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Abridgment

Factors Contributing to Abnormal Accident Reporting

DANIEL S. TURNER

ABSTRACT

A research project in Alabama addressed the problem of abnormal reporting of traffic accidents. More than one-eighth of the state's police chiefs were interviewed by telephone to determine investigation and reporting practices, procedural difficulties, and compliance with accident reporting provisions of the Alabama Code. In addition, one-fourth of the cities in the survey received thorough site visits. The study sample of 50 cities was composed of those that reported far too few or far too many collisions, and a control group that reported near the average number for their size. These cities had been targeted for further study by regression and confidence-band analyses. The research staff found the most important factor in abnormal accident reporting to be the attitude of the police chief. Another prominent factor appeared to be insufficient contact between state officials and local investigating officers. In addition, local officers did not understand the final use of accident data. For under-reporting cities, the major problems included withholding accident reports, a lack of knowledge (or interest) on the part of the police chief, and use of neighboring cities to prepare reports. These items also tended to appear frequently in smaller jurisdictions. In general, over-reporting sites were found to have hazardous situations rather than weak reporting practices. They were usually typified by high traffic volumes, knowledgeable and aggressive police chiefs, and good accident-reduction programs. At the conclusion of the study suggestions were made to provide targeted education to police chiefs, to strengthen training in police academies, and to improve communications between state agencies and local police departments.

The Alabama Code requires the reporting of all traffic accidents that are investigated by local law enforcement agencies. A research project was conducted to determine compliance with the Code and to identify reasons for noncompliance. The search for reasons for noncompliance, especially as related to the police chief, is documented.

IDENTIFICATION OF ABNORMAL REPORTING LOCATIONS

Regression analyses and confidence-band studies were applied to 423 cities and 67 counties in Alabama. Many variables (traffic volumes, registered vehicles, drivers' licenses, population, and so forth) were examined before population was determined to be the best prediction variable. Twenty-five cities, but no counties, were identified as outliers, falling far above or far below the predicted number of accidents. A second statistical analysis found that 21 cities had extremely erratic year-to-year reporting patterns, and these cities were added to the outlier group. Details of these studies have been published elsewhere (1,2).

TELEPHONE SURVEY

A telephone questionnaire was prepared to examine factors that were likely to influence the number of reported accidents. These included items such as traffic volumes, police training, the police chief's attitude, length of chief's service, investigating and reporting practices, private property collisions, and identification and correction of high accident locations.

Conducting the Study

The study population was divided into a matrix of four city-size groups and two reporting levels (over-reporting and under-reporting cities). For each population class, the number of control sites was balanced against the number of outlier and erratic reporting sites, thus yielding 50 cities.

The police chief for each city was contacted by telephone, the objectives of the project were explained, and the interviewer posed questions from a prepared list. As the interview progressed, additional topics were introduced as necessary to expand the material or to explore situations unique to the city. Where pertinent, the chief's comments were recorded for amplification of the questionnaire.

Results

Following the interview period, the results were tabulated and compared by using the Student's t-test. Because of the small sample size in some cells of the classification matrix, statistical conclusions were not always possible. Unfortunately, some items (e.g., traffic volumes) had to be dismissed because of variability in the chiefs' understanding of the topic. The remainder of this paper deals with the remaining factors found to most directly influence the quality of accident reporting.

Chief's Assessment of Accident Situation

A series of questions addressed the police chief's knowledge of the accident situation in his city. For example, police chiefs were asked to estimate the number of accidents and the percentage of injuries. The estimated and reported accidents were compared to find the percentage difference. In almost all cases, the chiefs overstated the number of accidents. The reasons for overestimating collisions could have been either a lack of knowledge on the subject or failure to report all accidents to the state. In either case, the trend toward overestimation was obvious.

Chiefs in the under-reporting cities averaged about a 770 percent error, as shown by Figure 1. Control cities exhibited more than a 130 percent error, whereas the chiefs in over-reporting cities had

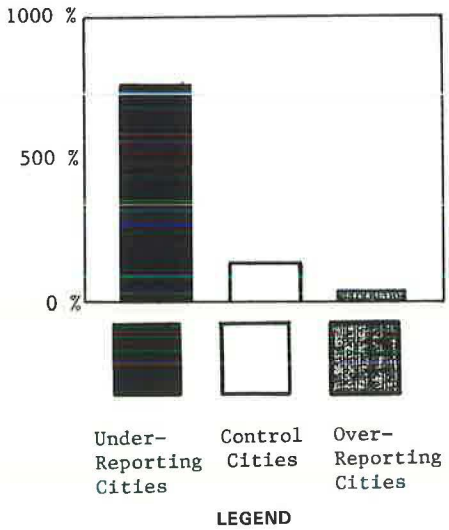


FIGURE 1 Error in chiefs' estimate of annual accidents.

reasonable estimates, with less than a 40 percent error. The higher the reporting level, the closer the chiefs' estimates were to the actual number of accidents. The under-reporting cities had significantly weaker estimates, as confirmed by the Student's t-test.

The analysis of estimated accidents suggests that the chiefs in under-reporting cities are least knowledgeable of the accident situation. The chiefs in over-reporting jurisdictions appear to have a uniformly satisfactory assessment of the situation, often citing traffic volumes and other factors, which suggests that their problem may be caused by hazardous traffic conditions rather than reporting deficiencies. The chiefs' estimates of other accident statistics support these findings.

Training

The amount and quality of training received by law enforcement personnel influence accident reporting. New officers are required to undergo a vigorous 240-hr general training program, which includes accident reporting, at one of Alabama's law enforcement academies. The number of staff officers receiving training in the past 5 years was found to be high, with the control group registering 94 percent (see Figure 2).

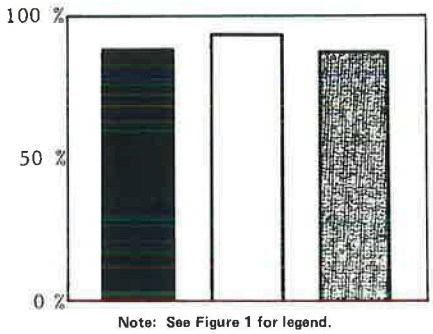


FIGURE 2 Percentage of police officers receiving detailed accident training in past 5 years.

A much lower percentage of chiefs had received training (Figure 3). Officers already on duty when the training requirements were enacted did not have to attend the academies. This explains why the chiefs have less accident training; they are generally older and exempt from training under the "grandfather" clause. This lack of training may help explain some chiefs' weak grasp of the local situation. It may also account for a virtual void of knowledge of accident summary reports. When queried, only a few of the chiefs were aware of the reports furnished by the Alabama Highway Department or of accident-reduction programs. This is a major weakness in the use of accident data.

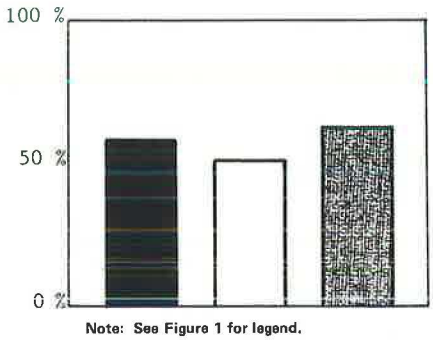


FIGURE 3 Percentage of cities where chief of police received detailed accident training.

In summary, it appears that the vast majority of law enforcement personnel has received training, with chiefs being significantly less trained than other staff personnel.

Investigation and Reporting

One portion of the survey was designed to determine if cities performed their own investigation and reporting or if they depended on other agencies for help. This is a possible source of error, because outside jurisdictions that assist in reporting accidents may be erroneously credited with their occurrence. Figure 4 indicates that under-reporting locations consistently used other jurisdictions. Smaller cities were also prone to use other jurisdictions to help gather and report accident information. The Student's t-test indicated that under-reporting sites were significantly different from other locations.

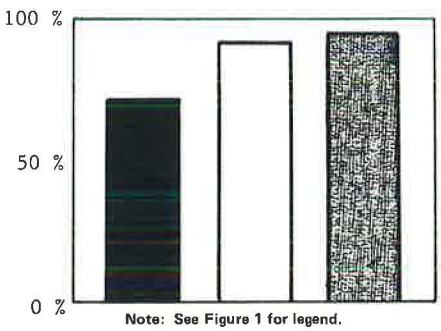
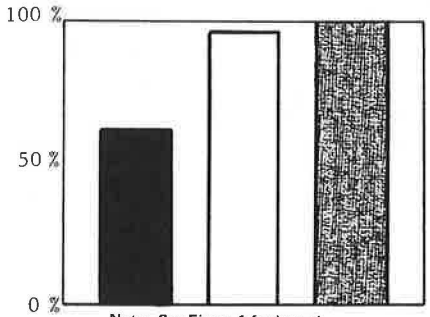


FIGURE 4 Percentage of cities that prepare all of their own accident reports.

Processing of Accident Reports

Local law enforcement officials are required to mail copies of completed accident report forms to the Department of Public Safety (DPS) within 24 hr of completing an accident investigation. The majority of the study sites complies with this regulation, as shown by Figure 5. However, under-reporting cities are seriously deficient in this area. Forty percent of these jurisdictions withhold some or all of their reports (statistically significant). One of the prime reasons that these cities appear to have a low accident level is that they simply do not report accidents to the DPS.



Note: See Figure 1 for legend.

FIGURE 5 Percentage of cities that forward accident reports to the DPS.

Other Items

Factors such as the stability of police leadership, reporting of private property accidents, and reporting of accidents outside of the city limits were also investigated during the study. In general, these data supported other findings; however, conclusions were not as easy to draw as those for topics discussed previously. The research staff considered and evaluated these other items when formulating conclusions and recommendations at the end of the project.

FIELD STUDIES

After the telephone survey uncovered some of the reasons for atypical reporting, a program of site visits was conducted to supply more detail. The investigators used a questionnaire at each site to gather information from the chief, the dispatcher, and investigating officers. Eleven cities were included in this phase of the project.

The main purposes of the field visits were to confirm telephone findings, to add insights to those findings, and to assist the research staff in formulating recommendations. Because of small sample sizes, statistical inferences could not be drawn. The results of the field studies are given in the following sections.

Training

Training of police chiefs was noticeably lacking. Few of the chiefs were aware that accident summary reports are generated and distributed by the Alabama Highway Department. Still fewer knew how to interpret and use such reports to alleviate dangerous situations. More important, many chiefs were not generally aware of what types of accident data were gathered in the field to produce these reports. These areas should be addressed and improved.

Assessment of Accident Situation

Questions were added to the field visit questionnaire to provide more information about police chiefs' understanding of the local accident situation. Small sample sizes made it hard to detect clear trends, but it appears that the chiefs in over-reporting cities, along with those in large cities, were more aware of the factors that control the overall accident situation. This reinforced the findings of the telephone survey.

Investigating and Reporting

The police chiefs in all reporting and population categories indicated similar investigating and reporting techniques. One noticeable trend was that a large percentage of the under-reporting cities used a threshold value (below which they would not investigate and report an accident). Although some threshold values were found for other cities, it was most pronounced for under-reporting cities.

Processing of Accident Reports

A very clear picture of accident data processing was obtained by asking questions of radio dispatchers and file clerks in each city. Clerks in some cases provided responses that contradicted those of the police chiefs. For example, some chiefs in under-reporting cities stated that reports were sent in as soon as they were completed, whereas their clerks indicated otherwise.

Interviews with Investigating Officers

Interviews with investigating officers provided information from a different perspective. It was clear to the research staff that police officers do not understand how accident data are used in making traffic engineering decisions, nor do they gather data with such uses in mind. Administrators of engineering and safety organizations need to provide input to police training curricula.

General Observations

In at least three cities high traffic volumes were found to be the primary cause for the level of accidents. These were all over-reporting locations, which demonstrates that population might not be the best way to predict accidents at these locations. However, such sites cannot be found without visits to identify the unusual conditions.

Another factor that became obvious during this part of the study was that there was very little contact with the DPS. Officers were generally unaware of what the DPS required of them.

SUMMARY

A search for reasons for abnormal accident reporting is described. This is one part of a project to improve accident data in Alabama. This portion of the research project was successful in that both the telephone survey and the site visits supplied useful data.

The project staff used tabulated responses from these studies and subjective judgment to devise ways to improve reporting.

1. The most important factor in the quality of accident reporting is the attitude of the police chief. The staff strongly believed that all other factors shrink in significance in comparison. Perhaps the most effective way to improve accident data might be to conduct a strong educational program aimed at chiefs. The program should include the use of Alabama Highway Department summary reports and accident-reduction efforts.
2. Patrolmen do not understand the final use of accident data. Law enforcement academy curricula should be modified to explain such uses. (Academy instructors received additional training in a subsequent project.)
3. The DPS should initiate contact with local entities. This could be in the form of a monthly newsletter reminding cities of their responsibilities, or a series of visits to jurisdictions known to have trouble with accident reporting. The DPS contact would demonstrate concern, would motivate local law enforcement officers to improve the quality of reporting, and would educate new administrators if the high rate of turnover continues.

In summary, there are simple and direct ways in which significant gains may be accomplished through improved communications. They require minimal resources and planning times, and can be put into practice in the near future to improve accident data and thus improve the quality of traffic safety programs.

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Abridgment

Impact Evaluation of Lexington – Fayette County Traffic Alcohol Program

JERRY G. PIGMAN and KENNETH R. AGENT

ABSTRACT

In an attempt to lower the number of alcohol-related accidents, a comprehensive program of countermeasures was implemented in Lexington - Fayette County, Kentucky. The program involved a coordinated effort among the Division of Police, the judicial system, rehabilitation program administrators, educational institutions, and the local news media. Included in the program were (a) officer training to spot driving under the influence (DUI), (b) deployment of officers for DUI enforcement, (c) a public information campaign, and (d) development and implementation of an effective alcohol education program. An evaluation of the Traffic Alcohol Program (TAP) that began on May 1, 1982, is given. Information collected for the analysis included accident data, arrest and adjudication data, and personal opinion data obtained by means of a questionnaire survey. Accident data were collected for 2 years before TAP and 1 year into the program. A 25 percent sample of arrest and adjudication data was collected 1 year before and 1 year during TAP. The questionnaire was sent to 2,500 registered vehicle owners. Results from before-and-after comparisons and time-series analyses indicated that alcohol-related accidents decreased significantly as a result of TAP. The number of DUI arrests increased from 929 in the year before TAP to 4,427 during the first year of TAP. The program as found to be cost effective with a benefit-cost ratio greater than 2. More than half of the respondents of the survey indicated that TAP increased their chance of DUI arrest.

In an attempt to lower the number of fatalities, injuries, and property-damage alcohol-related accidents, a comprehensive program of countermeasures

has been implemented in Lexington - Fayette County, Kentucky. The program involves a coordinated effort among the Division of Police, the judicial system, rehabilitation program administrators, educational institutions, and the local news media. Generally, the program includes the following components: (a) an officer training course on driving under the influence (DUI), (b) deployment of officers for DUI enforcement, (c) a public information campaign, and (d) development and administration of an effective alcohol education program.

Some expected accomplishments and anticipated long-range results of Lexington's Traffic Alcohol Program (TAP) are to

1. Reduce alcohol-related fatality and injury accidents by 25 percent,
2. Decrease the average blood alcohol level of those arrested for DUI from 0.20 to between 0.10 and 0.14,
3. Reduce the number of "Reckless Driving--Had Been Drinking" arrests (this notation is used to identify reckless driving arrests in which alcohol was involved),
4. Increase community awareness of the problems created by drinking drivers, and
5. Increase voluntary compliance to the DUI and implied consent laws.

TAP began in Lexington - Fayette County on May 1, 1982, and is scheduled to continue through September 30, 1984. This enforcement program operates every night of the week except Sunday, and the hours of operation are generally from 10:30 p.m. to 3:30 a.m. The number of police officers on TAP patrol varies from 15 to 25 per night, with higher numbers usually on patrol on weekends. Even though the program is still in operation, only the first year of data was selected for the impact evaluation.

DATA-COLLECTION PROCEDURES

To assess the impact of TAP, three primary types of data were collected for analysis: accident data, arrest and adjudication data, and personal opinion data obtained by means of a questionnaire survey. Data on alcohol-related accidents were collected for the 3-year period from May 1, 1980, through April 30, 1983. Arrest and adjudication data were the second major data element included in the analysis. Data reflecting a complete summary of the arrest and adjudication history for each DUI case were available from the Administrative Office of the Courts, which is part of the judicial system in Kentucky. Arrest and adjudication data were collected for the 2-year period from May 1, 1981, through April 30, 1983. Because of the time required to collect those data, only a 25 percent sample was obtained for inclusion in the analysis. The sample of 25 percent is sufficient to ensure that the confidence level or reliability is 95 percent that the error of the observed values would be between 2 and 3 percent.

To determine public opinion of TAP, a survey of registered vehicle owners in Fayette County was conducted. The number of registered vehicle owners in the county is approximately 100,000; the questionnaire was sent to 2,500. The survey response was sufficient to ensure a confidence level of 95 percent that the error of the results would be near 3 percent.

ANALYSIS OF RESULTS

Accident Data

As noted previously, accident trends and statistics were one of three primary areas of analysis. Included was a 2-year period before TAP and a 1-year period during TAP. It was found there was a 21 percent decrease in alcohol-related accidents between the 2-year period before TAP and the 1 year during TAP. To determine the significance of the accident reduction, the chi-square test was applied and the decrease was found to be significant at the 99.5 percent confidence level (1).

To determine whether the significant decrease in accidents was a result of TAP or a general decrease in accidents, total accidents for the same time period were tabulated; the overall decrease was 7.6 percent. This decrease was also significant at the 99.5 percent confidence level. The question of whether all the decrease in total accidents was attributable to alcohol-related accidents was also addressed. The result was a 6.1 percent decrease in all accidents, excluding those related to alcohol, and a 21.0 percent decrease in alcohol-related accidents. It was found that even though the reductions in both alcohol-related and other accidents were significant at the 99.5 percent confidence level, the magnitude of the reduction in alcohol-related accidents is approximately 3 times greater than for other accidents.

During the hours of TAP enforcement (10:30 p.m. until 3:30 a.m., except Sunday night and Monday morning), the decrease in alcohol-related accidents was 29.7 percent (significant at the 99.5 percent confidence level). This is slightly more than the decrease in alcohol-related accidents for all hours (21.0 percent); however, the impact of TAP extended to hours other than those hours of special enforcement because of increased public awareness and an increased level of enforcement during non-TAP hours.

Alcohol-related accidents for the 3-year study period were classified by the most severe injury. Data from this summary indicate that the percentage of fatal or injury accidents decreased by 22.5 percent when comparing the 2-year before period with the 1-year period during non-TAP hours.

Alcohol-related accidents for the 3-year study period were classified by the most severe injury. Data from this summary indicate that the percentage of fatal or injury accidents decreased by 22.5 percent when comparing the 2-year before period with the 1-year period during TAP.

Additional data for total injuries resulting from alcohol-related accidents during the study period indicated a 25 percent decrease when comparing the 2 years before with the year during TAP.

Time-Series Analysis of Accident Data

Alcohol-related accidents were obtained beginning in January 1980. This gave a total of 173 weeks of accident data that were available to be analyzed for the time period of January 5, 1980, through April 29, 1983. The analysis period started on January 5, 1980, because the TAP program began on a Saturday (May 1, 1982), and January 5 was the first Saturday in 1980. The relationship between number of accidents and time in weeks was analyzed.

The time-series analysis for the weekly accident data was first performed without consideration of a time-series lag. The resultant equation was

$$Y_t = 18.29 - 3.77X_t + \text{error} \quad (1)$$

Both coefficients were significant when the t-statistic was calculated. Based on this equation, the impact due to TAP was a significant reduction of 3.77 accidents per week.

Another equation was developed to assess whether

a time-lag effect affected the overall program. Results of that analysis indicated that the impact was immediate and did not lag the beginning of the Lexington TAP project on May 1, 1982.

Another analysis was performed for the relationship between alcohol-related accidents during TAP hours for each of the 173 weeks. The relationship was similar to that for total alcohol-related accidents. Again, the analysis was first performed without consideration of a time-series lag impact. The resultant equation was

$$Y_t = 8.77 - 2.23X_t + \text{error} \quad (2)$$

The t-statistics for the variable coefficients were significant, and the estimated reduction in alcohol-related accidents during TAP hours was 2.23 accidents per week. Results of the analysis indicated that the impact was immediate and did not lag the beginning of TAP.

Arrest and Adjudication Data

The impact of TAP on the number of DUI arrests occurred immediately after the program began on May 1, 1982. A large increase in the total number of DUI arrests was noted when comparing the before TAP records (929 arrests) with the year during TAP (4,427 arrests).

Another summary of DUI arrests indicated that the number of arrests during TAP hours increased from 141 before TAP to 939 during the first year of TAP. After the beginning of TAP, 84 percent of DUI arrests occurred during TAP hours (10:30 p.m. to 3:30 a.m.). Before TAP, 60 percent of all DUI arrests occurred during those same hours.

The outcome of the adjudication process is a critical element to any alcohol enforcement program. This process serves as the primary means for the judicial system to have an opportunity to rehabilitate or deter the offender. Education is offered in the form of the Alcohol Driver Education (ADE) School. Penalties are generally in the form of fines and jail sentences. A typical sentence for first-time offenders is a fine and mandatory attendance at the ADE School. One unique penalty required by some judges for first-time offenders is the requirement to submit a written report or an article relating to the consequences of drunk driving. More than 60 percent of the sample arrest cases resulted in combined sentences of fines and the ADE School. Almost 95 percent of the arrests resulted in fines for the offender. Cases dismissed or amended were approximately 15 percent before TAP and 11 percent during TAP. Some differences were noted when comparing the sampled data with available statistics from the complete adjudication data, which indicates a conviction rate of 95 percent for DUI arrests.

Another important consideration when attempting to deal with the drunk driving problem is the driving record of those arrested for DUI. Drivers arrested for DUI were found to have a worse prior driving record than the general driving population. This was true for both points and accidents. From a previous study of driver characteristics (2), the number of points per driver per year for a sample of all drivers was 0.22 as compared with 0.80 for those arrested for DUI. From that same study it was determined that all drivers have an average of 0.03 accidents per driver per year as compared with 0.18 for drivers arrested for DUI. Also, the number of violations per driver per year was 0.10 for all drivers as compared with 0.29 and 0.26 for drivers arrested for DUI the year before TAP and the year during TAP, respectively. The percentage of drivers arrested who had a previous DUI arrest was 18 percent for both years of analysis.

A basic skill required by the police officer involved in enforcement of drunk driving laws is the ability to detect those suspected of DUI. During the first year of the program the police officers were given training dealing with the most frequently occurring characteristics to use for detecting drunk drivers at night. To determine which driving characteristics were most frequently observed by the police officer, data were extracted from the arrest report. The most commonly occurring driving characteristic that indicated a potential drunk driver was weaving of the vehicle. Other frequently occurring characteristics were speeding, straddling or crossing the center of a lane marker, almost striking an object or vehicle, or disregarding a traffic signal.

After a driver has been stopped as a potential DUI offender, the officer generally requires the driver to go through a series of field sobriety tests to determine whether the person should be arrested. These tests are critical to the outcome of the case because the credibility of the arresting officer is at stake. An officer does not want to arrest a person unless they are legally drunk. In borderline cases [blood alcohol content (BAC) close to 0.10] the officer needs substantial evidence to support his decision to make an arrest. The most common test given was having the driver place one foot near the bumper to test the person's balance. Other common tests were requiring the driver to (a) touch his nose with his eyes closed and head tilted and (b) walk a line heel-to-toe. As the data indicate, a small percentage of those performing these tests passed. A large number of tests are available for use, and generally several tests are given to each driver. In some cases the driver may pass one but fail others.

Cost-Effectiveness

Data were gathered to make an estimate of the overall cost-effectiveness of the program. For the period of May 1, 1982, through April 30, 1983, total police personnel costs associated with the program were $367,900. In addition to personnel, support costs for such items as administration and vehicle mileage totaled $115,600. Other significant costs were court costs and jail costs. Based on a total of 4,427 DUI arrests during the first year of TAP, court costs were determined to be $114,700. Court costs to handle other traffic violations and public intoxication arrests totaled $99,700. Jail costs were determined to be approximately $497,500 during the first year of the program. The jail costs were calculated by using an average of $25 per day for each day served. Considering all components, the total cost of the program during the first year was computed to be $1,195,400.

Benefits and income were derived from two primary sources: DUI fines and reduced accident costs. Income from TAP was the result of fines assessed to those who were arrested for DUI. During the first year of TAP there were 4,427 arrests; the average fine per arrest was determined to be $194. After subtracting court costs from the total fine, income received from DUI fines was $697,900. A total court cost of $160,900 was paid by the drivers arrested for DUI, yielding an income of $858,800 from DUI fines (including court costs).

While TAP officers were on duty, they gave out a significant number of citations for other traffic violations and made several public intoxication ar-

rests. The revenue from these violations and arrests was estimated to be $245,400 (including court costs).

A commonly used measure of the benefit of a highway safety progam is an estimate of accident costs that will not be incurred as a result of reduced accidents. By using the number of injuries and property-damage accidents before and during TAP and accident costs reported by the National Safety Council (3), the savings resulting from reduced accident costs were determined to be $1,505,000. Therefore, the total benefits and income for a 1-year period resulting from the program were $2,609,200.

A benefit-cost ratio of 2.18 was calculated. This demonstrates that benefits were about 2 times greater than costs during the first year. It is also significant to note that direct revenue from fines and court costs would account for 92 percent of the cost of the program.

Questionnaire Survey

The survey of registered vehicle owners was conducted in the spring of 1983. From the total of approximately 100,000 registered vehicle owners, a random sample of 2,500 was selected and mailed a questionnaire containing 15 questions. Responses were received from 989, or approximately 40 percent of those sent questionnaires. It was found that 96 percent of the respondents knew about the program. More than three-fourths believed that TAP reduced their chances of involvement in an alcohol-related accident. Only 17 percent thought the enforcement program violated their rights as a driver. Eighty-five percent indicated they were in favor of increased enforcement as a means of reducing the number of drunk drivers. Probably the most surprising result was that 65 percent indicated they were willing, as taxpayers, to support increased enforcement after federal funding was discontinued.

One of the primary purposes of the survey was to determine the perceived risk of the drivers while TAP was ongoing. More than half (55 percent) indicated that TAP increased their chance of DUI arrest.

SUMMARY OF FINDINGS

Results from the impact evaluation of the Lexington - Fayette County TAP were analyzed for the following four areas: accidents, arrests and adjudication, cost-effectiveness, and a questionnaire survey. A summary of major findings from each of these analyses is presented.

Accidents

1. Alcohol-related accidents decreased by 21.0 percent when comparing the 2-year period before TAP with the first year of TAP.
2. Other non-alcohol-related accidents decreased by 6.1 percent when comparing the period before TAP with the TAP enforcement period.
3. Alcohol-related accidents decreased by 29.7 percent during the TAP hours of enforcement (10:30 p.m. to 3:30 a.m., except Sunday night and Monday morning).
4. Alcohol-related fatal and injury accidents decreased by 22.5 percent when comparing the 2-year period before TAP with the 1-year period during TAP.
5. Results from the time-series analysis revealed a significant reduction in the number of alcohol-related accidents after TAP began.

Arrest and Adjudication

1. DUI arrests increased from 929 in the year before TAP to 4,427 during the first year of TAP.
2. DUI arrests during TAP hours were 84 percent as compared with 60 percent during an equivalent time the year before TAP.
3. The most common types of adjudication were a fine or attendance at the ADE School or both.
4. Slightly more than 95 percent of those arrested and charged with DUI during the first year of TAP were convicted. For all of Kentucky, the conviction rate was 52 percent in 1980. The national average for 1978 through 1980 was 56 percent (4).
5. A significant drop in BAC level has occurred when comparing the year before TAP and the first year of TAP.
6. The number of points per driver per year was 0.22 for all drivers as compared with 0.80 for those arrested for DUI during the study period.
7. The percentage of drivers arrested for DUI who were male or young (younger than 25 years old) was much higher than the percentages of male or young drivers in the general driving population.
8. It was found that 18 percent of drivers arrested during the study period had a previous DUI arrest.
9. Drivers arrested for DUI during the study period were found to have a worse prior driving record than the general driving population. This was true for both points and accidents.

Cost-Effectiveness

1. Total cost of TAP during its first year was determined to be $1,195,400.
2. Benefits resulting from reduced accident costs and income from DUI totaled $2,609,200.
3. The first year benefit-cost ratio of the program was determined to be 2.18.
4. Direct revenue from fines and court costs would account for 92 percent of the cost of the program.

Questionnaire Survey

1. Responses were received from 989 (40 percent) of those mailed questionnaires.
2. It was found that 96 percent of the respondents previously knew about the program.
3. Seventy-eight percent believed that TAP reduced their chances of involvement in an alcohol-related accident.
4. Only 17 percent thought the enforcement program violated their rights as a driver.
5. Eighty-five percent indicated they were in favor of increased enforcement as a means of reducing the number of drunk drivers.
6. Almost two-thirds indicated they were willing, as taxpayers, to support increased enforcement after federal funding was discontinued.
7. More than half (55 percent) responded that TAP increased their chance of DUI arrest.

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Increase of Traffic Safety by Surveillance of Speed Limits with Automatic Radar Devices on a Dangerous Section of a German Autobahn: A Long-Term Investigation

RUEDIGER LAMM and JUERGEN H. KLOECKNER

ABSTRACT

Experiences in the Federal Republic of Germany have indicated that the introduction of speed limits often has only a short-term effect on reducing speeds, and consequently the number of accidents, unless police regularly enforce the speed limits. Posted speed limits alone will not guarantee compliance. Only when backed up by strict police enforcement can speed limits both reduce speed and alleviate accidents. To examine the influence of speed limits by strict surveillances by police, one of the most dangerous downgrade Autobahn sections in the Federal Republic of Germany was equipped with lane-related radar devices and additional DO NOT PASS signs for trucks. The results of a long-term investigation from 1970 to 1982 are as follows: (a) in 1971 the design speed was exceeded by most of the passenger cars in the left and middle lanes, whereas in 1981 few passenger cars exceeded the speed limit in either lane; (b) the 85th percentile speeds were reduced in all lanes for passenger cars and trucks, and a more uniform traffic flow was noted; (c) the accident frequency, as related to personal injury, was reduced by a ratio of 18:1 between 1971 and 1981, and the number of fatalities dramatically decreased; and (d) between 1974 and 1983 a total of 30 million German marks was paid in fines. The experiences have demonstrated that the common impact of reasonable lane-related speed limits and strict surveillance by police with automatic radar devices has had a decisively positive influence on driving behavior and accident reduction. The investigation period of more than 10 years appears to be long enough to verify that the improvements are permanent.

It is a documented fact in the United States and Europe that reasonable and systematic traffic surveillance can reduce the number and severity of accidents, especially on dangerous road sections. In many cases the danger of a road section is directly attributable to improper speed estimations by the driver. Besides alcohol abuse, not fastening seat belts, and inattention, most of the excessive speed errors occur with reference to road design, primarily in the sense of exceeding the critical speed for a curve or a downgrade and thereby losing control.

Therefore, strong efforts should be made by police to enforce the speed limits, at least on dangerous road sections. The purpose of this paper is to discuss the extent to which surveillance by police can produce an evident decrease in accidents. Experience gained in one of the most dangerous Autobahn (Interstate) sections in the Federal Republic of Germany, Elzer Mountain near the town of Wiesbaden, is used as the focus of the discussion.

ELZER MOUNTAIN

The Autobahn (A3) between Cologne and Frankfurt was built in the 1930s with two lanes in each direction, plus a median and paved shoulders.

Elzer Mountain lies in the route of this Autobahn and is located about 96.5 km south of Cologne and 48 km north of Frankfurt in hilly topography. Because of the high traffic increase in the 1960s [average daily traffic (ADT) 1960 ≈ 15,000 vehicles per day, both directions; ADT 1968 ≈ 30,000 vehicles per day, both directions], a third traffic lane and an emergency lane were added in 1969 in both directions.

Figure 1 shows the major part of the horizontal and vertical alignment on Elzer Mountain on Autobahn A3. Note the generous horizontal alignment of this Autobahn section, with relatively safe radii between 1500 and 2000 m.

The character of a generous and consistent align-

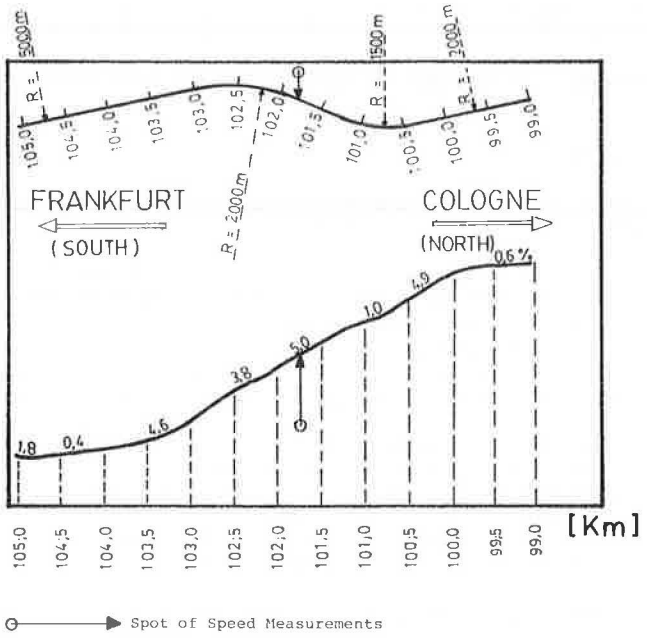


FIGURE 1 Horizontal and vertical alignment of Elzer Mountain.

ment is further supported by three wide traffic lanes per direction (lane width = 3.8 m) plus an additional emergency lane (Figure 2). In this connection the obviously good horizontal alignment superimposed by relatively high downgrade sections of up to 5 percent poses a real danger that is extremely difficult to recognize by the drivers. Drivers on such a downgrade tend to exceed safe driving speeds and thereby jeopardize their chances of stopping safely in an emergency.

FIGURE 2 Alignment of Elzer Mountain, downgrade direction.

In addition, there were great variations in vehicle speeds between passenger cars and trucks. For example, speed measurements indicated that 15 percent of the passenger cars in the left lane exceeded 150 km/h and in the middle lane they exceeded 135 km/h, whereas in the right lane truck speeds between 15 and 110 km/h were recorded (Figure 3). At this time there were no general speed regulations on German Autobahnen, and the great variations in vehicle speeds in the area of Elzer Mountain led to numerous hazardous driving situations.

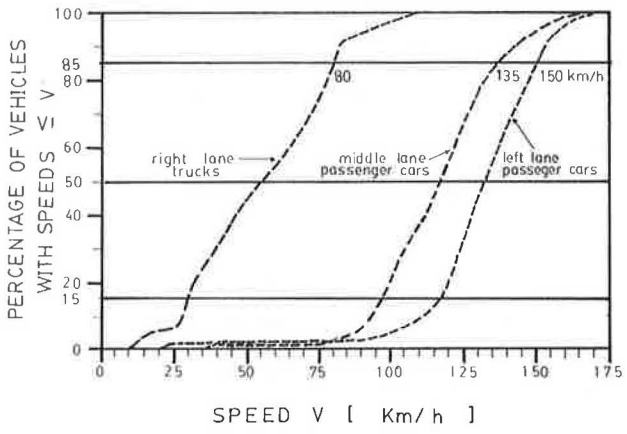


FIGURE 3 Characteristic distributions of speeds for passenger cars and trucks, downgrade direction.

After the end of the construction period and in spite of adding a third lane, drivers obviously were still unable to identify the steep downgrade sections of Elzer Mountain as dangerous because about 200 accidents occurred per year in 1970 and 1971 on a section length of only 7.2 km (Table 1). That meant that there were exactly 27 accidents per kilometer per year for the downgrade direction.

The data in Table 1 give the accident frequency on Elzer Mountain from 1961 to 1982 (1). Note that until 1972-1973 the downgrade direction from Cologne to Frankfurt was decisively more dangerous than the upgrade direction from Frankfurt to Cologne.

Furthermore, it should be mentioned that until 1970-1971, in spite of the addition of a third lane, the number of accidents with personal injuries was comparable with the number of accidents with injuries between 1964 and 1967. Since 1972 a continuous decrease of accidents with personal injuries can be noticed for the downgrade direction from Cologne to Frankfurt. The construction period for the third lane from 1968 to 1969 should not be taken into consideration here.

SPEED AND ACCIDENT ANALYSIS

To be able to make appropriate proposals for improving the accident situation on Elzer Mountain, the Institute of Highway and Railroad Design and Construction of the University of Karlsruhe conducted a comprehensive analysis of the speed distributions and the main accident causes (2). The investigation period was from April 1, 1970, to March 31, 1972.

Figure 3 shows characteristic distributions of speeds for a collection of passenger cars and trucks at one of the steepest downgrade sections on Elzer Mountain, at km 101.7 (see Figure 1). The 85th percentile speed in the left lane was 150 km/h, in the middle lane it was 135 km/h for passenger cars, and in the right lane it was 80 km/h for trucks. That meant that 15 percent of both passenger cars and trucks exceeded these speeds. The maximum design speed of 100 km/h, which had been permissible at that time in the Federal Republic of Germany for grades up to 5 percent, was exceeded by about 95 percent of the passenger cars in the left lane and by about 80 percent of the passenger cars in the middle lane. The general speed limit for trucks of 80 km/h in the Federal Republic of Germany was exceeded by 15 percent of vehicles of this type.

Figure 4 shows the computed accident rates of different accident types. For passenger cars the accident type "congestion" was dominant, whereas for trucks the accident type "run-into" was more relevant. The accident type run-into is related only to two vehicles (e.g., in a case when the driver of a following vehicle underestimates the speed of a vehicle in front and then normally causes a rear-end collision). The accident type congestion, which includes by definition more than two vehicles, in many cases originates from previous run-into accidents.

Because of the great differences in the driving speeds among trucks and between trucks and passenger cars on the downgrade section of Elzer Mountain (Figure 3), the predominance of run-into accidents and consequently the high portion of congestion accidents could be expected. For example, 54 percent of the accident damage of about $3.1 million on Elzer Mountain before the investigation period, from April 1970 to March 1972, was produced by run-into accidents of trucks alone.

Therefore, to reduce the severity and number of accidents on Elzer Mountain, the traffic flow was made more uniform by narrowing the great variations in vehicle speeds.

COUNTERMEASURES

To alleviate the accident situation on Elzer Mountain, in 1972 the Institute of Highway and Railroad Design and Construction of the University of Karlsruhe proposed lane-related speed limits that should be under surveillance by automatic radar devices (1, 2), combined with DO NOT PASS signs for trucks.

TABLE 1 Number of Accidents at Elzer Mountain, Long-Term Investigation

YEAR	Direction: Cologne-Frankfurt (Downgrade)			Direction: Frankfurt-Cologne (Upgrade)			Both Directions			ADT Vehicles per Day Both Directions
	Property Damage	Injuries	All	Property Damage	Injuries	All	Property Damage	Injuries	All	
60										
61	219	70	289			39			328	15849
62	161	69	230			43			273	17294
63	142	51	193			65			258	18871
64	164	85	249			65			314	20591
65	225	91	316			67			383	22469
66	227	96	323			90			413	24653
67	107	87	194	22	18	40	129	105	234	27049
68	116	102	218	33	15	48	149	117	266	29678
69	183	145	328	32	16	48	215	161	376	32562
70	116	79	195	32	18	50	148	97	245	35727
71	102	93	195	38	21	59	140	114	254	35015
72	114	63	177	30	15	45	144	78	222	34316
73	54	30	84	22	10	32	76	40	116	33632
74	24	19	43	32	6	38	56	25	81	33791
75	35	21	56	20	7	27	55	28	83	33951
76	27	6	33	11	16	27	38	22	60	32304
77	20	11	31	21	4	25	41	15	56	30737
78	15	5	20	18	10	28	33	15	48	35681
79	24	6	30	16	19	35	40	25	65	38233
80	17	9	26	22	9	31	39	18	57	38893
81	23	6	29	22	8	30	45	14	59	39351
82	21	5	26	19	6	25	40	11	51	40347

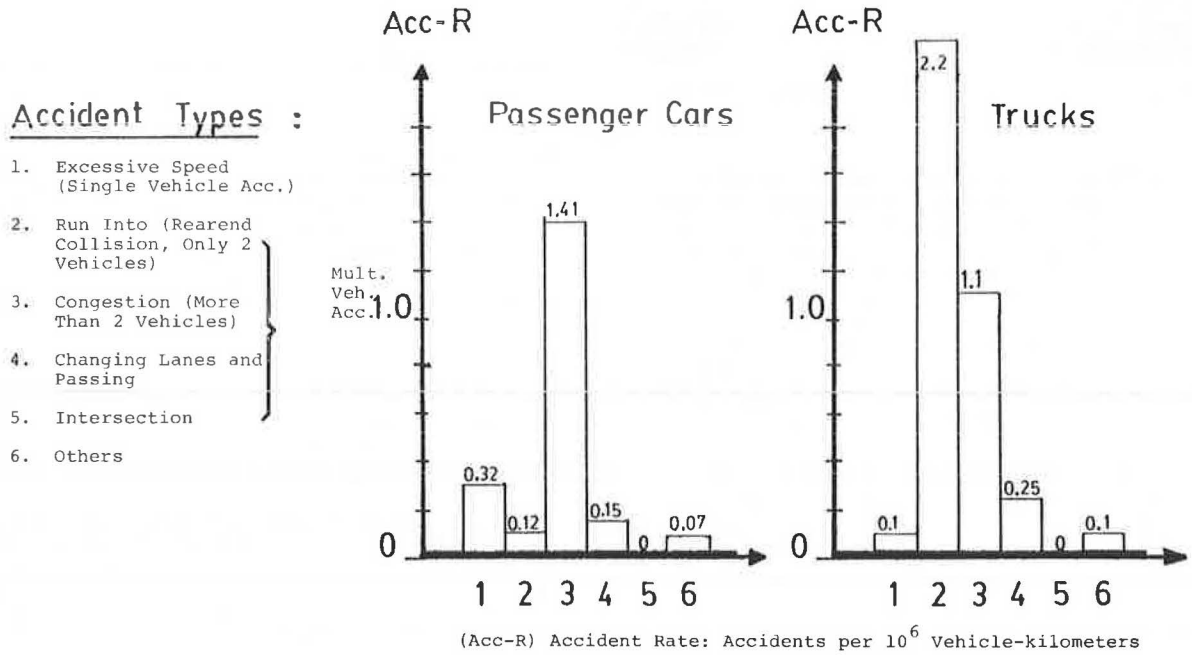


FIGURE 4 Accident rates caused by different accident types, downgrade direction (April 1, 1970-March 31, 1972).

To correct the extremely heterogeneous distributions of the driving speeds (Figure 3) and to reduce the accident risk (Figure 4), the allowable maximum speed was limited to 100 km/h for passenger cars and to 40 km/h for trucks. In addition, the speed limit of 100 km/h for passenger cars was assigned to the left and middle lanes only, whereas the speed limit of 40 km/h was directed to the right lane only (Figure 5).

To prevent numerous passing and lane-changing maneuvers of passenger cars in the left and middle lanes, for both lanes the same speed limit of 100 km/h was chosen, which corresponded to the maximum allowable design speed for a gradient of 5 percent. To prevent the middle lane from being occupied for passing maneuvers by slower vehicles, especially trucks, DO NOT PASS signs for trucks were also installed.

Figure 6 shows the traffic sign plan for Elzer Mountain in the downgrade direction. The speed limit signs were installed on four sign bridges across the Autobahn; the new speed and traffic regulations were introduced on April 1, 1972.

The experiences with general or local speed limits in the Federal Republic of Germany often were not satisfactory, especially in the case of rare surveillance by police. Therefore, the second

FIGURE 5 Traffic sign bridge at km 103.0 combined with DO NOT PASS signs for trucks, downgrade direction.

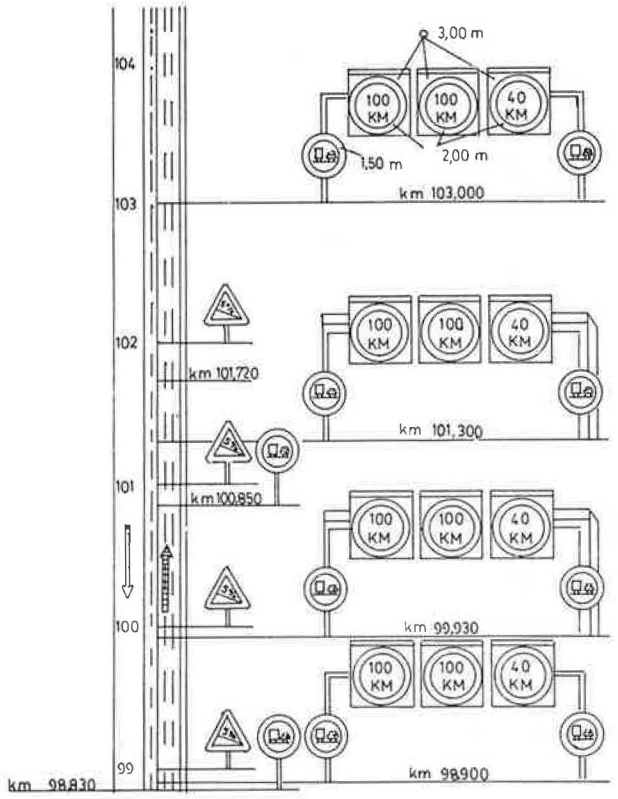


FIGURE 6 Traffic sign plan for Elzer Mountain, downgrade direction.

and the third traffic sign bridges were modified to use automatic radar devices, which were recommended by the Minister of Economy and Technique, State Hessen, Federal Republic of Germany (1).

Figure 7 (3) shows the traffic sign bridge at km 101.3 with the three automatic lane-related radar devices. The radar devices were installed in May 1973.

In addition to the traffic sign plan shown in Figure 6, the warning sign shown in Figure 8 (3) was installed at the beginning of Elzer Mountain at km 98.8, before the first speed limits began, to inform the driver by a visual impression of the danger of the steep downgrade road section ahead.

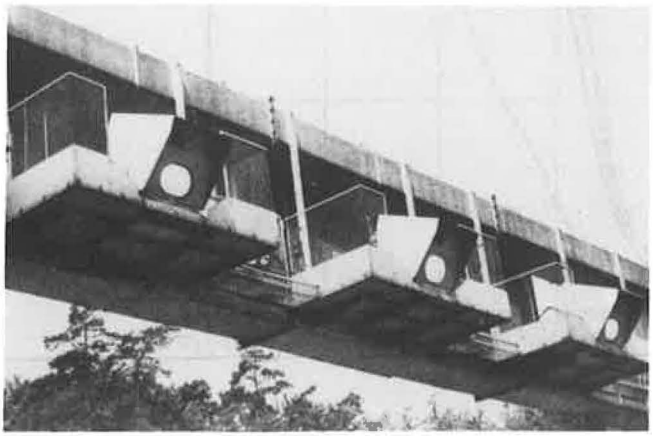


FIGURE 7 Automatic lane-related radar devices, downgrade direction *(3)*.

FIGURE 8 Warning sign at beginning of Elzer Mountain *(3)*.

SPEED EVALUATION: LONG-TERM INVESTIGATION

The first speed measurements (before investigation) at km 101.7 at Elzer Mountain were taken in October 1971. The characteristic distributions of driving speeds for passenger cars in the left and middle lanes and for trucks in the right lane are shown in Figure 3.

After the introduction of the speed limits in April 1972, an After I-Investigation, with comparable speed measurements, was conducted in October 1972. The results are shown as curve 2 for passenger cars (left lane) in Figure 9, for passenger cars (middle lane) in Figure 10, and for trucks (right lane) in Figure 11. Note that the 85th percentile speeds between curves 1 and 2 in the left and middle lanes could be reduced by about 25 to 30 km/h for passenger cars, but that still 60 percent of the passenger cars in the left lane and about 30 percent in the middle lane exceeded the speed limit of 100 km/h related to curve 2. For trucks (Figure 11), note that only about 10 percent exceeded the speed limit of 40 km/h in the right lane.

In May 1973 the automatic radar devices were installed, and in 1974 new speed measurements under comparable weather and daytime conditions were conducted. The results are shown in each case as curve 3 in Figures 9-11 (After II-Investigation). For the left lane an additional speed reduction of about 20 km/h could be reached, and the overall reductions for passenger cars in the left lane now amounted to about 45 or 50 km/h between 1971 (curve 1) and 1974 (curve 3), as related to the 85th percentile speed shown in Figure 9. Furthermore, the steep increase of the speed distribution of curve 3 indicates that the traffic flow became decisively more uniform. Only 78 percent of traffic violations by passenger cars were detected by the automatic radar devices, which were set to measure speeds exceeding 110 km/h.

In the middle lane (Figure 10) the overall speed reduction between curve 1 (1971) and curve 3 (1974) reached about 35 km/h, as related to the 85th percentile speed. Here less than 3 percent of the drivers were exceeding speeds of 110 km/h.

Curve 3 for the right lane (Figure 11) for trucks shows that in contrast to curve 2 (After I-Investigation, 1972) there is a certain speed increase, especially in the lower speed classes below the indicated speed limit of 40 km/h. On the other hand, the traffic flow for trucks now became uniform, so that this increase did not have any negative influence on the safety situation. The overall speed reduction for trucks between curve 1 (1971) and curve

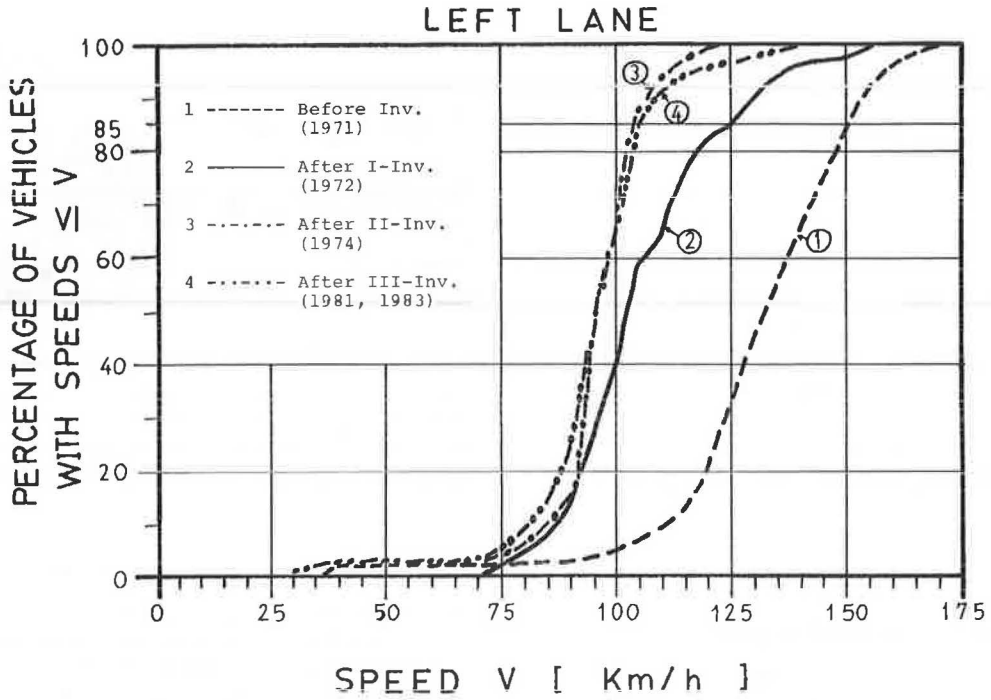


FIGURE 9 Characteristic distributions of speeds for passenger cars in the left lane between 1971 and 1983 at km 101.7, downgrade direction.

3 (1974) was about 40 km/h, as related to the 85th percentile speed. About 7 percent of the trucks were detected by the automatic radar devices, which were set to measure speeds exceeding 45 km/h.

In 1981 and 1983 two additional speed measurements in the course of the long-term investigation were conducted at Elzer Mountain (After III-Investigation). The results are expressed by curve 4 in Figures 9-11. It is to be noted that the observed differences between the 1974, 1981, and 1983 speed measurements are negligibly small. These differences mean that, by the surveillance of the automatic radar devices, the speed distributions and the traffic flow revealed no evident changes over 10 years for

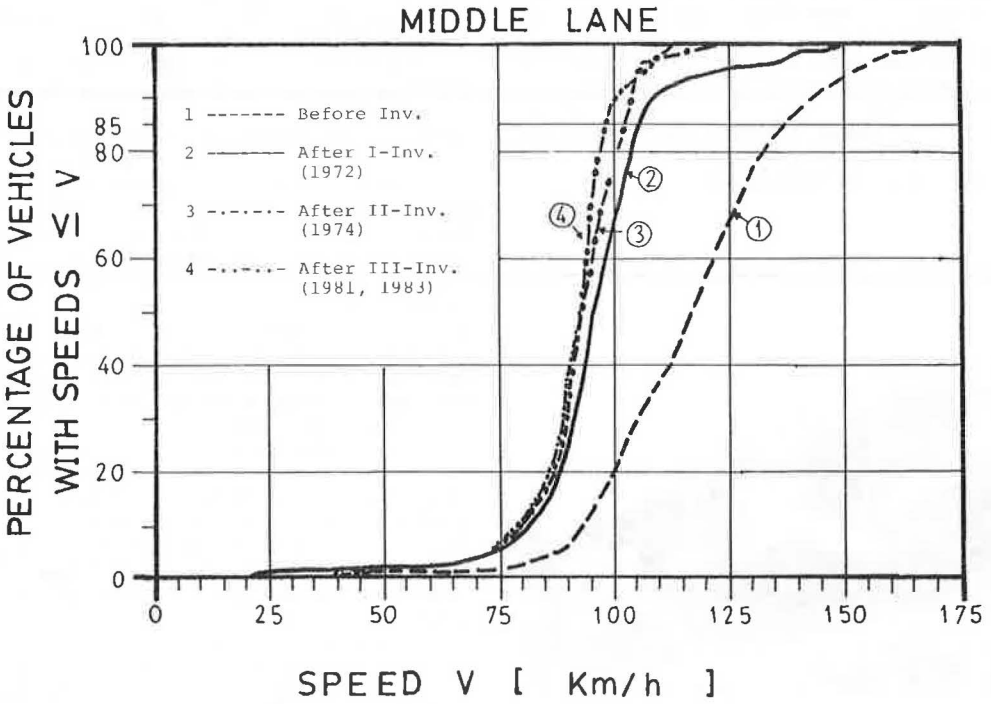


FIGURE 10 Characteristic distributions of speeds for passenger cars in the middle lane between 1971 and 1983 at km 101.7, downgrade direction.

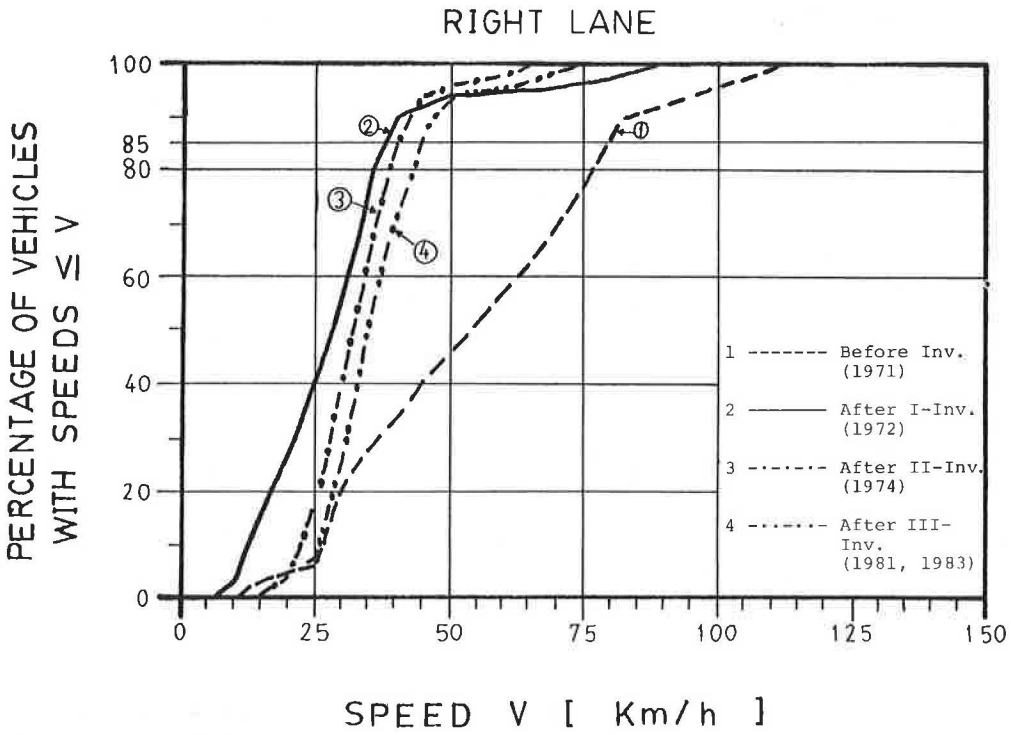


FIGURE 11 Characteristic distributions of speeds for trucks in the right lane between 1971 and 1983 at km 101.7, downgrade direction.

passenger cars in the left and middle lanes in the downgrade direction of Elzer Mountain. The little speed increase of trucks in the right lane has not had any impact on traffic safety, as the following accident investigation will verify.

ACCIDENT EVALUATION: LONG-TERM INVESTIGATION

The data in Table 1 give the development of the accident frequency between 1961 and 1982 for the 7.2-km-long investigation section at Elzer Mountain. As already mentioned, until 1972-1973, the downgrade direction from Cologne to Frankfurt was decisively more dangerous than the upgrade direction. But since 1972, with the introduction of the lane-related speed limits and especially since 1973 with the installation of the automatic radar devices, the accident frequency has decreased continuously from about 200 accidents in 1970-1971 to 84 accidents in 1973 to about 25 to 30 accidents at the beginning of the 1980s for the downgrade direction. The number of fatal and personal injury accidents went down, too. From 80 to 90 injuries per year (7 or 8 fatalities included) in 1970-1971, this number decreased to 30 injuries (3 fatalities included) in 1973 and to about 5 to 10 injuries (1 fatality per year on average) since 1976. Since that time the differences between the number of accidents for the downgrade and the upgrade directions at Elzer Mountain has been insignificant.

The obvious decrease of the accidents since 1973, combined with the low accident level since 1976 for the downgrade direction, cannot be a coincidence. It has to be attributed to the lane-related speed limits and the strict surveillance by police, which became possible for the first time in the Federal Republic of Germany by use of the automatic radar devices.

Furthermore, note that for more than one decade there were no other traffic regulations or structural actions at Elzer Mountain. Also, the ADT has not increased substantially during the past decade (Table 1) because a portion of the growing north-south through traffic elected to travel by a newly built parallel Autobahn on the other side of the Rhine River.

These statements are confirmed by the data in Table 2 and Figure 12. The data in Table 2 give the accident rates for the different driving directions at Elzer Mountain compared with the average accident rates for the whole Autobahn network of the Federal Republic of Germany between 1961 and 1982. The accident rates are again related to accidents involving property damages, personal injuries, and all accidents.

The fatal and personal injury accidents are of special interest in the long-term comparison. The data for these accidents can be considered to be relatively accurate because the figures have been identified and interpreted by the police; the data related to accidents with property damage may fluctuate over the years, however, especially in the case of long-term investigations. For example, the costs of reportable property-damage accidents are changing with inflation. In the Federal Republic of Germany the costs for reporting property-damage accidents were 500 marks [≈ $200 (U.S. dollars)] or more until 1965; between 1965 and 1982 costs of 1,000 marks (≈ $400) or more had to be reported, and since 1983 the reportable property damage has increased to 3,000 marks (≈ $1,200). Therefore, the following investigations are related to the more accurate data of accidents with personal injuries.

Figure 12 shows the accident rates only for accidents with personal injuries and fatalities for the downgrade direction from Cologne to Frankfurt, for the upgrade direction from Frankfurt to Cologne at Elzer Mountain, and also for the entire German Autobahn network. For the downgrade direction, a first

TABLE 2 Accident Rates at Elzer Mountain and Average Accident Rates for Whole German Autobahn Network, Long-Term Investigation

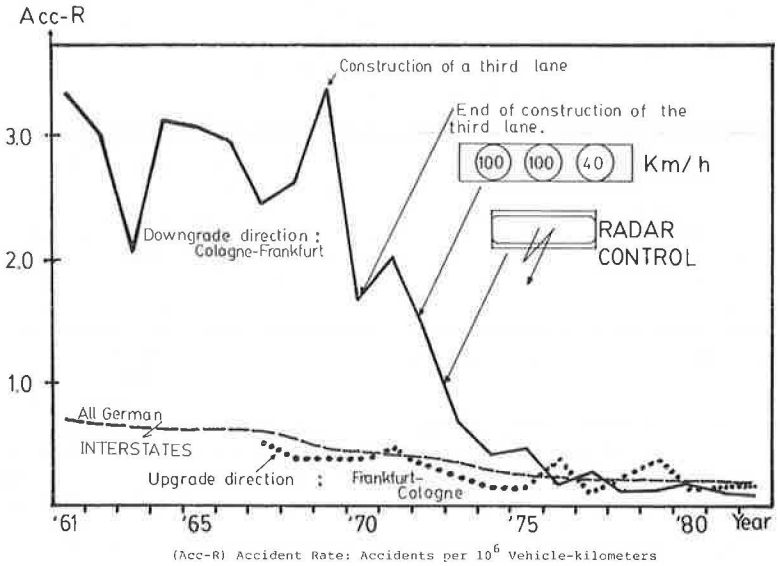
YEAR	Direction: Cologne-Frankfurt (Downgrade)			Direction: Frankfurt-Cologne (Upgrade)			Both Directions			Interstate Network		
	Property Damage	Injuries	All	Property Damage	Injuries	All	Property Damage	Injuries	All	Property Damage	Injuries	All
60											0.69	
61	10.52	3.36	13.88			1.87			7.87		0.71	
62	7.08	3.04	10.12			1.89			6.01		0.68	
63	5.73	2.06	7.78			2.62			5.20		0.64	
64	6.06	3.14	9.20			2.40			5.80		0.63	
65	7.62	3.08	10.70			2.27			6.49		0.63	
66	7.01	2.96	9.97			2.78			6.37		0.63	
67	3.01	2.45	5.46	0.62	0.51	1.13	1.81	1.48	3.29		0.61	
68	2.97	2.62	5.59	0.85	0.38	1.23	1.91	1.50	3.41		0.56	
69	4.28	3.39	7.67	0.75	0.37	1.12	2.51	1.88	4.39		0.47	
70	2.47	1.68	4.18	0.68	0.38	1.07	1.58	1.03	2.62		0.45	
71	2.22	2.02	4.24	0.83	0.46	1.28	1.52	1.24	2.76		0.42	
72	2.53	1.40	3.93	0.67	0.33	1.00	1.60	0.86	2.46	0.41	0.39	0.81
73	1.22	0.68	1.90	0.50	0.23	0.72	0.86	0.45	1.31	0.41	0.36	0.77
74	0.54	0.43	0.97	0.72	0.14	0.86	0.63	0.28	0.91	0.37	0.28	0.66
75	0.78	0.47	1.26	0.45	0.16	0.61	0.62	0.31	0.93	0.35	0.24	0.60
76	0.64	0.14	0.78	0.26	0.38	0.64	0.45	0.26	0.71	0.39	0.23	0.62
77	0.50	0.27	0.77	0.52	0.10	0.62	0.51	0.19	0.69	0.43	0.22	0.65
78	0.32	0.11	0.43	0.38	0.21	0.60	0.35	0.16	0.51	0.48	0.22	0.70
79	0.48	0.12	0.60	0.32	0.38	0.70	0.40	0.25	0.65	0.48	0.21	0.69
80	0.33	0.18	0.51	0.43	0.14	0.57	0.38	0.16	0.54	0.49	0.20	0.69
81	0.44	0.12	0.56	0.43	0.15	0.58	0.44	0.14	0.57		0.19	
82	0.40	0.09	0.49	0.36	0.11	0.47	0.38	0.10	0.48		0.19	

Accident Rate: Accidents per 10^6 Vehicle-kilometers

success could be noticed by the end of the construction of a third lane in 1970 and 1971. However, the accident rates of these 2 years are still about 4.5 times higher in comparison with the accident rates of the upgrade direction at Elzer Mountain and in comparison with the average accident rates of the German Autobahn network.

With the introduction of the lane-related speed limits in 1972 and the surveillance by automatic radar devices in 1973, the accident rates for the downgrade direction were decreasing continuously until 1976. Since 1976 there have been no more significant differences in the chi-square tests for a selected level of confidence of 95 percent between the accident rates of the downgrade and the upgrade driving directions at Elzer Mountain. The same is true for the average accident rates in the German Autobahn network (see Table 2 and Figure 12).

The experiences at Elzer Mountain have shown that reasonable speed regulations under surveillance by automatic radar devices can reduce the number and severity of accidents decisively. As related to personal injuries, the number of accidents and the accident rates were reduced by a ratio of about 18:1 between 1971 and 1982, whereas the number of at least seven or eight fatalities per year until 1972 has decreased to one fatality per year, on average, since 1977 for the downgrade direction at Elzer Mountain. Furthermore, the investigation period of more than 10 years appears to be long enough to verify that the improvement of the accident situation has permanence and that the common impact of lane-related speed limits and surveillance by police has reduced the number and severity of accidents to a level that can be indicated today as normal. As already mentioned, there were no changes



(Acc-R) Accident Rate: Accidents per 10^6 Vehicle-kilometers

FIGURE 12 Accident rates for accidents with personal injuries at Elzer Mountain and for the German Autobahn network.

in traffic regulations or structural activities and no substantial increase of the ADT (Table 1) during the past decade at Elzer Mountain to alter the previous statements.

In conclusion, it should be noted that on no other Autobahn sections in the Federal Republic of Germany have similarly high absolute or relative accident decreases been observed during the past decade.

POLICE PROCEDURES

The automatic radar devices at Elzer Mountain have operated continuously since 1973. They are installed on traffic sign bridges across the Autobahn and are lane related (see Figure 7). They are set to measure speeds exceeding 110 km/h for the left and the middle lanes and speeds exceeding 45 km/h for trucks in the right lane. If a vehicle exceeds these speeds, it is automatically measured and photographed. During nighttime, twilight, and rain periods additional strobe lights are used to illuminate the vehicles.

Figure 13 (3) shows a typical photograph, which indicates the speed, site, date, time, and license plate of the speeding vehicle. At least once a day the rolls of film are changed and evaluated by the police. Moving traffic violation tickets then are delivered to the vehicle owners by mail, and they have to declare if they themselves drove the vehicle or who was the driver of the vehicle. During 1982, 63 percent of all vehicle owners or named drivers paid the fine at once, 27 percent had to be reminded a second time, and about 10 percent contested the traffic citation.

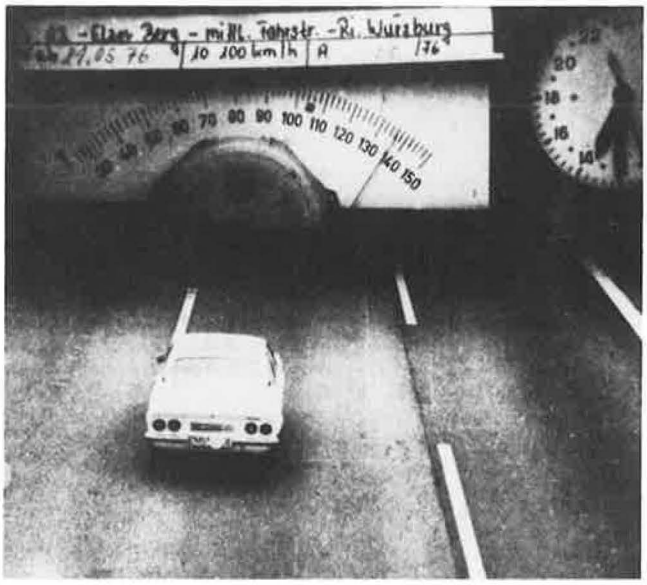


FIGURE 13 Photograph made by an automatic radar device at Elzer Mountain *(3).*

In addition to the continuous operation of the automatic radar devices, several times per year, especially during weekends and vacation times, the speed limits at Elzer Mountain are under direct surveillance by the police. In those periods police officers control the driving speeds directly from the traffic sign bridges [Figure 14 (3)] and inform their colleagues a few kilometers ahead by radio of

FIGURE 14 Police officer controlling speeding vehicles on traffic sign bridge at Elzer Mountain *(3).*

speeding drivers. The drivers are stopped and have to pay the fine on the spot, which is standard practice in Germany [Figure 15 (3)]. This procedure has proved its worth by keeping down the percentage of speeding German drivers, who would otherwise maintain they were not the drivers cited for a traffic violation. This method also provides control of drivers from other European countries (1,4).

FIGURE 15 Speeding drivers stopped at Elzer Mountain to pay fine *(3).*

It may be of additional interest that the main age group of drivers exceeding the speed limits at Elzer Mountain is between 35 and 44 years, followed by the age group of drivers between 25 and 34 years.

In 1982 the average fine at Elzer Mountain was 44.13 German marks (about $20). About 70,000 drivers in 1982 exceeded the indicated speed limits (i.e., about 190 drivers per day). The total sum in fines came to about 3.1 million marks (about $1.5 million) in 1982. As an example, the exact amount was 3,194,020 marks for 1978, and 3,049,937 marks for 1979, or an average of about $1.5 million per year. From 1974 to 1983, during which time the automatic radar devices at Elzer Mountain were continuously working, a total of about 30 million marks ($15 million) of paid fines was collected.

The radar devices of Elzer Mountain were frequently reported by the German newspapers, broad-

cast, and television to educate the public that the radar devices were not radar traps but traffic safety devices. Nevertheless, the previously mentioned amounts of money make clear that there is a always a certain portion of drivers who will not obey reasonable traffic or speed regulations that are necessary for traffic safety, especially on extremely dangerous road sections like Elzer Mountain.

Therefore, the only way to keep the number and severity of accidents down in these cases is by strict surveillance by police, even if such methods are not desired by traffic safety engineers. The authors of this paper would prefer that the individual drivers be conscious of good driving habits and the safety of other highway users with a minimum of police surveillance, but that probably will never occur.

CONCLUSIONS

Experiences in the Federal Republic of Germany have shown that the introduction of speed limits on dangerous road sections, unless they are controlled by the police (1,4), have, if anything, only a short-term effect on speed reductions and on the alleviation of accidents.

A long-term investigation of the relation between driving behavior and accidents when speed limits are strictly enforced by police with automatic radar devices was conducted at Elzer Mountain. The following comprehensive statements and evaluations about this long-term investigation from 1970 to 1982 can be made.

1. On the steep downgrade sections with gradients up to 5 percent at Elzer Mountain, the driving speeds on all three lanes were irresponsibly high, with great variations in the driving speeds, especially among passenger cars and trucks. Consequently, there were numerous passing and lane-changing maneuvers with high, dangerous risks, especially by trucks. The Before-Investigation in 1971 indicated that the maximum design speed of 100 km/h for grades up to 5 percent was exceeded by about 95 percent of the passenger cars in the left lane and by about 80 percent of the passenger cars in the middle lane. The general speed limit of 80 km/h for trucks in the Federal Republic of Germany was exceeded by 15 percent of vehicles. The personal injury accident rates in 1971 for the downgrade direction at Elzer Mountain were about 4.5 times higher than the comparable values for the upgrade direction, and the same was true for the whole German Autobahn network. The high number and severity of accidents were caused mainly by rear-end collisions of trucks.

2. In 1972 lane-related speed limits (100 km/h in the left and middle lanes and 40 km/h in the right lane) and additional DO NOT PASS signs for trucks were introduced. In 1973 automatic radar devices to control the speed limits were installed. Since then significant reductions in the driving speeds, combined with a uniform traffic flow in all three lanes and a decisive improvement of the accident situation, can be noticed for the downgrade direction at Elzer Mountain. For example, in 1981 in the left lane only 7 percent (passenger cars), in the middle lane only 3 percent (passenger cars), and in the right lane only 10 percent (trucks) were detected by the automatic radar devices. These were set to measure speeds exceeding 110 km/h for passenger cars in the left and middle lanes and 45 km/h for trucks in the right lane. Again, as related to personal injuries, the accident frequencies and the accident rates were reduced by a ratio of about 18:1 between 1971 and 1982, whereas the number of at least seven or eight fatalities per year until 1972 decreased, on average, to one fatality per year since 1977 for the downgrade direction at Elzer Mountain. Since 1976 there have been no more significant differences between the accident rates of the downgrade and upgrade direction at Elzer Mountain and the average accident rates of the entire German Autobahn network.

3. The experiences at Elzer Mountain have demonstrated that the two-pronged impact of reasonable lane-related speed limits and strict surveillance by police with automatic radar devices has reduced the number and severity of accidents to a level that can be considered today as normal. The investigation period of more than 10 years appears to be long enough to verify that the improvement in the accident situation has permanence. On no other Autobahn section could a similarly high absolute or relative accident decrease be observed during the past decade.

ACKNOWLEDGMENT

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Needs and Performance of Local Alcohol Countermeasure Programs in Pennsylvania

PATRICIA A. McCABE, MAUREEN C. GRIFFIN, and JOHN N. BALOG

ABSTRACT

Interest in deterring the drunk driver has recently grown substantially in the United States. The Pennsylvania Department of Transportation, in anticipation of an increased role in deterrence of driving while intoxicated (DWI) following passage of new state legislation, recently commissioned a study to (a) gather background information on existing local DWI programs, (b) determine what public information and education (PI&E) activities were already occurring at the substate government level, and (c) recommend methods by which the state could best support the efforts of local programs. The findings of that study are reported here. The main conclusions are as follows: (a) weak interagency linkages with police and local magistrates hampered program operations; (b) PI&E activities were already taking place at the local level, although their scope was limited by the lack of relevant training and experience among the program coordinators and the lack of work time available for PI&E; (c) there was need for a state-level staff member to act as a liaison between state agencies and local programs; and (d) networking among the independent local programs needed to be strengthened.

Recently there has been increased awareness among both government agencies and the general public of the problem of driving while intoxicated (DWI) or driving under the influence of alcohol (DUI). Public attitudes toward the problem appear to be changing from tacit acceptance of DWI as a minor problem to a more disapproving stance in which a majority of Americans now support mandatory jail sentences for persons convicted of DWI, even if they are first-time offenders. (Note that these data are from a poll of a sample of 1,580 adults conducted March 12-15, 1982, by the Gallup Organization.) Actions by state legislatures have reflected this change in public attitudes. Between January and September of 1982, 27 state legislatures toughened their drunk driving laws.

One state that recently effected such a change is Pennsylvania. In 1982 a new law was adopted that toughened sanctions for DWI and made a variety of changes in adjudication and referral procedures for DWI cases. The Pennsylvania Department of Transportation (PennDOT), in anticipation that the agency would have an increased role in the state DWI countermeasure effort, commissioned a study of existing local DWI countermeasure programs in the state. That study is the subject of this paper. The objectives of the study were to (a) gather basic information about the local programs, (b) ascertain what capabilities and interest existed at the local level to perform public information and education (PI&E) activities regarding DWI, and (c) clarify what, if any, support the programs needed from the state to improve their effectiveness.

At the time that the Pennsylvania State Legislature was considering the new DWI law, local programs played the major role in alcohol countermeasure efforts in the state. These programs existed at the county or judicial district level at the discretion of each district's President Judge of the Court of Common Pleas. There were 45 programs in the state, serving 60 of Pennsylvania's 67 counties.

Because of the important interrelationship between the local DWI programs and the local judiciary in Pennsylvania, it is necessary to briefly describe the latter. District justices (magistrates) can rule on summary cases and, in some districts, on lesser misdemeanor offenses. There can be several magistrates in each county. Guilt or innocence on more serious misdemeanors and in felony cases must be decided in the Court of Common Pleas. The President Judge is the administrative head of the Court of Common Pleas. He decides on procedures for all courts in his judicial district, including district courts. Each judicial district encompasses at least one and sometimes several counties.

PennDOT had played an important role in the development of the local programs. During a 10-year period PennDOT representatives visited all the counties in the state in an attempt to persuade the counties to set up countermeasure programs; it offered seed monies to support the programs until they could become self-supporting. Once the seed grants expired, state agencies played a much reduced role. The programs received some technical assistance from the Department of Health (primarily for the certification of instructors for the Safe Driving School) and some financial assistance from PennDOT (for the purchase of breathalyzers). However, their operating expenses were covered by the fees the programs collected for their services, and not from state funds. For the most part they operated as independent county-run programs that interacted little with state agencies or with each other.

Because the programs did not report to the state, state agencies lacked current basic information about the local programs, such as the number of staff persons in each program and their backgrounds, the size of the annual operating budget of each program, or its organizational structure. Several state agencies, particularly PennDOT, anticipated a need for such information, because it expected that the Governor's Task Force would recommend an increased role for its departments in the DWI countermeasures effort. PennDOT saw in the local programs a ready-made network for expanding and standardizing the alcohol countermeasures effort throughout the state. As a result PennDOT commissioned this study to gather background information about the programs, to discover whether capabilities and interest existed at the local level to perform PI&E activities regarding DWI, and to identify the most useful role for the state in programs regarding DWI.

METHODOLOGY

The study consisted of in-depth personal interviews with the person designated as the DWI coordinator

for each local program. The coordinator functioned as the contact point for all agencies in his catchment area that contributed to the anti-DWI effort and dealt with the DWI offender. These agencies included the Court of Common Pleas, the district or municipal justices, the police, the county prosecutor's office, probation officers, and alcohol treatment and prevention services. Figure 1 shows the interrelationships of agencies and the DWI coordinators.

The coordinators direct programs that, at a minimum, perform evaluations of the seriousness of the offenders' alcohol problems (such as the Mortimer-Filkens) and operate the Alcohol Safe Driving School. The coordinators either perform these functions themselves or contract for these services.

During the study the coordinators were visited and interviewed regarding the organization of their programs, responsibilities of the various actors, strength or weakness of interagency linkages, and any recent efforts to involve the public in anti-DWI efforts. If the coordinator deemed another program staff member to be a more appropriate source of information regarding a particular subject area, then that person was also interviewed. Total interview length was approximately 1.5 hr for each program.

FINDINGS

Background Information

As previously mentioned, the DWI countermeasure programs existed within judicial districts at the discretion of the President Judge of the Court of Common Pleas. The programs were locally designed to fit local needs. There were no statewide requirements for the programs other than certification requirements for teachers in the Alcohol Safe Driving Schools. Each program was unique.

The data in the following table give the agency affiliation of the person performing the coordinator function in the 44 local DWI programs that were visited by Retron Inc.:

Agency Type	No. of Programs
Drug and alcohol administration	18
Probation	14
Drug and alcohol treatment only	9
Other	3
Total	44

Most frequently, the coordinator was a staff member of the agency charged with administering drug and alcohol programs in the local area. Such an agency may or may not also deliver treatment for drug and alcohol problems. The second most frequent agency location was the county probation department. The remaining agencies either provided alcohol treatment or performed some other function, such as domestic relations or health and welfare. The program tended to be housed in a particular agency because the coordinator, who had in most cases been the person most interested in setting up a program after the visit of PennDOT's recruiting team, was located in that agency. The agency location was rarely chosen for philosophical reasons.

The data in the following table give the percentage of time allotted to the coordinator function in the 44 programs visited:

Percentage of Time Spent on Coordinator Function	No. of Programs
After hours; not part of regular job	6
Less than one-quarter time	13
One-quarter to one-half time	8
More than one-half time	17
Total	44

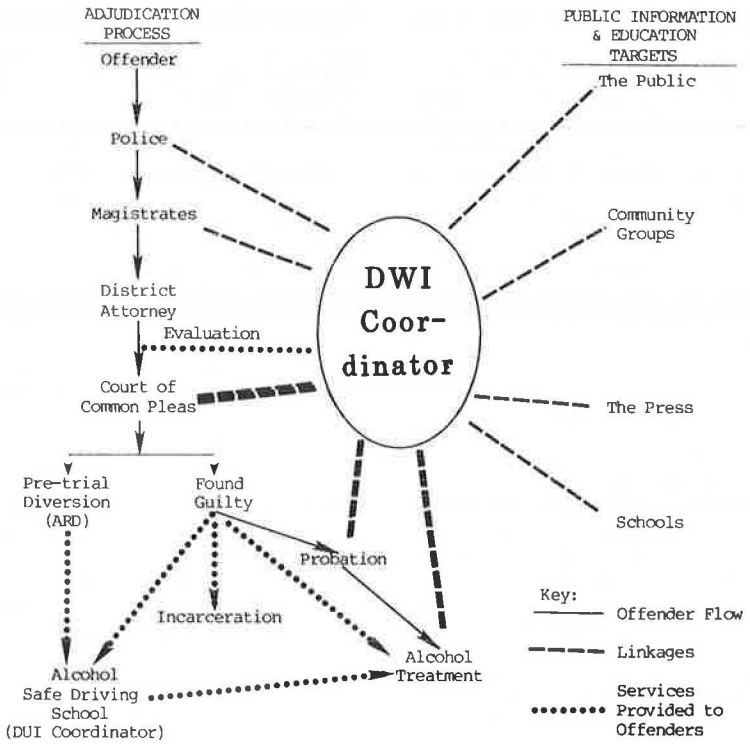

FIGURE 1 Interrelationships among agencies in the local DWI countermeasures program.

The data indicate that most often (61 percent of programs) the coordinator performed that function less than half of his working hours. The rest of the time the coordinator functioned in another capacity, such as probation officer or drug and alcohol counselor.

Interagency Linkages

Regardless of their locations, the coordinators needed to establish strong linkages with a number of agencies. The study findings indicated that coordinators had varying degrees of success in building these linkages. The two agencies with whom they most frequently reported problems were the police and the district justices or magistrates.

One of the most important aspects of a DWI countermeasures network is the intensity with which anti-DWI statutes are enforced. If no arrests are made, drivers with drinking problems are not identified and the treatment and referral aspects of the countermeasures network cannot move into action.

Each county program interacted with a number of local police departments and experienced varying levels of police support for the program and its goals. A DWI arrest is a time-consuming and bothersome process for police. They must regard DWI as an important problem before they are willing to arrest drivers for other than the most unavoidable reasons, such as accident involvement. A good indicator of the importance placed on deterring drunk drivers is the average blood alcohol content (BAC) at the time of arrest. The coordinators were of the opinion that high average BAC levels indicated that police rarely arrested drivers for DWI unless the drivers were very drunk or had been involved in an accident.

In Pennsylvania the BAC that defines a driver as legally intoxicated is 0.10. The average BAC levels at the time of arrest in all counties for which statistics were available are given in the following table:

BAC Level	No. of Counties
< 0.16	8
0.16-0.20	29
> 0.20	3
No information	12
Total	52

In 32 out of 40 counties the average was greater than 0.16. Overall, the willingness of police to make a DWI arrest was one of the weakest links in the countermeasures effort.

Support from the district justices (magistrates) was another problem area identified by the coordinators. These officials are the DWI offender's first contact with the judiciary after an arrest. Magistrates hold the preliminary hearing and decide if there is sufficient evidence to bind the offender over for trial in the Court of Common Pleas. In some countries the magistrates could decide guilt or innocence in DWI cases.

This link was perceived as weak because magistrates had the power to reduce charges from DWI to reckless driving or public drunkenness, and did so frequently. Such a charge reduction allowed the offender to keep his license and circumvent the DWI program. The offender would not be evaluated for alcohol problems and would not attend the Safe Driving School. Most important, the offender's driving record after the arrest would not indicate an alcohol-related driving offense.

The coordinators' perceptions of the levels of support from magistrates are given in the following table:

Frequency of Charge Reduction	No. of Counties
Almost never	18
Sometimes (for low BAC or under 21)	20
In most cases, except if arrested after serious accident	12
Total	50

In 32 counties, or 64 percent of the counties with DWI programs, coordinators experienced some, or significant, problems with support from district justices. In some counties magistrates sometimes reduced charges, particularly if the BAC level at the time of arrest was less than 0.15 or if the offender was under 21 years of age. (In the remaining cases the offender was generally bound over on a charge of drunk driving.) In other counties (24 percent) it was the usual practice of the magistrates to reduce charges, except in cases in which the arrest had been precipitated by a serious accident.

No such problems existed with the Court of Common Pleas. As mentioned previously, there was no legal requirement that a program be in place. Its existence depended on the support of the President Judge. If there was no support, there was no program. All coordinators reported at least moderate support from the Court of Common Pleas.

However, coordinators did report that their programs often were not used by the courts as well as they could be. One function of the programs was to evaluate the seriousness of the offender's alcohol problem. Ideally, this evaluation should be performed before sentencing and should be used to decide whether the offender will be required to attend an alcohol treatment program. The data in the following table describe whether the evaluation was used in this fashion:

Use of Evaluation	No. of Programs
Evaluation used as basis of sentencing	20
Evaluation not used	
Consistent sentencing	18
Inconsistent sentencing	6
Total	44

In 20 programs the evaluation was used to decide the appropriate sentence. In the other 24 programs the evaluation was not used for sentencing, but the sentences handed down by the court were consistent and predictable. That is, first offenders almost always received a particular sentence, whereas repeat offenders almost always received a different and harsher one. In a few programs, however, judges did not base sentences on the evaluation, and, in addition, sentences were inconsistent and unpredictable. Coordinators reported that such erratic sentencing practices negatively affected their interactions with police, who were frustrated by an offender's receipt of a "slap on the wrist."

Many coordinators considered support from probation departments after sentencing to be essential to a successful program, and most (37 counties, or 73 percent) reported they had enjoyed such support. (Note that in 14 programs serving 16 counties the coordinator was a probation officer.) Offenders who did not comply with the requirements of their sentences (i.e., did not attend the Safe Driving School or the required alcohol treatment sessions) were immediately contacted by their probation officers and threatened with being taken back to court and imprisoned unless they complied. Fourteen counties (12 programs) did not receive such support.

Data on the last interagency linkage to be ex-

amined, the interface between the DWI program and drug and alcohol treatment agencies, are given in the following table:

Interface	No. of Programs
Treatment required by court order	19
Treatment recommended by coordinator but not required by court order	21
Limited or no recommendation for further treatment	4
Total	44

In most cases this link was strong. Nineteen programs had judges who required treatment by court order. In an additional 21 programs the coordinator recommended treatment if the evaluation indicated it was necessary, even though treatment was not ordered by the court. The remaining four programs experienced problems with this linkage. These coordinators, all of whom were probation officers, reported strong philosophical differences from treatment staff. They perceived the treatment staff as not tough enough with DWI offenders.

In summary, the DWI coordinators reported weak interagency linkages with two agencies in particular--the police and the magistrates or district justices. Many police departments arrested only blatantly drunk drivers and considered DWI a low-priority offense. The magistrates reduced charges too frequently, thus frustrating those police who did make DWI arrests and circumventing opportunities for early intervention in an alcohol problem.

Public Information and Education

The experience and interest of coordinators in educating and informing the public about DWI was the second area studied. Before the study, PennDOT's perception had been that local programs did little PI&E.

The findings regarding the number of programs performing PI&E and what media the local programs used in the 2 years before this study are given in Table 1. Most programs undertook at least intermittent PI&E work. PI&E consisted generally of responding to information requests from community groups and the press. Only a small number of coordinators made regular and systematic efforts to use various media in educating the public.

If other staff either directly or peripherally involved in the DWI program were counted, the number of programs performing PI&E increased somewhat. Such staff included drug and alcohol administrators and prevention specialists who had a special interest in the DWI problem.

Three problems were identified that limited the local programs' ability to perform PI&E. First, the coordinators simply lacked the time necessary to plan and conduct a PI&E campaign. Second, programs had little or no funding available for PI&E efforts. The limited time allotted to the coordinator function often meant that there was little or no time for PI&E after other essential functions were completed. Finally, most of the coordinators did not have a background that gave them even rudimentary knowledge of PI&E techniques.

A serendipitous finding was that even with these limitations, a number of coordinators had developed innovative approaches for improving relations with the police and the judiciary and for educating the public. Unfortunately, the programs were administratively independent of each other, and the network for communicating these ideas to other coordinators was weak.

Similarly, there were resources at the state level, including expertise, materials, and grant monies, available to the coordinators, but many coordinators were unaware of them. The lack of one person at the state level with clear responsibility for liaison with the local programs made it difficult to identify the appropriate contact person for help in resolving a particular operations problem. There was a staff member available to assist local programs, but many coordinators were unaware of her existence.

TABLE 1 Number of Programs Performing Different Types of DWI PI&E

	Performed by Coordinator		Performed by Other Staff	
	Sporadic	Regular	Sporadic	Regular
Community groups	30	2	11	0
Schools	18	2	19	1
Newspaper				
Initiated by program	22	5	8	2
Initiated by press	30	2	2	1
Radio				
Public service announcements	23	4	9	1
Talk shows	17	3	3	1
Television	12	3	2	0

State Support Needed

The findings of this study integrated information that staff members of the various state agencies involved in working with the local programs had been gathering in a piecemeal fashion. The study's interim report was the first detailed summary available to state agencies that described all local programs in a standardized fashion. The final report recommended that the state take action in a number of problem areas.

Interagency Linkages

The study identified weak linkages with enforcement agencies as a problem area hampering program effectiveness. It recommended that the state take a role in helping coordinators inform police departments about the DWI problem and about services available through the DWI programs.

In response, the state developed and distributed a "shift-break" training package that coordinators could use to educate their local police. The sessions trained the police to recognize driving behavior, such as wide turns and slow driving, which gave the police probable cause to suspect that the driver was DWI.

During the study period, increased federal funding for enforcement became available. These monies were dispersed to several counties in the form of special enforcement grants to finance increased staffing for DWI enforcement efforts.

The study also noted weak linkages with local magistrates. Recommendation was made that the state provide assistance to the coordinators in educating magistrates about the value of a DWI arrest as an early intervention tool in alcohol problems. The magistrates needed to have a better understanding of what the programs did. To promote improved relations between the DWI programs and the judiciary, the Department of Health instituted a program to certify

judicial trainers. These persons would be available to counties on a consulting basis to conduct workshops about DWI programs for the judiciary. The workshops would include background on the program, its philosophy, and its function. It was expected that increased knowledge would improve understanding, support, and referrals from all levels of the judiciary.

Many of the problems with the judiciary were addressed by new legislation that became effective in January 1983. Two major changes were made. First, DWI became a second rather than a third degree misdemeanor. This meant that magistrates could no longer rule on the guilt or innocence of a DWI offender. All DWI cases were to be decided in the Court of Common Pleas. Second, reduction of DWI charges to lesser offenses was expressly forbidden by the statute.

Public Information and Education

The study recommended that a number of different steps be taken to increase the amount of PI&E being done in the state. The state needed to recognize that it was unrealistic to expect each coordinator to develop and operate a PI&E campaign independently. However, the coordinators could be used effectively to support the campaigns organized at the state level. Coordinators uniformly recognized the importance of PI&E, but they often lacked the knowledge and time to conduct programs. If the state prepared materials such as news releases or radio spots, the coordinators could distribute them to local media. This method would most likely get better results than if materials were directly sent from the state. The coordinators could add local favor to these materials and give the campaign a more personal touch through supplementary efforts such as school programs or mall exhibits. This system would have the additional benefit of ensuring that neighboring areas would not be delivering conflicting or competing messages about DWI in their PI&E efforts because the same basic theme would always be used.

The state first tried this distribution system in the publicity campaign about the new DWI law. The state developed television, radio, newspaper, and pamphlet materials that coordinators used and supplemented with local efforts. Interest was so high that more than 500,000 pamphlets were distributed by local programs in less than 2 months.

To help the local coordinators build some basic public relations skills, PennDOT commissioned a contractor to develop an instructional manual and conduct four regional workshops for those interested in learning about PI&E. The workshops offered instruction in choosing objectives, selecting target audiences, obtaining free and low-cost materials, choosing appropriate media, and learning how to tell good PI&E materials from poorly designed or ineffective ones. Those who attended the workshops also were asked to practice designing their own materials. The workshops were held 1 month after the new DWI law went into effect, and the coordinators were interested in methods of informing the public and other agencies about the changes in the law. Therefore, the workshops were extremely well attended; more than twice as many staff attended as had been expected.

The instructional manual that was developed for the workshops took a "cookbook" approach to PI&E. It contained how-to's for speech making, obtaining materials, writing news releases, using broadcast media, interacting with the press, and handling opposition.

The study had found that many coordinators had developed innovative PI&E and linkage-building activities, but that the network for sharing these ideas with other programs was weak. To begin sharing these techniques, it was recommended that the manual include an ideas catalogue. The catalogue would document the activities so that they would be available to other coordinators with the same problems. The program and name of the coordinator who originated each idea would be included to recognize their contributions. This would also allow persons interested in obtaining further information about any particular activity to contact the person who had already implemented it.

Creating and Strengthening the Countermeasures Network

The study strongly recommended that the state enable the coordinators to meet each other and share ideas. It was also recommended that coordinators be informed about resources (staff and materials) available from the various state departments to assist them in their countermeasure efforts. A number of steps were recommended to encourage the growth of a network among program staff members.

First, an organization already existed for persons working in the DWI field, called the Pennsylvania DUI Association. However, many new coordinators and most prevention and drug and alcohol staff did not know that the Association existed. The Association offered PennDOT a ready-made network through which state and national DWI news could be distributed easily to its practitioners. Therefore, it was suggested that PennDOT support the Association and its activities in every way possible.

PennDOT implemented this suggestion by automating the DWI mailing list and publicizing Association events statewide. Local activities remained the responsibility of the Association's regional staff. PennDOT also began publishing a DWI newsletter that would be mailed to coordinators on a quarterly basis. The newsletter includes Association news and state and national DWI developments, and promotes the ideas exchange begun in the how-to manual.

The study identified a need at the state level for a single individual to act as liaison between the coordinators and state departments. The state implemented this suggestion by creating a position for an alcohol program manager in the Department of Transportation. The individual appointed to the position was himself a former local DWI coordinator, who enjoyed wide respect among those currently in that function. His responsibilities are shown in Figure 2. He is to act as the first point of con-

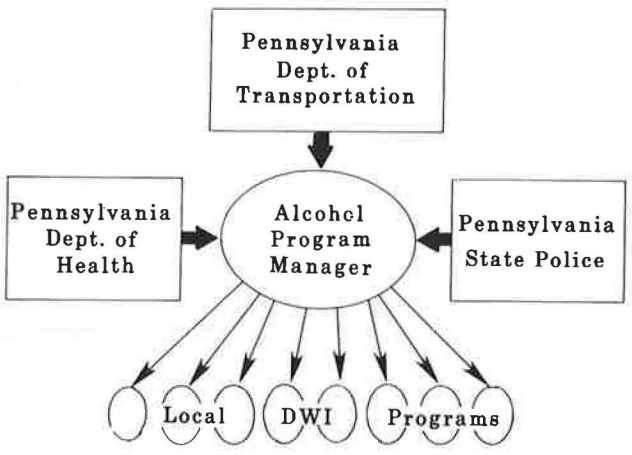

FIGURE 2 Role of Pennsylvania state alcohol program manager.

tact for the coordinators, referring them to the most appropriate source of assistance for whatever problems they encounter. He is also to protect the coordinators' interests at the state level and to make their continuing needs known to relevant state agencies.

SUMMARY

In summary, this study identified a number of problem areas in the current local programs.

1. Weak interagency linkages with police and magistrates, which hampered program operations, were pinpointed.
2. PI&E activities were taking place, although they were limited by the lack of relevant training and experience among the coordinators and the lack of work time during which PI&E could be performed.
3. There was need for a state-level staff member to act as a liaison between state agencies and local programs.
4. Networking among the independent local programs needed to be strengthened.

Publication of this paper sponsored by Committee on Traffic Law Enforcement.

Abridgment

The Drunk Driving Warning System: Status Review

MONROE B. SNYDER

ABSTRACT

An overview and highlights from a review of the status of work on in-vehicle devices that has led to the development and test of the drunk driving warning system are presented.

An overview and highlights from a review of the status of work on in-vehicle devices that has led to the development and test of the drunk driving warning system (DDWS) are presented. The idea of a car that would deter drunk drivers is intriguing. Various approaches have been proposed, and some aspects have been the subject of research studies during the past decade.

BACKGROUND STUDIES

In October 1970, NHTSA issued a prospectus entitled "Some Considerations Related to the Development of an Alcohol Safety Interlock System (ASIS)." Its purpose was to acquaint commercial and academic organizations with the U.S. Department of Transportation's (DOT) interest in ASIS devices to deter or prevent drunk drivers from operating their cars, and to ensure that all possible ASIS techniques would be considered. Twenty-five organizations responded to the prospectus. Their responses were analyzed in conjunction with a general survey of the literature on various kinds of performance degradation induced by alcohol. A number of performance test devices underwent laboratory testing to determine the percentage of "prevented starts" that could be expected at various levels of blood alcohol content (BAC). The results of the studies indicated that none of the devices tested was acceptable for application at that time. At about the same time, General Motors reached a similar conclusion.

Development of an on-board breath measurement vehicle-control device took place during 1972 and 1973. At the same time, initial evaluation of four additional performance-testing devices took place. The major conclusion of this second-generation program was that three of the instruments offered better performance than the devices tested during the 1972 program. By using the scoring procedures highlighted in the report, false positives were minimized (i.e., there were few cases of a sober person failing). However, although many legally intoxicated persons were detected, a noticeable number were not. A review of the various test devices and systems from the standpoint of circumvention was undertaken about this time.

In 1976 some significant conclusions and decisions were reached.

1. It appeared that breath test devices for vehicle control were too susceptible to circumvention or cheating to be practical. There appeared to be a number of ways that a sample of air, which did not come from the driver at the time of the test, could be delivered to the testing device. A practical way to combat such circumvention or cheating was not identified. Research and development (R&D) on an in-vehicle breath test ASIS was suspended. [Recently, as part of the DOT small business innovation research (SBIR) program, a small feasibility study was initiated regarding the development of a sensing device that, when installed near the driver's seat, would continuously monitor the alcohol content emitted from the driver's breath.]
2. It appeared that an interlock approach presented disadvantages associated with the disabling of a car, particularly when the driver might not be intoxicated. These include prevention of emergency use, danger to other traffic, and public acceptability. R&D on the ASIS (i.e., interlock) concept was

stopped. The approach was shifted to use of a warning system as opposed to a disabling interlock when the test was not taken or passed. The concept of a DDWS for use with convicted drunk drivers was to be the subject of future R&D.

3. It was decided to conduct a field test that focused on the operational feasibility of the DDWS concept.

4. The critical tracking test (CTT) device was selected for use in the DDWS to be fabricated for field testing because it was among the top performers with respect to discrimination and did not require additional engineering development in order to integrate it into a vehicle system. CTT discrimination rates would be maximized by the use of individually set pass scores in the field test.

5. Work on the divided attention test (DAT), and on other test devices that might offer better discrimination than the CTT, was put on hold until field test results could be evaluated.

About the same time that preparations were being made for a field test in the United States, cooperative studies were undertaken with foreign governments, which provided additional laboratory data on performance devices.

CALIFORNIA FIELD TEST

In 1976 and 1977, 11 DDWSs were fabricated for field testing by using the CTT as the impairment test component. The DDWS constructed is a vehicle-mounted system that requires the driver to pass a brief test using the steering wheel before the car can be driven in a normal manner. The test must be passed in order to deactivate alarms consisting of the emergency flasher system and the horn. Because DDWS is a warning system and does not prevent the vehicle from running, the car can be driven without passing the test. However, if the test is not passed, the emergency flashers operate, and if the car is then driven at speeds greater than 10 mph, the horn honks at 1-sec intervals. If the test is failed, the driver must wait 10 min before retesting is permitted.

The current DDWS consists of two major components. The first is a CTT display unit, which is located adjacent to the vehicle steering wheel. The second component is an electronics module located in the trunk, which scores the test performance, activates the alarms if appropriate, and records necessary data. A cassette recorder keeps a permanent time-based record of items such as test scores, ignition on or off, and alarms activated (i.e., speed greater than 10 mph).

Various countermeasures have been incorporated into the DDWS to prevent cheating. These include sealing components and cables to prevent or reveal physical tampering, and requiring retesting if the driver leaves the driver's seat after passing the test.

The DDWS was used with drivers who have a history of repeated drunk driving offenses and who were under court supervision. Their driver's licenses were restricted to use of the DDWS-equipped vehicle. Probationary conditions required regular check-ins to collect cassette-recorded data and to verify driver compliance.

STATE-OF-THE-ART SUMMARY

1. There are many ways in which an in-vehicle drunk driving deterrence system might be applied. Different applications have different requirements that may be best met by different approaches. For only one approach is there a significant amount of data: a performance test DDWS with individually based scores used under court supervision.

2. Field test data suggest that it is feasible to use a DDWS as an alternative sentencing sanction and that people are highly unlikely to drive a DDWS vehicle when the alarms are activated.

3. Available laboratory data suggest (a) that some performance tests can identify highly intoxicated persons (0.15 percent BAC); (b) that the ability of the CTT to identify those who should not drive does not appear high enough to avoid the problem of intoxicated drivers retaking the test a few times until they pass; (c) that at least one performance test, the divided attention test (DAT-2), which uses individualized scoring as part of a DDWS, would warn against practically any trips at or greater than 0.10 percent BAC, with little delay for trips with no prior alcohol intake; and (d) that the same test may have potential for application with large segments of the population without individualized scoring; however, norms would have to be developed based on much more extensive performance testing.

4. Performance-test-based systems appear to be relatively resistant to substitute test takers; further refinements could be made in this area. Although the DDWS cannot prevent someone from driving a substitute vehicle, it does appear to reduce the likelihood this will be done to a level less than that for license suspension or vehicle impoundment.

5. Off-the-shelf, low-cost equipment that is effective and easy to install does not now exist. There do not appear to be any technical reasons that redesign and improvement of present equipment could not reach that goal for a performance-test-based system.

6. Breath-test-based vehicle-control systems could be made available for some applications involving drivers who are not likely to try very hard to beat the system. However, testing is needed to determine the extent to which new systems have been made resistant to cheating, and further development may still be needed for breath testers to achieve this goal.

The full paper (from which this abridgment was taken) treats differing design approaches for differing applications and identifies major issues that must be considered. A future report will apply the conclusions of this paper to the delineation of options for future work in the area.

[Note: Those interested in a more comprehensive consideration of the data and issues as well as a complete bibliography are referred to the full paper from which this abridgment was drawn. A limited number of copies are available from the Office of Driver and Pedestrian Research (NRD-40), National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.]

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Help Save Lives, Report Drunk Drivers: Maryland's Citizen Drunk Driver Reporting Program

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ABSTRACT

The tragic but real consequences of drinking and driving continue as one of the most current examples of irresponsible social behavior in the United States. In addressing this highway safety problem, many states have enacted new laws, developed general deterrent programs, and earmarked special funding projects to fight this national social problem--the drinking driver. The efforts in Maryland to reduce alcohol-related deaths and injuries have been successful, in part, because of a citizen reporting program implemented in July 1982. A discussion of this program's success is provided in this paper.

On July 1, 1982, the Maryland State Police implemented a "Citizens Report Drunk Driver Program." This program was designed to solicit the support, participation, and cooperation of all citizens, state and local government agencies, private businesses, citizen groups, and citizen band (CB) radio organizations within Maryland to report all suspected drunk drivers to law enforcement agencies. The results of this program have proved to be gratifying. During the first year citizens reported in excess of 9,100 suspected drunk drivers to law enforcement agencies; more than 3,300 suspected drunk drivers have been contacted by police and more than 1,250 of those contacted were arrested.

HISTORY

With the development of the automobile, a need for better communications became essential. As advanced radio technology was perfected, the need for communication improvement, coupled with the desire to install radio equipment in vehicles, became a reality. Because of these desires, the Federal Communications Commission (FCC) created the Citizen Band Radio Service (Class D) in 1958. The original intent of the CB radio was to provide a private, two-way, short-range communication system for use by the general public.

After the 89th Congress passed the Highway Safety Act in 1966, the House Committee on Public Works, while addressing the House of Representatives, stated, "When accidents occur, it is essential that every resource be mobilized to save lives, lessen the severity of injuries, protect property, and restore the movement of traffic."

In 1970 the FCC set aside channel 9 on the CB radio solely for emergency communications. In 1975 the U.S. Department of Transportation (DOT) approved a report on the use of the CB radio for transportation safety when it recognized the absence of a national uniform system to assist motorists in the event of disaster, serious accidents, and so forth. NHTSA, following the approved report, developed the National Emergency Aid Radio (NEAR) Program. This program encouraged each state to develop a statewide NEAR Program. Funding for the NEAR Program was to be provided to the states through the use of state 402 funds.

PROGRAM DEVELOPMENT

Maryland decided to participate in the NEAR Program in 1978, and a comprehensive plan was developed. The goals set for the program were to provide the motoring public within Maryland with an emergency assistance communications system for obtaining emergency services and traveler assistance easily and rapidly. This is a volunteer program, and its success depended greatly on the support of local government, individual monitors, and volunteer groups. It was believed that the potential of this program toward the enhancement of highway safety in Maryland was outstanding.

The NEAR Program was organized so that the first level of coordination would be within all 23 county boundaries of the state. A Maryland State Police officer was selected to coordinate NEAR activities within each county.

The State Police coordinator's primary responsibility was to foster cooperation among all CB monitoring groups and individuals within their county. Furthermore, the coordinator provided assistance as necessary in support of the statewide programs, goals, and objectives.

Currently, the Maryland State Police have 24-hr CB monitoring capabilities from 1,200 CB-equipped patrol vehicles and 28 installations. During the first year of implementation more than 4,000 calls were received through the CB radio that required police action. Calls received dealt with criminal as well as traffic-related incidents.

In late 1981 the Field Operations Bureau of the State Police decided to use the agency's CB capability to facilitate its driving while intoxicated (DWI) countermeasures effort. The idea was to combine elements of the NEAR Program and the basic concept of the Report Every Drunk Driver Immediately (REDDI) Programs currently operating in several states. According to Michelle McMurtry of the National Transportation Safety Board, "some 17 states now have programs of this type, and most can be implemented relatively inexpensively."

GOALS

In concert with the agency's commitment to increasing DWI arrests, a program was designed that would solicit the support of every citizen in reporting drunk drivers to state and local law enforcement agencies. A working committee was formed. The committee consisted of one NEAR coordinator from each of the seven State Police Troops, one member from the Public Information Office of the State Police, one member from Planning and Research, one representative from the Alcohol Speed Enforcement Unit of the State Police, and a member from the

Field Operations Bureau, Traffic Program Planning Unit, who acted as chairman.

OBJECTIVES

The objective of the committee was to develop a comprehensive statewide program to solicit the support, participation, and cooperation of all citizens within Maryland to report all suspected drunk drivers to law enforcement agencies. This was to include state and local government agencies, private businesses, citizen groups, and CB radio organizations. Such a program would act as a general deterrent to those who may have the proclivity to violate the Maryland drunk driving statutes. It was anticipated that through the efforts of all citizens in reporting drunk drivers, this program would increase the drunk driver's risk and his perceived risk of being detected and arrested. The result would be a reduction in the number of drinking drivers and alcohol-related crashes on Maryland roadways. Moreover, a social climate would pervade Maryland that would identify drunk driving as socially unacceptable behavior.

In an effort to gain maximum participation from all citizens in support of the program, public information and education (PI&E) materials were developed and disseminated to local law enforcement agencies and citizen groups through the local State Police NEAR coordinator. All marked State Police patrol vehicles displayed "Help Save Lives Report Drunk Drivers" and "For Help Call CB Channel 9" bumper stickers. Letters were forwarded to all law enforcement agencies in Maryland requesting their support and assistance in monitoring the effectiveness of the program. Local police participation in the program would be to assist the State Police in the dissemination of PI&E materials and to encourage everyone taking a citizen report of a drunk driver to keep a record so that the results of the program could be measured. The information necessary to monitor the program was

1. The number of citizen-reported drunk drivers,
2. The number of drunk driver contacts as a result of the citizen reports, and
3. The number of drunk drivers arrested as a result of the contact.

Each agency was asked to forward weekly totals of citizens reports to the State Police Field Operations Bureau, Traffic Program Planning Unit, so that a statewide total could be compiled.

IMPLEMENTATION

On June 29, 1982, Governor Harry Hughes announced the program during an afternoon news conference held at the State Police Headquarters in Pikesville, Maryland. This news conference was attended by police chiefs from across the state, who offered their support for the program.

The program amassed some 903 citizen reports, 279 contacts, and 119 arrests during the first month of implementation. As of August 23, 1982, just 7 weeks into the program, 1,442 citizen reports had been received, which resulted in 439 contacts and 195 drunk driver arrests.

As of January 10, 1983, just 6 months into the program, 5,301 calls from citizens resulted in contact being made with 1,879 suspected drunk drivers; of those contacts, 717 drinking drivers were arrested. It is not known how many of the other 1,162 drivers were issued citations for non-alcohol-related violations.

Feedback is being provided to the participating agencies in the form of a statistical chart (Table 1), which lists each agency and the number of calls, contacts, and arrests received by each agency. These data are forwarded to participating agencies periodically to keep them informed of the program's success as well as their commitment to the program goals of promoting highway safety in Maryland through law enforcement cooperation, professionalism, and coordination. In addition, the information is being used to inform the public as to the success of their efforts in reducing alcohol-related crashes.

NATIONAL PERSPECTIVE

During the fall of 1982 the National Transportation Safety Board (NTSB) conducted a survey of five states (Washington, Colorado, Nebraska, Utah, and Maryland) that had implemented programs designed to increase public awareness of the drunk driving problem and to encourage citizen involvement to help eradicate it. Early program statistics for these states are given in Table 2.

Nebraska credits its REDDI Program with a 26 percent reduction in highway fatalities during the first 12 months of operation. More significant, when comparing June 1980 through May 1981 with June 1981 through May 1982, Nebraska authorities report a 10 percent decline in fatal accidents involving alcohol. Although there may be other factors that contribute to this decline, the NTSB reports that it could not identify any significant changes in Nebraska's enforcement policy or procedures that would have served as a catalyst for this reduction.

The five programs surveyed by NTSB had been implemented by either the state highway or highway law enforcement agencies or both. Based on the positive results of these state programs, NTSB forwarded to the governors of the 50 states and to the mayor of the District of Columbia a highway safety recommendation (H-82-35), which stated they should "implement a citizens awareness and citizens drunk driving reporting program such as the REDDI type programs used by Washington, Colorado, Nebraska, Utah, an Maryland."

During the spring of 1983 the Alliance of American Insurers, located in Chicago, joined with REACT International, Incorporated, to form the CB Coalition. This coalition is credited with development of the Impaired Driver Alert Program. This program, according to Gerald Reese, Executive Director of REACT and L.C. Christopher, Vice-President/Communications, Alliance of American Insurers, "is designed to encourage the use of CB radios to provide emergency help for disabled motorists and to deter drunk driving."

In June 1983 the International Association of Chiefs of Police (IACP) forwarded correspondence to state agency administrators informing them that there is "considerable renewed interest in the use of Citizen Band Radios to alert highway patrols and local authorities of any vehicle being operated in a dangerous, erratic manner indicating the driver may be impaired by alcohol, drugs, sudden illness, or other problems." In response to this communication, Colonel W.T. Travers, Jr., Superintendent of the Maryland State Police, submitted a resolution on June 21, 1983, at a regional IACP Conference in Williamsburg, Virginia, which was adopted, in support of citizen DWI reporting. It is Colonel Travers' belief that "such programs can serve as viable short-term general deterrent DWI countermeasure efforts." He personally urges "all states to adopt similar programs to further their efforts in reducing alcohol-related deaths and injuries."

TABLE 1 Results of Maryland's Citizens Report Drunk Driving Program as of 7/4/83

ENFORCEMENT AGENCY	REPORTS	CONTACTS	ARRESTS
BALTO CITY P.D.	467	121	106
ANNE ARUNDEL P.D.	550	43	14
ANNAPOLIS P.D.	80	7	5
BALTIMORE CO. P.D.	1,793	732	91
DEPT. NATUREAL RESOURCES	1	1	0
TOLL FACILITIES	141	68	25
HOWARD COUNTY P.D.	275	47	47
EMMITSBURG P.D.	0	0	0
FREDERICK CITY P.D.	5	4	4
THURMONT P.D.	0	0	0
FREDERICK CO. SHERIFF	1	1	1
WESTMINSTER P.D.	48	7	7
ELKTON P.D.	9	4	1
ABERDEEN P.D.	15	2	0
BELAIR P.D.	0	0	0
PRINCE GEORGE'S CO. P.D.	346	99	37
ROCKVILLE CITY P.D.	0	0	0
MONTGOMERY COUNTY P.D.	1,028	904	223
CAMBRIDGE CITY P.D.	0	0	0
HURLOCK P.D.	0	0	0
OCEAN CITY P.D.	1	2	0
BERLIN P.D.	1	1	1
SALISBURY P.D.	0	0	0
EASTON P.D.	42	10	3
WASHINGTON CO. SHERIFF	25	5	3
ALLEGANY SHERIFF	0	0	0
CUMBERLAND CITY P.D.	30	21	14
WILLIAMSPORT P.D.	1	0	0
MARYLAND STATE POLICE	4,047	1,270	667
GRAND TOTAL	9,134	3,348	1,251

REPORT PREPARED BY - MARYLAND STATE POLICE TRAFFIC PROGRAM PLANNING UNIT

TABLE 2 State Citizen Participation Programs

State	Program	Program Evaluation Time Period	No. of Months	Total No. of Calls and CB Reports	Total Contacts		Total Arrests for DWI	
					No.	Percent	No.	Percent
Colorado	REDDI	December 1980 to July 1982	20	13,274	1,701	20	1,661	62
Maryland	Citizens Report Drunk Driver Program	July 1 to August 29, 1982	2	1,623	500	31	230	46
Nebraska	REDDI	June 1981 to May 1982	12	2,836	1,827	64	1,428	78
Utah	REDDI	May 1 to June 30, 1982	2	262	102	38	76	74
Washington	Poster Girl	March 1980 to July 1982	27	8,000	1,400	18	1,000	71

It appears that the CB radio is again a viable communications network that can be used toward the enhancement of highway safety, except that this time highway safety advocates are providing the impetus.

PROGRAM EFFECTIVENESS

Maryland's citizen reporting program has proved to be effective in increasing public awareness of the drinking driver problem and identifying hazardous drivers. Moreover, these citizen reports have resulted in increased arrest totals and sometimes criminal apprehensions. Examples of these are as follows:

1. In August 1982 a citizen made personal contact with a trooper to report a drunk driver. This notification resulted in an arrest of a DWI with three prior convictions for DWI.
2. In November 1982 a trooper assigned to the Special Traffic Enforcement Unit received a report of a drunk driver over the CB radio. He subsequently stopped the vehicle and arrested the operator. A search incident to the arrest revealed 14,995 methaqualone tablets, with a street value of nearly $50,000. In addition, a small quantity of cocaine and marijuana was confiscated.

Aside from creating a general deterrent against drinking and driving, citizen reporting programs have been established by NHTSA as one of the supplemental grant criteria elements under 23 CFR Part 1209, Incentive Grant Criteria Safety Programs, that states may adopt to become eligible for additional federal 408 funding.

There is little doubt that without the availability of CB radio equipment this program would not have been as successful as the numbers might reveal. Moreover, there is no substantive or pragmatic conclusion that can be drawn as to the impact this program had on reducing alcohol-related highway fatalities in Maryland. However, it is safe to conclude that the increased public awareness aspect of

this program, coupled with the increased risk and perception of risk by the drinking driver of being detected and arrested, has in some way contributed to the greatest single annual decline in Maryland highway fatalities during the past decade. The 1,200 alcohol-related arrests have contributed to the largest total number of DWI arrests ever recorded in Maryland. In 1982 there were 33,556 alcohol-related arrests, which represented a 42 percent increase over 1981 totals and a 115 percent increase over 1980.

SUMMARY

Citizen reporting programs are working in many areas of the country. The structure and success of each program varies, depending on the availability of funding and resources.

A national survey of REDDI-type programs conducted by NTSB in March 1983 revealed that about one-half of the states surveyed indicated that the increased public awareness, which these programs bolster, was more important than the increased number of DWI arrests.

Because of the attention that these programs have received, perhaps drivers are more cognizant of the perils of drinking and driving. Moreover, the increased risk of the DWI offender being detected, reported, and subsequently arrested may have contributed to the overall national decline in highway deaths.

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