to be meaningful. Law enforcement officials should be made aware that such thresholds are not condoned under existing statutes.

13. Lines of communication should be developed and maintained between the DPS and local jurisdictions. The high turnover among administrators causes constant change at the local level. The DPS must continually emphasize reporting requirements and the reasons for them to ensure that accident data are consistent and of high quality.

Implementation of these recommendations will result in rapid improvement in the quality and quantity of accident data. Safety studies based on a more reliable data base will result in better use of safety funds. In turn, the citizens of Alabama will benefit from an enhanced roadway environment.

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