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Site Report: Knoxville, Tennessee Field Test of Combined Speed, Alcohol, and Safety Belt Enforcement Strategies

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Ted Anderson served as COTR on the project.

16. Abstract

This report describes the implementation and evaluation of a traffic safety program in Knoxville, Tennessee. The goal of the program was to reduce the incidence of speeding, alcohol-impaired driving (DWI) and non-use of safety belts through well-publicized enforcement strategies focusing attention on all three areas. The Knoxville Police Department selected "Triple Jeopardy: Speeding, Drunk Driving and Belt Use - In Knoxville, if you're stopped for one, you're checked for all three" as the theme for their program. The program sequentially emphasized five different combined enforcement strategies over a period of approximately one year. A public information and education program that focused on each strategy ran for about two months. The study concluded that Knoxville's combined enforcement program did not decrease speeding or DWI, nor did it result in increased us of safety belts. Though an impressive public information and education program was implemented, it was not matched by actual increases in enforcement intensity for any of the target offenses. This provides additional support to prior research which has suggested that public information and education programs with enforcement themes should be backed up by a credible enforcement threat.

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Chattanooga was the comparison site for the Knoxville project. Its role was to provide data on related traffic enforcement activity in Chattanooga. Ms. Peggy Ramage of the Hamilton County Department of Health was our principal point of contact in Chattanooga. The Department kindly provided us the results of their survey of attitudes and driving behavior of Chattanooga drivers.

The Tennessee Department of Safety also played a critical role in the data collection effort associated with this project. The Knoxville and Chattanooga surveys of driver attitudes and driving behavior were conducted in the Department's driver license stations. Mr. Dean Tyler of the Department of Safety arranged the preparation of traffic accident tapes for Knoxville and Chattanooga for our use in our evaluation of the project.

Mid-America was assisted in this project by two subcontractors, the University of North Carolina Highway Safety Research Center (HSRC) and the Center of Applied Research (CAR). We extend our thanks to our colleagues at Mid-America, HSRC, and CAR who helped in this study. Peter V. Murphy of Mid-America assisted in the PI&E effort, and Georgine Russell of Mid-America assisted in producing the report. Richard Knoblauch and Marsha Nitzberg of CAR played key roles in collecting field data of vehicle speeds and seatbelt use in Knoxville and Chattanooga.

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EXECUTIVE SUMMARY

This report describes the implementation and evaluation of a project in Knoxville, Tennessee, to test the hypothesis that combined speed, alcohol, and seatbelt enforcement strategies, coupled with a strong PI&E program, can reduce the incidence of speeding, alcohol-impaired driving, and non-use of seatbelts. This project publicized the enforcement of several highway safety laws *in combination*, rather than enforcement of one particular law. This approach is designed to make enforcement more efficient in raising perceived risk of arrest for each type of violation and also to achieve increased deterrence by creating a perception of more severe penalties for multiple violations occurring in a single incident. We hypothesized that, as a result, deterrence for one category of violation may be enhanced by the perceived severity of sanctions for another.

The Knoxville program began in September 1990, and sequentially emphasized five different combined enforcement strategies during a period of approximately one year. A PI&E campaign focussing on each strategy was operated for about two months. A general program theme underlaid all of these campaigns, stressing the concept of simultaneous enforcement of speeding, DWI, and occupant restraint laws. The theme selected by the Knoxville Police Department was:

Triple Jeopardy: Speeding, Drunk Driving and Belt Use - In Knoxville, if you're stopped for one, you're checked for all three.

The lead enforcement strategies of the five campaigns were:

1. Sobriety Checkpoints.
2. Saturation Patrols.
3. Interstate Speed Enforcement and Child Safety Device Enforcement.
4. Young Driver Campaign.
5. Speeding-DWI-Seatbelt Blitz.

It is important to note that more than one of these strategies were used during a given PI&E campaign. The strategy being emphasized by a PI&E campaign was always employed while the campaign was underway, but other strategies were also employed during that campaign. For example, sobriety checkpoints were operated during the first campaign, but so were saturation patrols. Further, routine enforcement of traffic laws continued while these strategies were in effect. For example, general patrol units continued enforcing all observed violations of DWI, speeding, and non-use of seatbelts.

The evaluation effort was directed at measuring the effect of the combined enforcement / PI&E program on:

- driver awareness of the program;
- driver perceptions of enforcement;
- driver self-reported behavior with respect to speeding, drinking-driving, and seatbelt use;
- measured speed distributions and seatbelt use at several locations throughout the program period; and
- accidents and accident variables related to drinking-driving, speeding and seatbelt use.

A comparison site (Chattanooga, Tennessee) was used to help recognize trends that could affect the test site and confound the effects of the program in the test site (Knoxville, Tennessee). The comparison site was chosen so as to match the test site closely as possible except that it planned no special traffic-law enforcement program. About six months into the project we learned that Chattanooga had been given the opportunity to implement an intensive speed enforcement campaign supported by a PI&E effort. The project was funded by a state grant from the Tennessee Governor's Highway Safety Program matched with local government funds, and was conducted from March 1991 through September 1991.

By comparing data from the first six months of the Knoxville program with data from Chattanooga during the same period when Chattanooga had not yet implemented its speed enforcement campaign, we were able to determine whether Knoxville's combined enforcement approach was effective at all. Similarly, by comparing data from the second six months of the Knoxville program with data from Chattanooga during that period, we were able to determine whether the combined enforcement approach was more effective than the single-violation (speeding) approach implemented in Chattanooga.

Our evaluation showed essentially no change in various measures of speeding in either site during *the first six-month period*. Neither Knoxville's combined enforcement program nor Chattanooga's nominal enforcement effort had any measurable effect on speeding or speeding-related accidents. There was also no measurable change in seatbelt use or in accidents related to seatbelt use at either site. Further, there was no change in self-reported incidence of drinking-driving or in alcohol-related accidents at either site.

The speed measurement data from *the second six-month period* showed the percentage of vehicles exceeding the speed limit by at least 10 mph in Knoxville increased slightly and then dropped after the Knoxville project period. Meanwhile, the percentage of vehicles exceeding the speed limit by at least 10 mph in Chattanooga dropped sharply shortly after the start of its speeding enforcement campaign. This effect was maintained throughout the Chattanooga campaign and continued on beyond the campaign for another two months when data collection ceased. The Knoxville changes were not statistically significant, but the Chattanooga changes were. Again, there was no measurable difference in seatbelt use or in accidents related to to seatbelt use at the two sites. Finally, there was no significant change in self-reported incidence of drinking-driving or in alcohol-related accidents at either site.

Data from a survey of Knoxville and Chattanooga drivers support the hypothesis that the relative decrease of speeding in Chattanooga was due to its speeding enforcement campaign. Perceived enforcement of speeding in Chattanooga was some 20 to 30 percentage points higher in Chattanooga than in Knoxville. The survey data also indicated that Knoxville's combined-enforcement program had little or no effect on awareness and self-reported behavior with respect to the three target violations. By contrast, the single-strategy program in Chattanooga which concentrated on speeding had a significant positive effect on awareness of *speeding* messages and self-reported speeding.

An analysis of accident data in Chattanooga also suggests that the speeding reductions measured there had a significant positive effect on speeding-related accidents. *The percentage of all accidents in which there was one or more injuries decreased by about 8% shortly after the speeding campaign began.* Since there was no increase in seatbelt use in Chattanooga, it is logical to attribute this reduction to the reduction in speeding.

The major conclusions of the Knoxville field test are:

1. *Knoxville's combined-enforcement program*

   a) was neither less effective nor more effective against any of the target violations and related crashes than was its prior enforcement program;
   b) was neither less effective nor more effective against any of the target violations and related crashes than was Chattanooga's nominal-enforcement program; and
   c) was less effective against speeding and related crashes than was Chattanooga's single-violation speeding program.

2. *Chattanooga's single-violation speeding program*

   a) was more effective against speeding and related crashes than was its prior nominal enforcement program; and
   b) achieved its positive effects against speeding with no apparent negative effects on perceived enforcement or self-reported behavior with respect to DWI or seatbelt use. There were also no negative effects on observed use of seatbelts.

The Knoxville project was based on a design concept requiring:

- use of high-intensity, combined-enforcement strategies incorporating both new and traditional techniques; and

- heavy use of public information and education tailored to match each of the combined-enforcement strategies.

As implemented, the Knoxville project employed combined-enforcement strategies but was not accompanied by an increase in enforcement intensity (as measured by number of citations and number of officers assigned to enforce the target violation). Also, while the project did include a comprehensive PI&E campaign, the phasing of that campaign did not coincide with the phasing of the various combined enforcement strategies. *Therefore, the basic requirements of the combined-enforcement concept were only partially met in Knoxville.* By contrast, Chattanooga's single-violation enforcement approach was supported by heavily-increased enforcement intensity and by a PI&E campaign that coincided with the enforcement effort.

Thus, Knoxville's project differed from Chattanooga's project not only in the use or non-use of combined enforcement, but also in the way in which those two enforcement approaches were executed. Therefore, it cannot be said that the reason for Knoxville's lack of success and for Chattanooga's success was that Knoxville used combined enforcement and Chattanooga used single-violation enforcement.

If the combined-enforcement approach was responsible or partly responsible for Knoxville's lack of success, then it could be because efforts targeted at multiple unsafe driving behaviors diluted Knoxville's enforcement effort and made it more difficult for the public to grasp the combined-enforcement concept. Messages aimed at several unsafe driving behaviors are inherently more complex and thus more difficult to publicize and to capture hard news coverage. Public awareness of combined-enforcement messages may have become clouded and the enforcement effort diluted in trying to maintain a high level of enforcement for three violations at once instead of just one. This might have resulted in a perception of "business as usual" by the Knoxville public.

If the lack of increased enforcement intensity played a significant role in the results of the Knoxville project, then additional support is provided for the findings of some prior research that PI&E campaigns with enforcement themes should be backed up by a credible enforcement threat. Knoxville mounted an impressive PI&E campaign, but did not increase its enforcement of the target violations. A combined-enforcement approach may require a large increase in enforcement intensity to be effective. Conceivably, a combined-enforcement approach with increased enforcement intensity could be even more effective than a single-violation approach with an equivalent increase in enforcement intensity. Results from the other two field tests being conducted under this project should shed more light on the relative role of enforcement approach and enforcement intensity in the effectiveness of this kind of traffic law enforcement program.

1 - INTRODUCTION

GENERAL NATURE OF THE PROJECT

This report describes the implementation and evaluation of a one-year project in Knoxville, Tennessee, to test the hypothesis that combined speed, alcohol, and seatbelt enforcement strategies, coupled with a strong public information and education (PI&E) program, can reduce the incidence of speeding, alcohol-impaired driving, and non-use of seatbelts. The project was conducted for the National Highway Traffic Safety Administration under Contract No. DTNH22-89-R-07396 entitled "Field Test of Combined Speed, Alcohol, Safety Belt Enforcement Strategies." This project publicized the enforcement of several highway safety laws *in combination*, rather than enforcement of one particular law. This approach is designed to make enforcement more efficient in raising perceived risk of arrest for each type of violation and also to achieve increased deterrence by creating a perception of more severe penalties for multiple violations occurring in a single incident. We hypothesized that, as a result, deterrence for one category of violation may be enhanced by the perceived severity of sanctions for another.

For example, a strategy may involve publicizing that all nighttime speeding stops will also include administration of a Preliminary Breath Test (PBT) for alcohol impairment (subject to probable cause constraints) and investigation of safety belt and child restraint use. Deterrence may be enhanced for restraint and DWI violations by creating a perception of an increased risk of apprehension brought about by increased nighttime speeding enforcement. For speeding violations, publicizing enforcement may itself increase the perceived risk of arrest. Publicizing such enhanced speeding enforcement may also increase the perceived severity of punishment by creating a threat of a conviction for an alcohol violation and its attendant sanctions.

This combined enforcement concept is also being tested in two other sites in this contract, Lexington, Kentucky, and Wichita, Kansas. The results of these two subprojects will be documented in separate reports.

PROJECT SCOPE AND APPROACH

Each of the three subprojects (Knoxville, Lexington, and Wichita) was based on a design concept requiring:

1. use of high-intensity, combined-enforcement strategies incorporating both new and traditional techniques; and

2. heavy use of public information and education tailored to match each of the enforcement strategies.

Two distinct types of effort were required in each of the subprojects, (1) design and implementation of the enforcement / PI&E program, and (2) evaluation of that

program. The *design and implementation effort* began with the selection of suitable jurisdictions in which to locate the subprojects. This involved contact with NHTSA's regional offices as well as drawing upon our own knowledge of traffic enforcement agencies throughout the country. Once a list of possible jurisdictions and agencies was developed, we set about contacting management staff in those agencies. Initially, the contacts were by telephone and through written correspondence. We then visited agencies that appeared promising to confirm their appropriateness. Criteria used in selecting sites are discussed later in this report and included those critical to enforcement and those critical to the PI&E effort. Knoxville was the first site selected. The Knoxville subproject began in September 1990, and was completed in August 1991.[1]

The *evaluation effort* was directed at measuring the effect of the enforcement / PI&E program on the following groups of variables:

- driver awareness of the program;
- driver perceptions of enforcement;
- driver self-reported behavior with respect to speeding, drinking-driving, and seatbelt use;
- measured speed distributions and seatbelt use at several locations throughout the program period; and
- accidents and accident variables related to drinking-driving, speeding and seatbelt use.

The evaluation was designed to measure changes in these variables in the test site over the project period. In addition, a comparison site was used to help recognize trends that could affect the test site and confound the effects of the program in the test site. The comparison site was chosen so as to match the test site closely as possible except that it planned no special traffic law enforcement program during the project period.

This design permits one to estimate the effectiveness of the *combined enforcement effort* relative to a *nominal enforcement effort involving no special campaign of any kind.* In addition, we contacted highway safety practitioners and surveyed the literature to learn whether there had been any evaluations of single-strategy speed enforcement programs in jurisdictions similar to our test jurisdictions. If such data were available, it could be combined with the data from our pertinent site pairs to get an estimate of the benefit of a combined enforcement approach compared to a single-violation enforcement approach.

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[1] Mid-America's participation ended in August 1991, but the Knoxville Police Department decided to continue the program after Mid-America's participation ended. At this writing the program is still continuing.

Ultimately, we selected Chattanooga, Tennessee, as the comparison site for the first test site, Knoxville, Tennessee. The criteria discussed in the next section were used in selecting Knoxville and Chattanooga.

About six months into the project we learned that Chattanooga had the opportunity to implement an intensive speed enforcement campaign supported by a PI&E effort. The project was funded by a state grant from the Governor's Highway Safety program matched with local government funds. Twelve high-accident areas were targeted as the areas where the additional speed enforcement effort would take place.

The Chattanooga speeding crackdown was conducted from March 1991 through September 1991. Six teams, using a total of 24 police officers working on overtime, provided the enforcement. Each enforcement team consisted of one officer operating a speed detection unit and three officers involved in apprehending violators. The teams operated six days a week (excluding Wednesdays) from 7:00 a.m. until 11:00 a.m., 3:00 p.m. until 7:00 p.m. and 11:00 p.m. until 3:00 a.m.

The speeding enforcement effort in Chattanooga was supported by a PI&E program to increase public awareness. The twelve locations were publicized, and two newspapers printed those locations. In addition, radio and television spots were aired and interviews were given publicizing the crackdown on speeders. Public appearances to groups such as civic and garden clubs discussed the purpose of the program and tried to gain public support. The news media were allowed access to the teams at any time for photo opportunities and interviews while the officers were working. Officers cooperated by answering questions and giving demonstrations. A daily schedule of three specific enforcement locations was made available to the media. However, the timetable was not publicized and, at times, additional locations were covered that day, thereby creating the illusion that more enforcement teams existed. Unmarked and marked police units and motorcycles were used.

Through this program, Chattanooga provided data for analyzing (1) whether the combined enforcement approach was effective at all and also (2) whether it was more effective than a single-violation approach. The first analysis compared the first six months of the Knoxville effort with the first six months of the Chattanooga effort, and the second analysis compared the second six months of the Knoxville effort with the second six months of the Chattanooga effort.

Finally, our project sought data from other communities that might have implemented special enforcement campaigns directed at speed alone. Our search involved both a library search of the speed-enforcement literature and contacts with NHTSA regional offices. No literature was found reporting the *jurisdiction-wide* effects of such a campaign on speed distributions or traffic crashes. Prior research on speed-enforcement campaigns appears to have focussed on their effects in the immediate vicinity of an enforcement symbol rather than within the entire jurisdiction served by an enforcement agency.

2 - PROJECT SITES

SITE SELECTION

Our contract called for sites with populations between 200,000 and 500,000. Two categories of criteria were used in selecting sites of this size, those critical to enforcement and those critical to the PI&E effort. *Site selection criteria critical to enforcement* included:

Willingness of police to cooperate. This criterion included the willingness to adhere to the experimental design (discussed later in this report), and the willingness to provide personnel and equipment needed for the enforcement efforts.

Conditions justifying speed enforcement. This criterion was aimed at ensuring that traffic laws, speed limits, and road conditions were such that a program that includes speed enforcement had a reasonable chance of influencing driver behavior.

Availability of data. This included specific data on the coincidence of problem behaviors (e.g., speeding and DWI) in the locality, for the purpose of planning the enforcement campaign. It also included the availability of more general data (crash, arrest, etc.) for determination of program effectiveness. It included the current availability (or reliable prospect of future availability) of independent attitudinal survey data on issues related to the project.

Quality and accessibility of accident data. Computer tapes from a central agency were preferable to hard copy from the local agencies, which would have to be retrieved and keypunched. The detail of information on the accident reports was also important; for example, data which contain the TAD scale for vehicle damage were deemed preferable to those which do not. Also, sites with more extensive police investigation of accidents were preferable to those which rely more heavily on operator reports.

Legal environment. Considerations were the requirements for a speeding citation, the definitions of the various levels of alcohol offenses, the legal techniques for determining BAC, whether roadblocks are permitted, the exact requirements for safety belt use, and the strategies permitted for enforcing safety belt use. It was also important that there would be no new local or state legislation which would affect the legal basis for the enforcement strategies (e.g., repeal of a seatbelt law, or drastic strengthening of the drunk driving laws).

Availability of Comparison Sites. Comparison sites were preferably from the same states. Confounding factors, especially those arising from differences in laws, and in accident data, can make a comparison of sites in different states more difficult. Desirable characteristics of comparison sites were:

- Similarity in general social and economic characteristics.
- Similarity in general characteristics of the Highway Transportation System.
- Similarity in intensity of enforcement of target traffic law violations.
- Similarity in historic traffic law enforcement patterns and trends.
- No plans for changes in current traffic law enforcement and PI&E practices.
- Similarity in historic accident patterns and trends.
- Data availability comparable to those of the test sites.
- Willingness to permit collection of speed and seatbelt use data.

Site Selection Criteria Critical to the PI&E Campaign were:

Willingness of local police agencies to make true commitment to the program. This includes the willingness on the part of the chief(s) to give the project high priority, to make resources available to make this a real and permanent initiative, and to take an active role in both the enforcement and public information activities.

Availability of an effective police-based local coordinator. The potential for success for this type of public information program can rest largely on the effectiveness of the local coordinator. The ability to work well with the public, the media, and the departments cooperating in the program was essential. A person based within the enforcement agency was desired.

Ability to develop widespread local ownership and resources. Because it was desired to develop a program that could be operated locally without Federal funding, this project had little funds available for materials and promotions. It was therefore necessary to choose a site that had sufficient resources available to supplement the efforts of the law enforcement agencies. These resources include support of local businesses, industry and volunteer and civic groups.

Availability of local media. Local television and radio stations, newspapers and other media outlets were necessary to get the messages out to a significant portion of the driving public. Ideally, the site should be its own media market or the main metropolitan area within the market. The support of the media in donating public service efforts to the program, including the development, production and play of public service announcements was an essential ingredient.

The suitability of Knoxville as a test site and of Chattanooga as a comparison site with respect to these criteria was assessed and documented in an interim report to NHTSA. This site pair was recommended in the report, and the recommendation was accepted by NHTSA.

TEST SITE DESCRIPTION

Knoxville and Knox County

Knoxville is located in eastern Tennessee in Knox County. The city has a population of about 165,000, compared to about 336,000 in the county. The county (excluding the city) is largely rural. About 35% of the population in the county are under 25 years of age, and about 13% are 65 or older. Some 10% are classified as minority (primarily black).

Per capita personal income for the county is about $17,000, about the same as the state as a whole. About 11% of Knox County families were below the poverty level in income in 1979, a bit less than the state as a whole (13%). The unemployment rate in the county was 4.0% in 1990, also less than that of the state as a whole which had a rate of about 5.2%. Alcoa in adjoining Blount County is a major employer, and Oak Ridge is also nearby.

Knoxville is the home campus of the University of Tennessee, with an enrollment of about 27,000. Knoxville Technical Institute (enrollment of about 3,000) is also in the city.

Knoxville has 18 newspapers, including the daily *News-Sentinel* and the *University of Tennessee Daily Beacon.* There are six television stations, including stations that are affiliated with ABC, NBC, and CBS. In addition, Knoxville has 19 radio stations.

There were 238,000 registered motor vehicles in Knox County in 1985. Road mileage by type in 1983 was:

Interstate Highway:	57
State Highway:	190
County Roads:	1,134
City Streets:	1,169

Three interstate highways pass through Knoxville, I-40, I-75, and I-81.

Traffic accidents in Knoxville have remained stable over the past five years. Each year, there are about 7,000 property damage accidents, 2,000 personal injury accidents, and 30 fatal accidents.

Law Enforcement Agencies

Law enforcement in Knox County is performed almost entirely by the Knoxville Police Department and the Knox County Sheriff's Department. The Sheriff is more than a jailer, and does considerable patrol outside of the city and some patrol on interstate highways within the city. These two agencies collaborate from time to time, including establishing and operating sobriety checkpoints. The Tennessee Highway

Patrol does very little law enforcement in Knox County, and there are no other smaller police departments of any significance to this project.

Our project was housed within the Knoxville Police Department (KPD). The KPD has 292 sworn officers with an average length of service of 14.5 years. There are, in addition, 93 civilians working for the department. The annual budget of the department is over $17 million. The department is organized into two operational divisions, the Patrol Division and the Criminal Investigations Division, plus an Administrative Bureau, an Internal Investigations Unit, and a Planning and Budget Office. There is no Traffic Division: most traffic law enforcement is handled by general patrol units and the motorcycle unit.

The KPD responds to nearly 140,000 calls for service annually. In the 12 months preceding this project, citations and arrests for traffic law violations totalled about 40,000, including some 1,400 DUI arrests and 17,000 speeding citations. The refusal rate for a chemical test in Tennessee was 23% in 1987, which is close to the national average of 19%. The average BAC of KPD arrestees is fairly typical of DUI arrestees, 0.18%. A significant percentage (17%) of those arrested for DUI are female.

The KPD has been active in traffic law enforcement. The most directly related enforcement program was a three-year 55 mph speed enforcement program. However, this program was not widely publicized and was not integrated with other traffic law enforcement efforts.

COMPARISON SITE DESCRIPTION

Chattanooga and Hamilton County

Chattanooga is located in Hamilton County in the mountainous, southeastern part of Tennessee, immediately north of the Georgia border. The city has a population of about 250,000, and the county has a population of about 300,000. As is the case in Knoxville and Knox County, the county (excluding the city) is largely rural. About 28% of the population are under 18 years of age, and about 11% are over 65. About 30% are classified as minority (primarily black).

Per capita income for the county is about $12,000, The unemployment rate in the county was 7.7% in 1984.

Chattanooga is one of the nation's oldest manufacturing cities, with more than 26% of its employment in that sector. However, there is no single dominating industry. Chattanooga is the home of the University of Tennessee at Chattanooga. The Chattanooga area was also a major Civil War battle site and is the home of such tourist attractions as Rock City and Ruby Falls.

Chattanooga is served by two daily papers: the Chattanooga Times in the morning and the Chattanooga News-Free Press in the afternoon. The city also has

eight television stations (including one local independent station) and 23 radio stations.

There were 246,000 registered motor vehicles in Hamilton County in 1985. Road mileage by type in 1983 was:

Interstate Highway:	32
State Highway:	227
County Roads:	888
City Streets:	762

The city is served by three major interstate highways--I-75, a north-south highway linking the Great Lakes states with Florida; I-24, an east-west highway linking Chattanooga and Nashville; and I-59, a north--south highway linking Chattanooga and Birmingham, Alabama--and, as a result, a large volume of traffic travels through the city.

As in Knoxville, traffic accidents in Chattanooga have also remained stable over the past five years. Each year, there are about 12,000 accidents involving some 2,400 injuries.

Law Enforcement Agencies

In Chattanooga the Chattanooga Police Department and the Hamilton County Sheriff's Department are the primary traffic law enforcement agencies. Some enforcement is performed by the Tennessee Highway Patrol. The CPD has 354 sworn officers, 15 of whom are assigned to the Traffic Division. Chattanooga has a DUI Task Force, which was established in 1984 as a part of a comprehensive, community based drunk-driving program. The Task Force consists of five law enforcement officers whose duties include only drunk driving enforcement.

In 1989, The CPD responded to some 136,000 calls for service. Citations and arrests for traffic law violations were about 28,000, including some 1,500 DUI arrests and an estimated 18,000 speeding citations. CPD management staff informed us that these numbers have been fairly constant over the past several years.

SUMMARY OF CHARACTERISTICS OF THE TEST SITE AND THE COMPARISON SITE

Table 1 compares the counties in which the two sites were located with respect to key site selection criteria and some other pertinent variables. The data shown are for various years prior to the project period for the Knoxville experiment. The table indicates that the sites compared very well on all of the characteristics shown.

Table 1: Comparison of Site Characteristics Prior to Project Period (*Circa* 1989)

Characteristic	Knoxville	Chattanooga
State located in	Tennessee	Tennessee
Geographical area, square miles	506	539
General social and economic characteristics[1]	Population: 336,000 < 25 yrs: 35% > 64 yrs: 13% Per capita income: $17,000 Unemployment: 4.0%	Population: 285,000 < 25 yrs: 35% > 65 yrs: 13% Per capita income: $17,000 Unemployment: 4.2%
Highway Transportation System	Registered vehicles: 238,000 Road mileage by type: Interstate: 57 State highway: 190 County roads: 1134 City streets: 1169	Registered vehicles: 246,000 Road mileage by type: Interstate: 32 State highway: 227 County roads: 888 City streets: 762
Historic accident patterns and trends	Stable	Stable
Intensity of traffic enforcement	Relatively high	Relatively high
Speeding citations	17,000	18,000
DWI arrests	1,400	1,500
Historic enforcement patterns and trends	Stable	Stable
Total calls for police services	140,000	136,000
Data availability	Enforcement data available from police agencies; accident data and survey data from state.	Enforcement data available from police agencies; accident data and survey data from state.
Permission to collect speed and seatbelt use data	Permission given	Permission given

3 - PROJECT DESCRIPTION

This section describes the local project, the strategies employed, and the general time frame. The description is in narrative form and does not include quantitative measures of activity which are provided in the Section 4, PROJECT EVALUATION.

This project was operated as a local project housed within the Knoxville Police Department. The development and operation of enforcement and PI&E strategies was a local effort. Local activities were coordinated for KPD by Ms. Janet Brewer, the Traffic Safety Coordinator for the Department. Mid-America's role was to provide assistance as required in the design of the project and in the development of PI&E materials. The University of North Carolina Highway Safety Research Center participated as a subcontractor to Mid-America with responsibility for assisting in the PI&E effort. Significant local effort was put forth in coordinating the project and in producing PI&E materials.

GENERAL APPROACH

The Knoxville Triple Jeopardy program sequentially emphasized five different combined enforcement strategies during a period of approximately one year. A PI&E campaign focussing on each strategy was operated for about two months. The first campaign was preceded by a one-month period of planning and collection of baseline data, and the last campaign was followed by a one-month period of post-operations data collection. A general program theme underlaid all of these campaigns, stressing the concept of simultaneous enforcement of speeding, DWI, and occupant restraint laws. The theme selected by the Knoxville Police Department was:

Triple Jeopardy: Speeding, Drunk Driving and Belt Use - In Knoxville, if you're stopped for one, you're checked for all three.

The logo used the image of a key chain imprinted with the words speeding, drunk driving, and belt use. The image for the Triple Jeopardy concept was a composite high-contrast photograph of three police cars. The police cars were used interchangeably with the image of three motorcycle officers. The message was that each stop is actually three enforcement stops in one. To give the program continuity and high recognition, these images were used on all materials and public service announcements produced. A brochure explained the program and highlighted the various strategies.

The lead enforcement strategies of the five campaigns were:

1. Sobriety Checkpoints.
2. Saturation Patrols.
3. Interstate Speed Enforcement and Child Safety Device Enforcement.
4. Young Driver Campaign.
5. Speeding-DWI-Seatbelt Blitz.

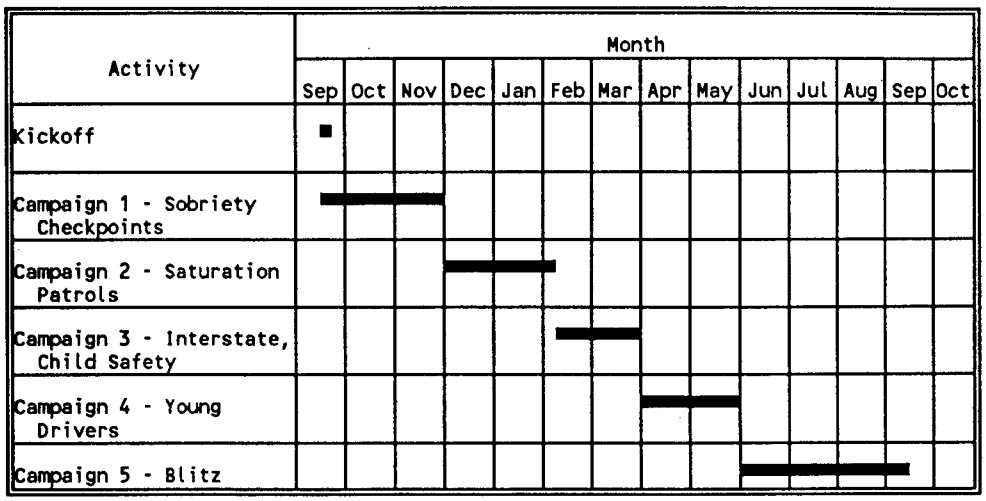
It is important to note that more than one of these strategies were used during a given PI&E campaign. The strategy being emphasized by a PI&E campaign was always employed while the campaign was underway, but other strategies were also employed during that campaign. For example, sobriety checkpoints were operated during the first campaign, but so were saturation patrols. Further, routine enforcement of traffic laws continued while these strategies were in effect. For example, general patrol units continued enforcing all observed violations of DWI, speeding, and non-use of seatbelts. The realities of operational law enforcement precluded the operation of only one strategy over an extended period. Availability of enforcement personnel, weather conditions, and specific enforcement needs all contributed to the Knoxville Police Department's choice of the enforcement strategies that were used during a given period.

PROJECT COMPONENTS

Project Kickoff

The Knoxville project kickoff occurred in September, 1990 (Table 2). On September 10th, the police department held a luncheon for the area media to inform them about the program and to request their participation through coverage of the enforcement strategies and through public service programming. Media kits were distributed that explained the program, gave local statistics that supported the need for the program, and supplied examples of the materials. The luncheon was followed by a news conference on September 14th, which officially kicked off the program. The television stations were given PSAs that were produced by WBIR-TV Channel 10. The storyboards were developed by the Knoxville Police Department and by our project team.

Table 2: Phasing of Knoxville Campaigns



Campaign 1 - Sobriety Checkpoints

This campaign was in operation during September, October, and November of 1990. Typically, the checkpoints involved some 20 officers stopping about 100 vehicles during the hours from 10:30 p.m. through 12:30 a.m. on a Monday night. Monday night was chosen to make use of available personnel. Radar units were located upstream from the checkpoints. The Knox County Sheriff's department supported the Knoxville Police Department in this effort. The campaign was kicked off with a sobriety checkpoint on September 17. Hard news coverage was received from the local television and radio stations and the Knoxville Journal.

The checkpoints were operated in accordance with court-approved guidelines. Officers directed groups of stopped vehicles into an observation area and engaged the drivers in a conversation during which the drivers were observed for signs of intoxication. Stops were made in such a way that each vehicle had about the same chance of being stopped (for example, every tenth car). Behavioral tests for alcohol-impairment followed. When possible intoxication was indicated, the drivers were asked for a sample of their breath for a chemical test of their BAC by a hand-held evidentiary breath testing device. If the tests indicated impairment beyond the legal limit, the driver was arrested for drunk driving. Drivers and children were checked for restraint use.

The radar component was used to increase the "hit ratio" in stopping drivers who were impaired relative to drivers who were not impaired. Speeding provided a reason for departing from the sampling scheme normally used, allowing the police to identify specific, higher-risk vehicles to direct into the checkpoint.

A card explaining what checkpoints are, why they are needed, and how they were a part of the Triple Jeopardy enforcement program was given out to motorists who passed through the checkpoints. The accompanying PI&E program emphasized how drinking drivers could not escape detection, that drivers would be observed for belt use, and that radar would be used around the checkpoint area to catch motorists attempting to avoid the checkpoint.

Major PI&E support was in the form of TV PSAs, TV and radio talk shows, and posters on local buses. Two TV PSAs were produced and aired, one focussing on explaining the Triple Jeopardy Program and the second emphasizing the checkpoints. The PSAs were produced by WATE-TV Channel 6.

The talk shows involved Knoxville Police Department spokespersons and other persons advocating action against the target unsafe driving actions. In addition, Chief Keith and Ms. Brewer, our Project Coordinator, appeared on several TV newscasts on Channel 6 and Channel 10 to talk about the Triple Jeopardy program.

Advertising space on the back of K-Trans buses was used to display the program logo and theme. This space, measuring 2 1/2 feet by 7 feet, was used throughout the project with alternating messages of the general program and specific strategies. For this campaign, the posters appeared during the last two weeks of September.

The Knoxville Police Department developed several promotional items to use during educational programs. The Triple Jeopardy folders included: fact sheets, pamphlets, brochures, pens, and the sobriety checkpoint cards. The cards were given to everyone stopped during the sobriety checkpoint on September 17. A banner was designed to use as a visual aid during news conferences, and educational programs.

In addition to its checkpoint operations, the Knoxville Police Department joined efforts with the Tennessee Highway Patrol, and the Knox County Sheriff's Department to conduct saturation patrols October 29 through November 2 and November 26 through November 30. The week of October 29th, the enforcement was conducted on Interstates 40 and 640 and from November 26 through November 30 on Alcoa Highway and Kingston Pike. These saturation patrols merged into the Campaign 2 effort discussed below.

Campaign 2 - Saturation Patrols

This campaign used patrol units deployed about every two blocks in a given sector. The patrol force was rotated to other sectors on a weekly basis, so that the entire Knoxville area was covered. Each patrol vehicle was equipped with hand-held radar, and the officers were trained in the use of visual cues for detecting alcohol-impaired drivers. Speeders were stopped and citations given where appropriate. Officers observed for seatbelt usage and DWI during the stop.

The kickoff of this campaign was timed to coincide with National Drugged and Drunk Driver Awareness Week (3-D Week) during December 9-15, 1990. The

Knoxville Police Department and S.A.D.D. of the Knox County Health Department sponsored the second campaign kick-off on December 7, 1990 at the city / county building. A display was staged in the main lobby during 3-D Week to educate viewers of the dangers of impaired driving. Knoxville Police Department patrol cars were located on Hill Avenue (a major thoroughfare) for Chief Keith and Mayor Victor Ashe to decorate with 3-D Ribbons as a symbol of the department's dedication to reduce impaired driving. The Knoxville-Knox County Highway Safety Task Force participated in activities for 3-D Week, and a kickoff was held to inform the community of the highway safety network. The event gave each agency in the network the opportunity to announce its educational efforts which tied in with the Triple Jeopardy program. Additional publicity included PSAs and TV and radio talk shows. Incentives were developed to use at the kickoff and for the educational programs. These included buttons, brochures, and sweat shirts or T-shirts.

Saturation patrols by the Knoxville Police Department were set up in high risk areas in the city during 3-D Week to decrease traffic injuries and fatalities as part of the Triple Jeopardy Program. The Patrol Division, Motorcycle Unit, and Power Squad[2] conducted saturation patrols in high risk areas through February 8, 1991.

A public service announcement was provided to area media during 3-D Week which focused on the saturation patrols. Triple Jeopardy tailgate posters continued to be displayed on K-Trans buses through December 14, 1990.

Chief Keith and Ms. Brewer, Highway Safety Coordinator were guests on WBIR-TV Channel 10, Early Morning News and WATE-TV Channel 6, Tennessee This Morning.

Campaign 3 - Interstate Speed Enforcement and Child Safety Device Enforcement

This was a two-part campaign emphasizing speed enforcement at designated sites on the interstate highways passing through Knoxville and enforcing the child passenger law which permits primary enforcement of non-use of restraints for children under four years old. The first component of this campaign used various tactics for detecting speeding violations on interstate highways, including pacing during which officers also observed for child safety device violations. Stops for either violation resulted in additional observations for DWI or non-use of a safety restraint by the driver. Officers observed seatbelt usage after a stop for DWI.

The second component of this campaign involved monitoring Knoxville malls / shopping center exits for individuals transporting children under four years of age without child safety devices. Enforcement was for 30 minute intervals at each of the designated sites.

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[2] The Power Squad is a unit created by having additional officers available from overlapping shifts. These units are assigned to duties in response to special enforcement needs, for example, drug enforcement, traffic, etc.

This campaign was put into operation during National Child Passenger Safety Awareness Week, February 10 through February 16, 1991. Chief Keith and Ms. Brewer were guests on WBIR's Early Morning Show on February 11 to inform the community of the activities and enforcement efforts of the Knoxville Police Department. Public service announcements were produced to air during this campaign. The thirty second and fifteen second spots were of Chief Keith with six employee's children delivering a message about the importance of child safety seats and seatbelts.

Local scout groups handed out flyers in the shopping centers regarding the importance of observing the speed limit, DUI, and child passenger laws. The Knoxville Police Department presented safety belt and child safety device programs to elementary students within the city. The educational effort was a network effort within the Knoxville-Knox County Highway Safety Task Force.

The Patrol Division Supervisor and the Vice Mayor of Knoxville gave away a child safety seat at the University of Tennessee Medical Center on February 11. The local television media provided coverage. The seat was donated by Sears, Roebuck and Company.

Educational programs were scheduled at area day care centers. The Knoxville Police Officers showed the Bucklebear video tape, a seat belt demo, and provided each child with a packet including a certificate, coloring sheet, sticker and a letter from Chief Keith for the parents with a pamphlet attached. AAA, East Tennessee Automobile Club provided litter bags.

Letters and pamphlets were sent to every day care center in the Knoxville-Knox County Area in the name of the Knoxville-Knox County Traffic Safety Task Force regarding National Child Passenger Safety Awareness Week. The pamphlets, "Tennessee's Law of Love" were provided by the Knox County Health Department. Many of the day care centers requested additional copies to give each parent.

The Child Restraint Device Offender Class was offered as an alternative to the $25 and $50 fine. The first class was taught on January 9 by a Knoxville Police Officer at Moses Center, and continued through March 13. Judge Rosson, of the Municipal Court, gave offenders the option of attending the class or paying a fine. The offender had to: register for the class within ten (10) working days, bring their drivers license, bring a working car seat, class fine ($5.00) and be on time. This class later became a component of Campaign 3.

Campaign 4 - Young Driver Campaign

This was also a two-part campaign and was aimed at young drivers during the prom and graduation season. The campaign focussed on teenage drivers and the illegal sale of alcoholic beverages to underage drivers. The first part stressed the use of radar units at locations where there had been a large number of young-driver accidents. The second part emphasized the need for establishments to "validate"

alcohol beverage sales to young patrons. A high-accident area analysis for individuals between 15 and 21 years of age determined the sites for radar enforcement within the city. This campaign was in effect in April and May, 1991.

One element of the young driver campaign incorporated a "Show Your Ugly Face" program to supply local mini-markets, restaurants, and liquor stores with promotional items that identified the establishment as one not selling alcoholic beverages to individuals under the age of 21. PSAs and TV and radio shows involving high school students were used to promote the campaign.

The Knoxville Police Department networked with task force members to offer a contest for a PSA to be produced for the Prom and Graduation Season. Assembly programs were held to inform the students about the laws regarding the possession of alcoholic beverages and the "Show Your Ugly Face" Program.

In April, the "Show Your Ugly Face" supplies (table tents, napkins, buttons, and posters) were distributed by the Power Squad to all area establishments that sold alcoholic beverages. S.A.D.D. clubs displayed the "Show Your Ugly Face" posters in their schools. Chief Keith sent a letter and supplies to the hotels which hosted high school proms. Selective traffic enforcement efforts and sobriety checkpoints were planned to coincide with the prom dates. The sobriety checkpoints were April 13th and May 11th. Eight of the high school proms were on May 11th.

A slide presentation, "DUI: The Price is High" was developed by the Knoxville Police Department to educate high school students about the consequences of using or possessing alcohol and other drugs. Eleven high school students played the characters in the slide presentation. The Knoxville Police Department and S.A.D.D. conducted assembly programs at the local high schools during the prom and graduation season. Approximately 2400 students attended the programs. Chief Keith recognized the students for their efforts with a pizza party and presented each student with a certificate.

A wide variety of supporting enforcement activity occurred during this campaign. The Knoxville Police Department participated in the I-75 Alive Program, a 24 hour enforcement effort against drunk driving, speeding, and non-use of safety belts. The Tennessee Interagency Committee conducted a Selective Traffic Enforcement Program during the Memorial Day weekend. The Operation Buckle Down Program was emphasized. Chief Keith held a news conference May 24th at 7:00 a.m. on Interstate 75 to announce the efforts of the Knoxville Police Department during the enforcement period. The enforcement began with rolling road blocks at three locations. A sobriety checkpoint was conducted on Friday, May 24th at Cherokee Boulevard and Kingston Pike. Saturation patrols were conducted throughout the holiday period. The Knoxville Police Department received excellent media coverage for the enforcement efforts, which were tied into the Triple Jeopardy program.

Chief Keith and Ms. Brewer were guests on City Beat, a local talk show for WBIR Channel 10. Topics discussed included the Triple Jeopardy program.

Officers presented educational programs at area day care centers and provided packets to each child during Buckle Up America Week. The packets also contained information for parents.

Campaign 5 - Speeding-DWI-Seatbelt Blitz.

This campaign involved an all-out effort employing several methods used previously in the program. It focused on interstate speed enforcement and safety around the school zones and was in effect from June through August, 1991. Two additional public service announcements were developed about speeding, drunk driving, and seat belt use and were also used in the prior campaign.

The I-75 Alive program was conducted by the Knoxville Police Department and the Tennessee Highway Patrol on July 12th, August 24th, and September 6th. Officers from the motorcycle unit and the Power Squad participated in the enforcement effort. Sobriety checkpoints were conducted on Monday, July 15th and Saturday, August 10th by the Knoxville Police Department's Power Squad.

The Knoxville Police Department and AAA joined efforts to promote the School's Open - Drive Carefully Program. The Mayor, the Chief of Police, and a representative from AAA kicked off the program August t at an elementary school. The Knoxville Police Department officers pulled over traffic violators in the school zones and gave them a flyer with important safety tips rather than a ticket the first few days of the program. The officers continued to give out information with citations for several days. Packets of information were provided to Kindergarten and first grade students that included a letter to the parents, a coloring book, and stickers with the "School's Open - Drive Carefully" slogan. The theme was also placed on milk cartons and fast food tray liners in the Knoxville community. Public service announcements regarding the program were provided to the local television stations.

New art work was developed for the "Show Your Ugly Face" program that could be used as posters in area bars and restaurants.

4 - PROJECT EVALUATION

This section presents our evaluation of the Knoxville combined enforcement project. The approach, methods, and results of the evaluation are described in detail.

OVERVIEW

As indicated in Section 1 of this report, the evaluation of this project was initially designed to compare various measures of effectiveness in the test site (Knoxville) with those in a similar site (Chattanooga) that operated a "nominal" enforcement program against DWI, speeding, and non-use of seatbelts. However, Chattanooga departed from its nominal program about halfway through the Knoxville project, implementing an intensive speed-enforcement campaign supported by PI&E. This development provided the opportunity to perform a two-part evaluation of the Knoxville project.

In the first part, we examined the effectiveness of the combined enforcement project in the test site (Knoxville) relative to the nominal enforcement program in the comparison site (Chattanooga) during the first six months of the Knoxville program. To do this, we compared the first six months of data from Knoxville with the first six months of data from Chattanooga. In the second part, we estimated the effectiveness of the combined enforcement program relative to the single-violation (speeding) enforcement program operating in Chattanooga during the second six months of the Knoxville program. This was accomplished by comparing the second six months of data from Knoxville with the second six months of data from Chattanooga.

The evaluation was conducted on several levels. At the lowest level, *project activity* was monitored. Two types of activity were generated by this project, enforcement and PI&E. The activity evaluation tracked and assessed the enforcement and PI&E effort over the course of the project. The available enforcement data consist primarily of arrests for DWI and citations for speeding and non-use of restraints. The PI&E data include such measures of exposure as the number of plays of PSAs by given stations, and number of special events held.

Higher levels of project evaluation dealt with the effects of the project activities on variables related to the target driving behaviors, that is, DWI, speeding, and seatbelt use. *Awareness, perceived risk of enforcement, and self-reported behavior* were measured through questionnaires filled out by drivers at driver license stations. The awareness component was concerned both with awareness of project messages as disseminated through PI&E activities, and with the awareness of the enhanced enforcement activity generated by the project. Perceived enforcement risk dealt with the drivers' perception of the risk of getting arrested or ticketed for one of the three target violations, and self-reported behavior addresses the drivers' own reports of violating DWI, speeding, and seatbelt-use laws. The survey was conducted in Knoxville and Chattanooga in three waves, (1) shortly before the Knoxville project

began, (2) about halfway through the project, and (3) shortly after the project was completed.

Unfortunately, It was not possible to compare survey results in Knoxville with those in Chattanooga during the first six months of the project. This is because the second wave of the survey was not conducted in either city until the end of March, 1991, seven months after the Knoxville project began and about a month after the Chattanooga speed enforcement program began.

A field measurement program was conducted to obtain data on *actual speeding and seatbelt-use behavior.* Vehicle speeds were measured and seatbelt use was observed at several locations in Knoxville and Chattanooga. Seven waves of measurements were conducted, one before and one after the Knoxville project, and five during the project.

Finally, an *analysis of traffic crashes* was performed for both sites. The analysis was concerned with the time variation of crashes and crash losses involving DWI, speeding, and non-use of seatbelts. Crash data were provided by the Tennessee Department of Safety.

ORGANIZATION OF THIS SECTION

A discussion of the data and data collection procedures used in the project is presented next. This is followed by the first evaluation which compares the first six months of the Knoxville combined enforcement project with the Chattanooga nominal enforcement effort. The time period for the first evaluation was from September, 1990, through February, 1991. Next, the results of the second evaluation are presented. The second evaluation compares the second six months of the Knoxville project with the Chattanooga single-violation program. The time period covered by the second evaluation was March 1, 1991, through August 31, 1991. Finally, a synthesis and interpretation of the results of the two evaluations is given.

DATA AND DATA COLLECTION

Awareness, Perceived Risk of Enforcement, and Self-Reported Behavior

The data for this level of evaluation were collected through a driver survey conducted by the Tennessee Department of Safety at drivers license stations in Knoxville and Chattanooga. Table 3 shows the time phasing of the three survey waves (as well as the time phasing of the field measurement program, discussed later) in relation to the five PI&E campaigns. The instrument used in both jurisdictions is shown in Appendix B. Persons appearing at driver license stations were given the questionnaires to fill out while they were waiting to be served at the stations. Refusal rates were less than 1%.

Table 3: Phasing of PI&E Campaigns in Knoxville and Field Data Collection Activity in Knoxville and Chattanooga

Activity	Month													
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
PI&E														
Kickoff	■													
Campaign 1 - Sobriety Checkpoints	▬	▬	▬											
Campaign 2 - Saturation Patrols				▬	▬	▬								
Campaign 3 - Interstate, Child Safety						▬	▬							
Campaign 4 - Young Drivers								▬	▬					
Campaign 5 - Blitz										▬	▬	▬	▬	
Data Collection														
Attitude Survey	▬						▬							■
Field Measurements	▬	▬			▬		▬		▬		▬			■

Note: Shaded area indicates the period of the Chattanooga speeding campaign.

Questions 1 through 3 sought information on the respondents' reasons for being in the driver license station and their age and sex. Question 4 dealt with the respondents' awareness of public information messages relating to DWI, speeding, and seatbelt use, and question 5 asked about any perceived increase in the enforcement of DWI, speeding, and seatbelt use over the past three months. Question 6 asked about the respondents' drinking frequency, and question 7 asked about the respondents' frequency of drinking-driving. The remainder of the questions (8 through 13) sought information about the respondents' self-reported driving behavior with respect to DWI, speeding, and seatbelt use.

Some differences were found in the attributes of the respondents in the three survey waves and in the two survey sites. The data were weighted to help account for these differences so that valid comparisons could be made of Knoxville and Chattanooga responses. The procedure used for developing these weights is described in Appendix C.

Measured Speed

Speed data for the entire project were collected according to the following experimental design:

- Observations at each city were made seven times during the project. Each of these seven sets of observations was called a "wave." The first wave was before the project to provide "baseline" data, the seventh after completion of the project. Waves two through six were timed to coincide with completion of a particular enforcement campaign (see Table 3). The relationship between these dates and the periods during which the various enforcement / PI&E campaigns were in effect is also shown in Table 3.

- In each city, observations were made at eight different locations. In Chattanooga, one location had to be replaced during the project because the police believed it to be unsafe for data collection during certain hours.

- Observations were made during three time periods called "shifts:" 1 pm - 3 pm, 6 pm - 8 pm, and 8 pm - 10 pm. The design was balanced, so that all combinations of waves, locations, and shifts were covered.

During data collection, measurements of individual vehicle speeds were obtained, together with the lane used by the vehicle, and the vehicle type. In addition, vehicle counts for five minute periods were made to get information on traffic density. The locations were chosen to represent the range of different speed limits at the site, and were also locations where speeding was recognized by the local police as a problem. In addition, the locations were such that an observation vehicle could be safely parked without being obtrusive or affecting speeds. Following these general principles, our subcontractor, The Center for Applied Research (CAR), selected the specific locations on the basis of information provided by the local police. Speed measure-

ments were made with modified radar guns which operated on a frequency which did not trigger radar detectors, and which could be used unobtrusively.

Seatbelt Usage Observations

Seatbelt usage was observed at the roadside by the same field team that collected the speed data. Seatbelt observations were made in 24 sessions during each of the seven waves. The eight observation locations were at controlled intersections, where vehicles had to stop. Intersections were selected by CAR as to represent a wide range of speed limits and other conditions.

Observations were made during the time period 3pm - 6pm, when no speed measurements were made. Sessions at each location were held on three different days of the week, but no attempt was made to assign them to a specific time within each three-hour period.

Observations were made by observers looking into the vehicles and observing shoulder-belt and child restraint use for the driver and one front-seat passenger. Vehicle type, driver sex, driver shoulder belt use were recorded in four classes. If a front passenger seat was occupied, passenger sex and shoulder belt-use were recorded in the same categories used for the driver. In addition, seat use by a child, seat use by a child under four years of age, and any child held by the passenger were recorded.

Accident Data

Accident data were taken from computerized files of police accident reports. Four calendar years of data were available, from 1988 through 1991. The files contained data on non-pedestrian accidents investigated by the Knoxville Police Department and the Chattanooga Police Department. Using computer tapes purchased from the Tennessee Department of Safety, Mid-America staff developed monthly counts of various kinds of accidents and accident-related events investigated by each department. Variables reflecting these counts were:

Total number of accidents
Number of injury accidents
Number of property damage accidents
Number of nighttime accidents
Number of daytime accidents
Number of occupants with injuries of any kind
Number of nighttime injury accidents
Number of daytime injury accidents
Number of nighttime property damage accidents
Number of daytime property damage accidents
Number of alcohol-related accidents (police-reported)
Number of single-vehicle accidents
Number of nighttime single-vehicle accidents
Number of injury single-vehicle accidents

Number of nighttime single-vehicle injury accidents
Number of occupants not injured
Number of occupants with minor injuries
Number of occupants with serious or fatal injuries
Number of speeding-related accidents (police-reported)

EVALUATION I - COMBINED ENFORCEMENT VERSUS NOMINAL ENFORCEMENT

Enforcement Activity

The primary available measures of overall enforcement activity were DWI arrests, speeding citations, and warnings issued for non-use of seatbelts. In Knoxville, monthly counts of DWI arrests and speeding citations were available for the project period and for a period of six months prior to the start of the project. Data on seatbelt warnings were available only for the project period and two months prior to the start of the project.

The data for the first six months of the projects show that DWI arrests were maintained at about the same level (about 140 per month) as in the six months preceding the project (Figure 1). Speeding citations were slightly down at about 1,500 per month (Figure 2). Seatbelt warnings rose initially and then fell back to about 300 per month (Figure 3).

These data indicate that the target violations were enforced in Knoxville at a reasonable level during the project period. The lack of any increases in enforcement of DWI and speeding (as called for by our design concept), was due to the fact that no additional enforcement resources (for example, funding for overtime hours) were available to police management.

In Chattanooga, the number of DWI arrests continued essentially unchanged through the period at about 130 per month. The number of speeding citations also remained unchanged during the first six months of the project period at an estimated 1,500 per month. No data were available on the number of seatbelt warnings in Chattanooga.

Figure 1: DWI Arrests in Knoxville, March, 1990 - February, 1991

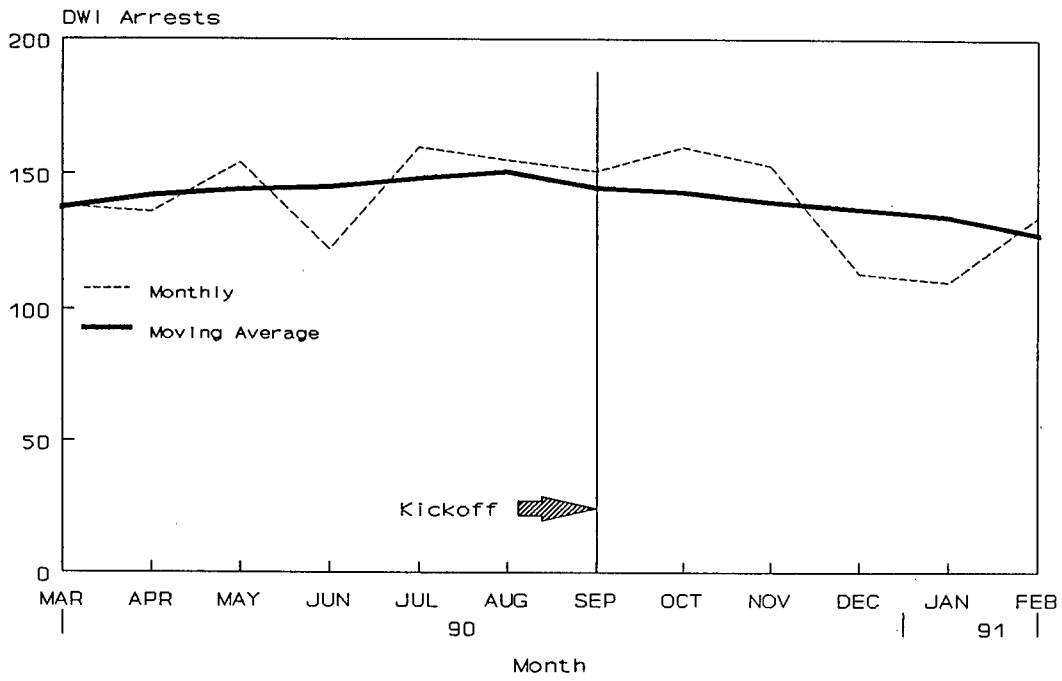


Figure 2: Speeding Citations in Knoxville, March, 1990 - February, 1991

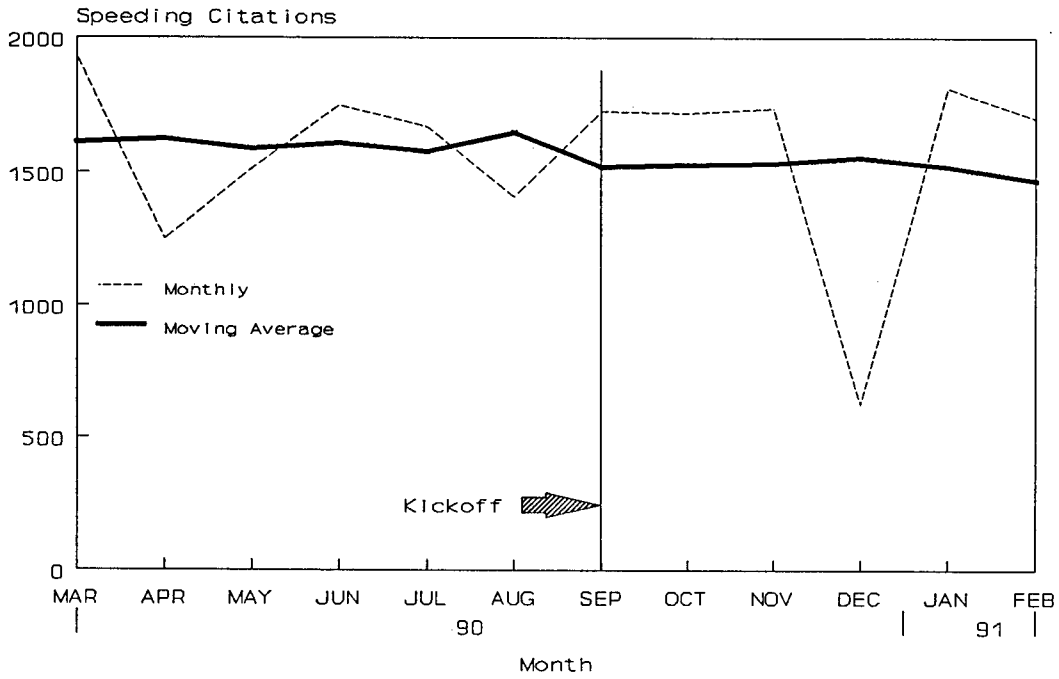
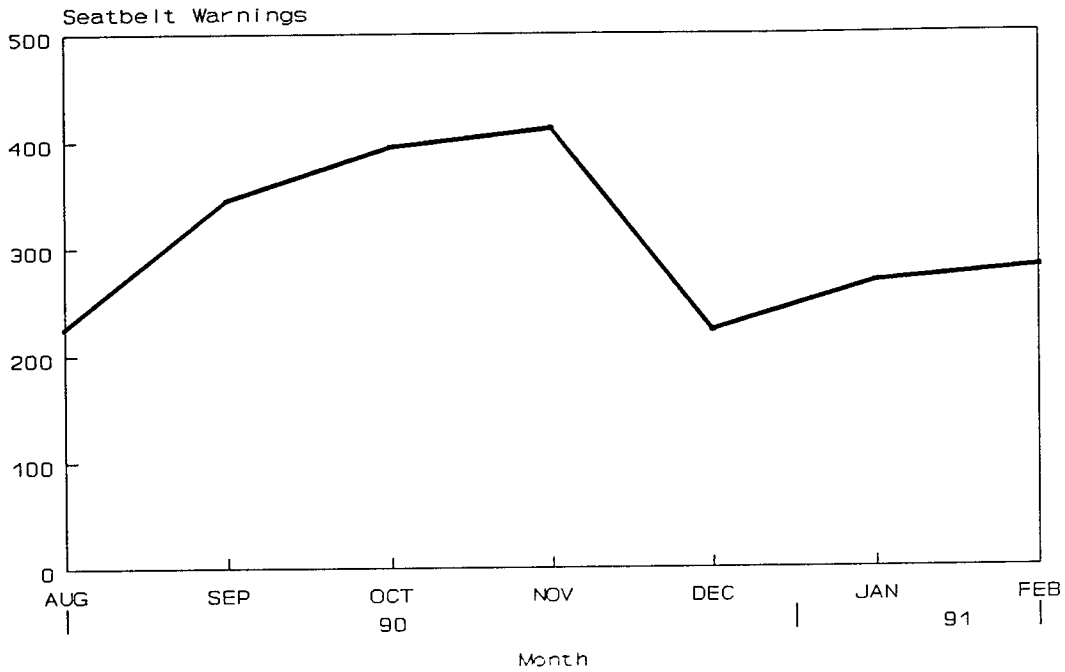


Figure 3: Seatbelt Warnings in Knoxville, August, 1990 - February, 1991



PI&E Activity

Narrative descriptions of PI&E activities are provided above in the descriptions of the various campaigns in Knoxville. Measurable activities were:

- Kickoff events for the various campaigns;
- Participation in TV / radio shows;
- Special events; and
- TV public service announcements.

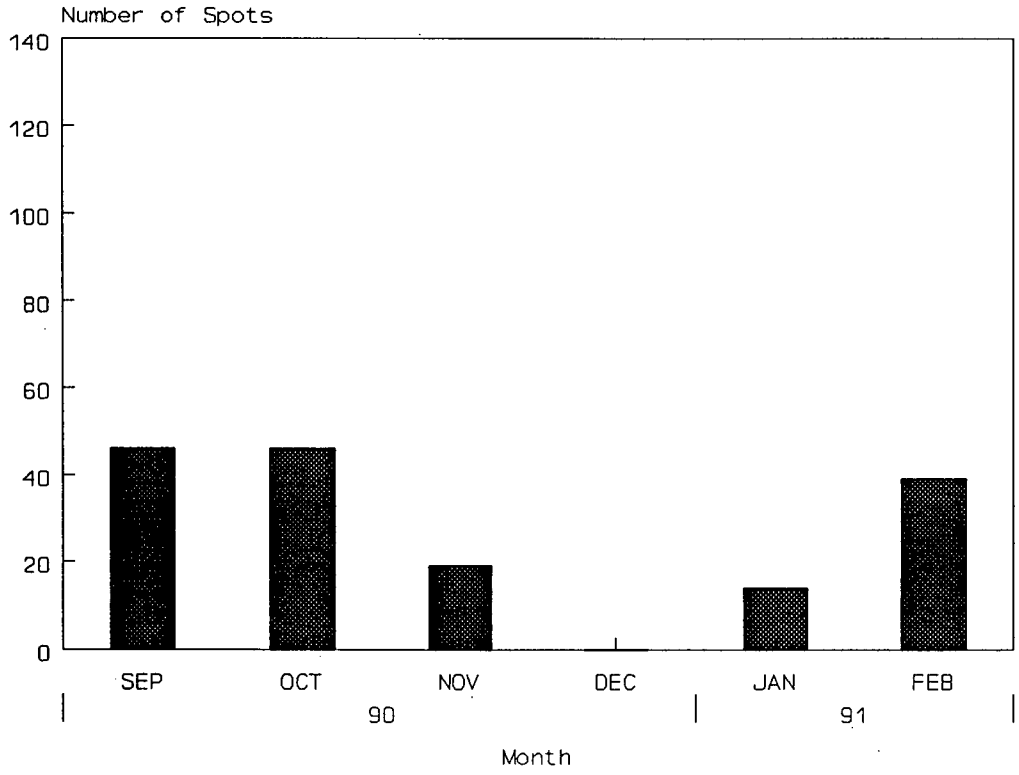
Each campaign had a *kickoff event.* In the period being considered, these occurred in September, 1990; December, 1990; and February, 1991. Several *TV / talk shows* involving local project staff / participants were held. Also, *special events* were held to publicize the program, usually in conjunction with some other topic of general interest. An average of about one special event per month occurred during the project.

Television public service announcements were run by several stations, but the bulk of these (663 spots in total over the entire project period) were played by station WBIR-TV. Figure 4 shows how the number of plays on WBIR-TV varied by month during the first six months of the project.

Clearly, there was a high level of measurable PI&E activity in Knoxville during the first six months of the project. December was the exception for TV spots because of

other demands on time. The Triple Jeopardy theme was mentioned in all pertinent events. No quantitative data were available on Chattanooga's PI&E effort during the project period.

Figure 4: Number of Television Spots Played Station WBIR-TV by Month, Knoxville, September, 1990 - February, 1991



Phasing of Enforcement Activity and PI&E Activity

It was mentioned earlier in this report that the enforcement strategies and the PI&E campaigns in Knoxville were not always in phase, although they were planned to be so. This is illustrated in Table 4. For example, the child safety enforcement effort actually preceded the PI&E effort and was not in effect while the child safety PI&E campaign was underway. Local project staff attribute this to a number of factors, including availability of enforcement personnel, weather conditions, and specific enforcement needs that could not be planned in advance.

Table 4: Phasing of PI&E and Special Enforcement Activities in Knoxville

Activity	Month													
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
PI&E														
Kickoff	■													
Campaign 1 - Sobriety Checkpoints	▬	▬	▬											
Campaign 2 - Saturation Patrols				▬	▬	▬								
Campaign 3 - Interstate, Child Safety						▬	▬							
Campaign 4 - Young Drivers								▬	▬					
Campaign 5 - Blitz										▬	▬	▬	▬	
Enforcement														
Sobriety Checkpoints	■		■					■	■ ▬		■	■		
Saturation Patrols		■	■	▬	■				▬					
Child Restraint Enforcement					▬									
Interstate Highway Speed Enforcement					▬	▬								
I-75 Alive									■		■	▬	▬	

The effect of this problem in phasing is not known, but research suggests that traffic law enforcement programs supported by PI&E are more effective when the enforcement program being operated in the field is strongly and clearly related to the PI&E campaign publicizing that program[3]. Failure to do so may make it more difficult for the target audience of a campaign to relate that campaign to a specific enforcement threat.

Awareness, Perceived Risk of Enforcement, and Self-Reported Behavior

As indicated above, a comparison of survey results in Knoxville and Chattanooga is not possible for the first six months of the project. The second wave of the survey was not conducted in either city until seven months after the Knoxville project began which was about a month after the Chattanooga speed enforcement program began. Changes in survey responses in *Knoxville alone* between the first and second waves are discussed in the EVALUATION II section. The responses indicate a decrease in awareness of DWI and seatbelt messages, and no change in awareness of speeding messages. Perceived enforcement decreased slightly for DWI, increased slightly for speeding, and increased significantly for seatbelt non-use. Self-reported DWI and speeding decreased slightly, and self-reported non-use of seatbelts increased significantly.

Measured Speed

For each session[4], the following speed characteristics were calculated from the individual measurements, separate for the two lanes, if there was more than one lane:

- Average speed
- Average speed of vehicles exceeding the speed limit (average "excess" speed)
- Percentage of vehicles exceeding the speed limit
- Percentage of vehicles exceeding the speed limit by at least 5 mph
- Percentage of vehicles exceeding the speed limit by at least 10 mph

In addition, for each of these measures, its "standard error" was calculated. Note that this is not really an error in the usual sense of the word, but that it is a consequence of the random variation of the actual speeds[5].

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[3] Lacey, LH; Stewart, JR; Marchetti, LM; Popkin, CL; and Murphy, PV. (1986). *Enforcement and public information strategies for DWI (driving while intoxicated) general deterrence: Arrest drunk driving - The Clearwater and Largo, Florida experience.* Washington, DC: National Highway Traffic Safety Administration.

[4] A measurement session is defined as the time period during which a set of measurements were taken at a given location during a given shift.

[5] Standard errors are discussed in more detail in Appendix C.

Average speed is usually of little interest in the context of speed enforcement, if the majority of drivers drive below or near the speed limit. Their travel habits should not be changed by enforcement; thus the effect of reducing the speed of relatively few speeders should have little effect on the average speed. The *average excess speed*, however, should show a greater effect; still, it is heavily influenced by the many vehicles which travel only a little over the speed limit, against which usually no enforcement action is taken. However, a few vehicles with very high speeds can influence this average; if their speeds are dramatically reduced, it could have a noticeable effect on the average excess speed.

The *percentage of drivers exceeding the speed limit* contains a large number which exceed the limit only by a small amount. In this case, it makes no difference even if the highest speeds are dramatically reduced. Therefore, this measure should not be a very sensitive measure of enforcement effects.

The most meaningful measure of speeding for this project is the *percentage of drivers exceeding the speed limit by at least 10 mph.* Since enforcement actions are often taken only when the limit is exceeded by at least 10 mph, this percentage should be the most sensitive measure of the effectiveness of enforcement.

We speculated that traffic density might influence travel speeds. Therefore, some preliminary analyses included the 5-minute vehicle counts as variables. Since no effect of this variable appeared, it was not used in subsequent analyses.

There were usually some, though small, difference in speeds between the lanes at one location. Therefore, most analyses used location/lane combinations as one factor. Because the results differed only little from those combining both lanes, if any, at each location, some analyses used combined data for both lanes. We also found no significant difference was found between the first and second "shift." Therefore, these were later combined into one afternoon period (1 pm - 8 pm).

Our analyses of measured speed used a linear model in which each measure (for example, average speed) was written as a linear function of three independent variables: measurement location, wave, and shift. Some interactions between these independent variables were explored, but were not included in later analyses because they were either not significant, or if marginally significant, seemed to represent only random deviations between model and data.

We analyzed sets of figures showing the coefficients of the wave variable relative to the baseline wave (wave 1). The data for Knoxville and Chattanooga showed that all the measures for the second and third waves did not differ significantly from the baseline. Since the percentage 10 mph or more over the speed limit is the clearest measure of speeding, we paid the most attention to this measure. Figure 5 shows how this measure varied with wave in Knoxville and Chattanooga. The absence of any significant change is apparent.

Figure 5: Change in Percentage of All Vehicles Traveling at 10 mph or More Over the Speed Limit in Knoxville and Chattanooga, September, 1990 - February, 1991

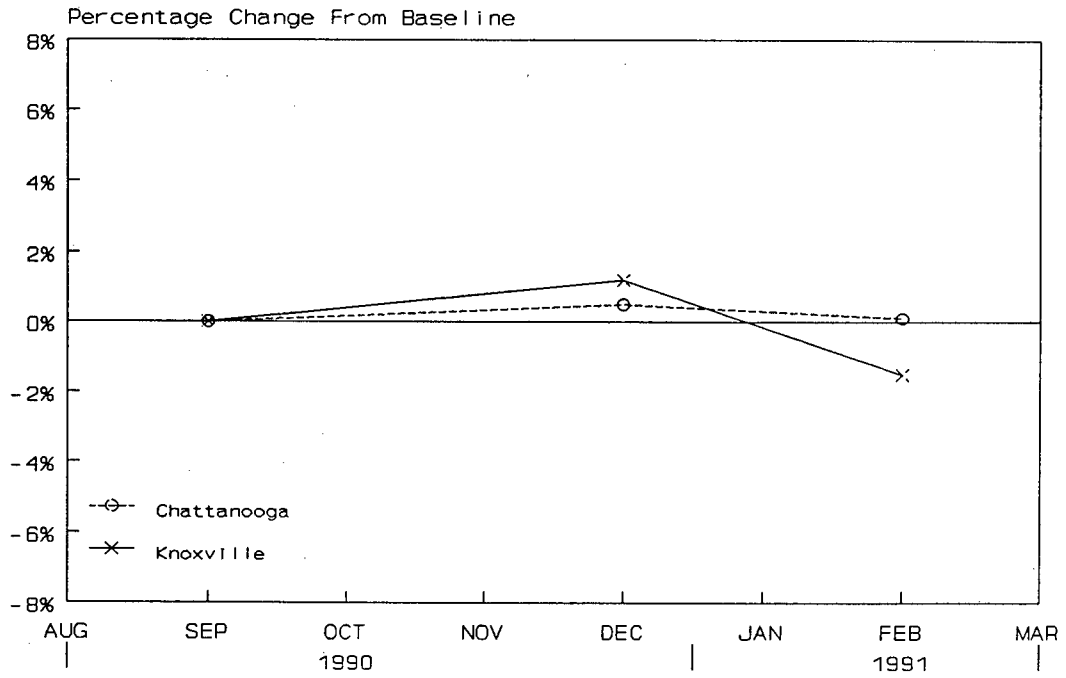
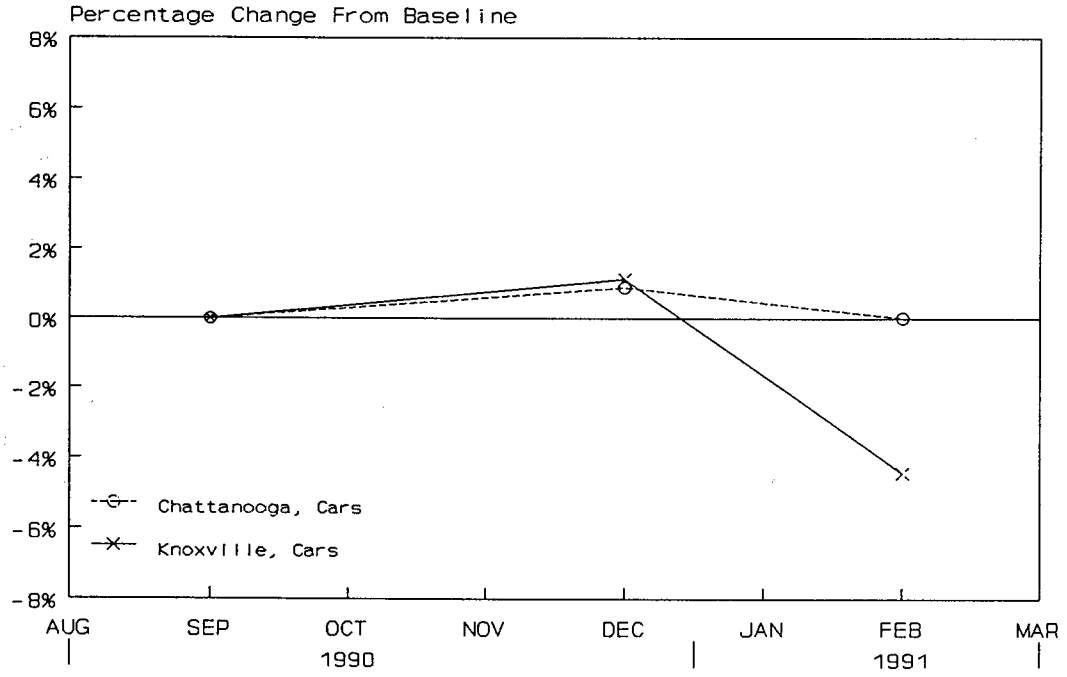


Figure 6: Change in Percentage of Cars Traveling at 10 mph or More Over the Speed Limit in Knoxville and Chattanooga, September, 1990 - February, 1991

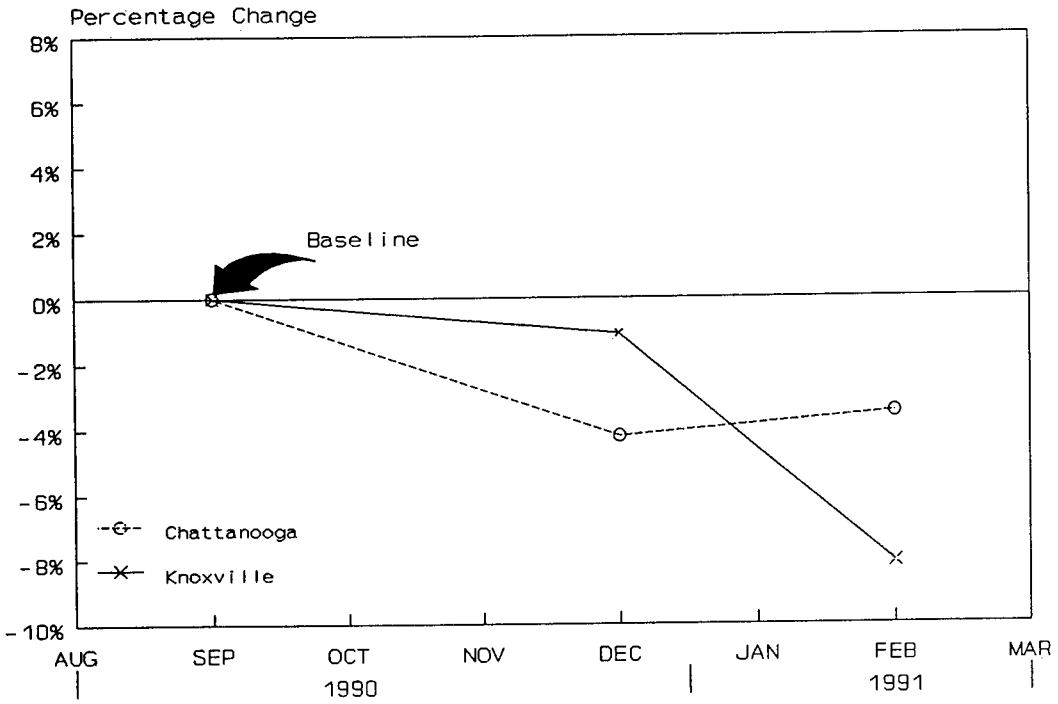


We also examined the speed distributions of passenger cars in Knoxville to see if there might have been an effect on this class of vehicles. The results were similar to those for vehicles of all types for wave 2, but wave 3 (February, 1991) for Knoxville showed a somewhat greater reduction for cars than for vehicles of all types (Figure 6). This reduction for cars (about four percentage points) was statistically significant.

Observed Restraint Usage

The analysis of seatbelt use was similar to the analysis of speeds. Since there were 24 locations in each city, and all observations were made during three hours in the afternoon, no shift factor was included. However, day of week was used, and turned out to be a significant factor. Figure 7 shows the change in usage rates for all adult occupants versus wave for Knoxville and Chattanooga during the first six months of the project. The only recognizable pattern is a small declining trend in both cities, with Knoxville's reduction being about twice that of Chattanooga's at the end of the period. However, the difference between the rate changes in the two sites is not statistically significant.

Figure 7: Change in Percentage of Seatbelt Users in Knoxville and Chattanooga, September, 1990 - February, 1991



Accidents

This section presents a time series analysis of the effect of the project on traffic crash losses during the time when the Chattanooga speed campaign was *not* in effect.

A number of variables that might be related to the various types of behaviors being studied were examined. For *speeding and non-use of seatbelts*, these were:

Number of injury accidents
Number of property damage accidents
Number of occupants with injuries of any kind
Number of nighttime injury accidents
Number of daytime injury accidents
Number of injury single-vehicle accidents
Number of nighttime single-vehicle injury accidents
Number of occupants with minor injuries
Number of occupants with serious or fatal injuries

For *speeding*, we also examined the number of speeding-related accidents (police-reported). For *DWI*, we studied the following variables:

Number of injury accidents
Number of nighttime accidents
Number of nighttime injury accidents
Number of nighttime property damage accidents
Number of alcohol-related accidents (police-reported)
Number of nighttime single-vehicle accidents
Number of injury single-vehicle accidents
Number of nighttime single-vehicle injury accidents

First, we modeled each of the above variables in Knoxville as a function of the same variable in Chattanooga. Our model included a time trend, the difference in unemployment rate in the two cities (to account for possible economic effects), and an intervention variable. *We found no significant effect of the intervention variable on any of dependent variables studied.*

We also studied various ratios separately for each city, using, in effect the denominator as a control. Ratios examined were:

Number of injury accidents / number of accidents of all types
Number of nighttime accidents / number of daytime accidents
Number of nighttime injury accidents / number of daytime injury accidents
Number of alcohol-related accidents / number of accidents of all types
Number of nighttime single-vehicle accidents / number of accidents of all types
Number of nighttime single-vehicle injury accidents / number of accidents of all types
Number of speeding-related accidents / number of accidents of all types

Regression analyses were performed that included a time trend, seasonal effects, unemployment rate (concurrent as well as lagged one month), and the intervention variable in Knoxville. *The analysis showed no significant effect of the Knoxville intervention variable for any of the ratios in either city.*

EVALUATION II - COMBINED ENFORCEMENT VERSUS SINGLE-VIOLATION ENFORCEMENT

Enforcement Activity

The data for the second six months of the project show that DWI arrests in Knoxville increased slightly during the period, from 140 per month initially to about 165 per month at the end of the period (Figure 8).

Speeding citations started out at about 1,700 per month and then remained steady at about 2,000 per month, an increase of about 500 per month over the rate experienced in the first six months of the project (Figure 9). Seatbelt warnings rose from about 150 per month initially to nearly 300 per month in June and July, and then fell back again to about 200 per month (Figure 10).

In Chattanooga, the number of DWI arrests continued essentially unchanged through the period at about 130 per month, *but the number of speeding citations increased by about 67%, from about 1,500 a month initially to an estimated 2,500 a month.* No data were available on the number of seatbelt warnings in Chattanooga.

PI&E Activity

Kickoff events occurred in April, 1991, and June, 1991. TV / talk shows and special events continued at a rate of about two per month.

Television public service announcements continued to be run by several stations. Figure 11 shows how the number of plays on the most active station, WBIR-TV, varied by month during the second six months of the project. The number of plays increased greatly during this period, from a rate of about 35 per month initially to nearly 120 per month in June.

Thus, the high level of PI&E activity in Knoxville continued during the second six months of the project, and the Triple Jeopardy theme was widely used. However, there continued to be a problem in phasing the enforcement effort to coincide with the PI&E effort, but the phasing was better than in the first six months. Again, no quantitative data were available on Chattanooga's PI&E effort.

Awareness, Perceived Risk of Enforcement, and Self-Reported Behavior

All three survey data points are applicable to this comparison. Wave 1 which occurred in early September, 1990, before any intervention at either site may be considered to be the baseline "before" survey. Wave 2 occurred about one month after the Chattanooga speeding campaign had been kicked off on March 1, 1991, and may be considered as a "during" survey. Wave 3 occurred in October, 1991, after the projects at both sites had completed their program and is therefore the "after" survey.

Figure 8: DWI Arrests in Knoxville, March, 1991 - September, 1991

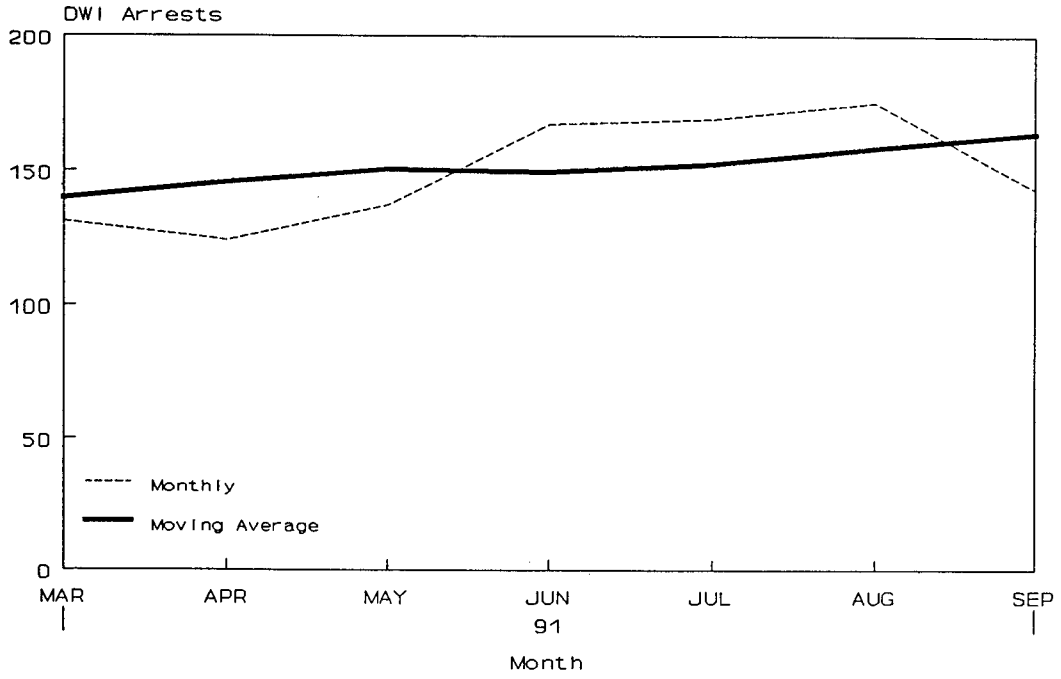


Figure 9: Speeding Citations in Knoxville, March, 1991 - September, 1991

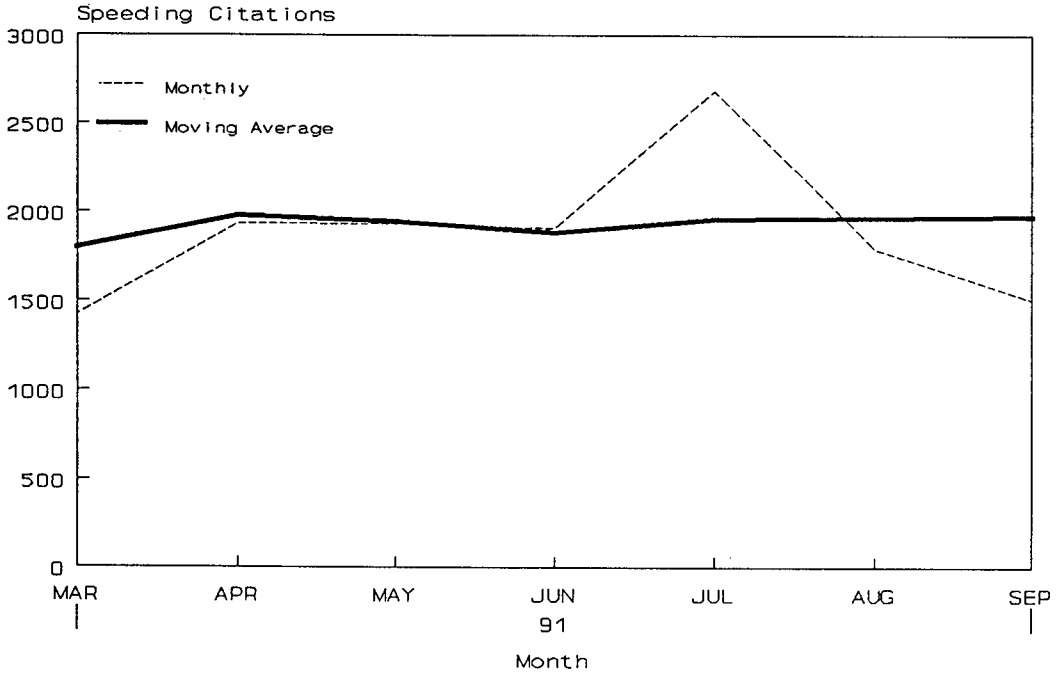
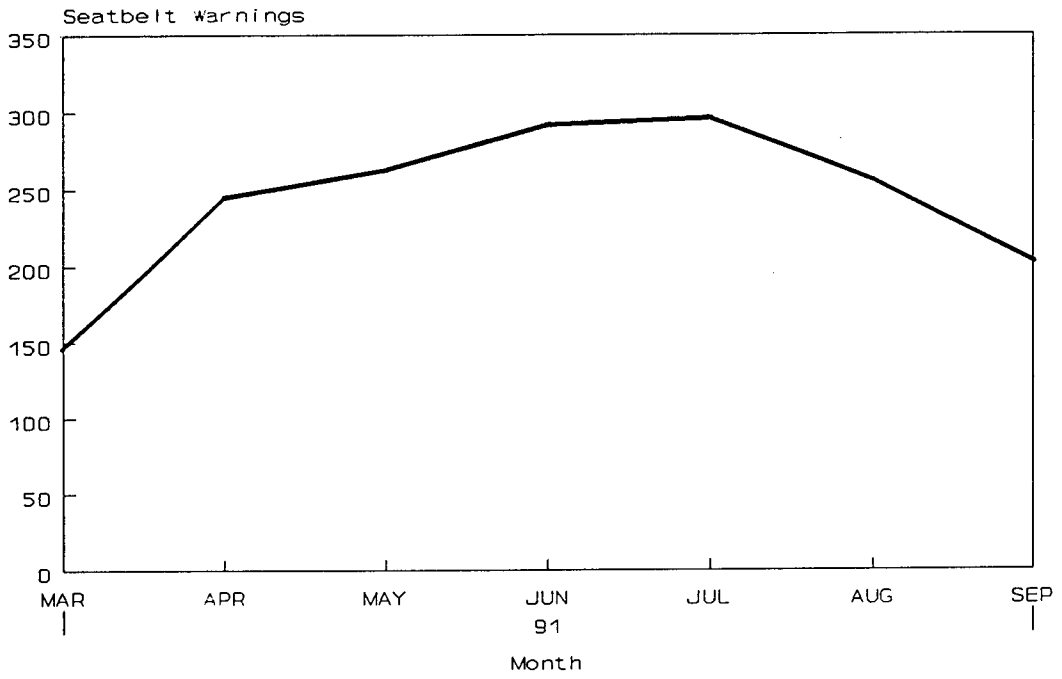


Figure 10: Seatbelt Warnings in Knoxville, March, 1991 - September, 1991

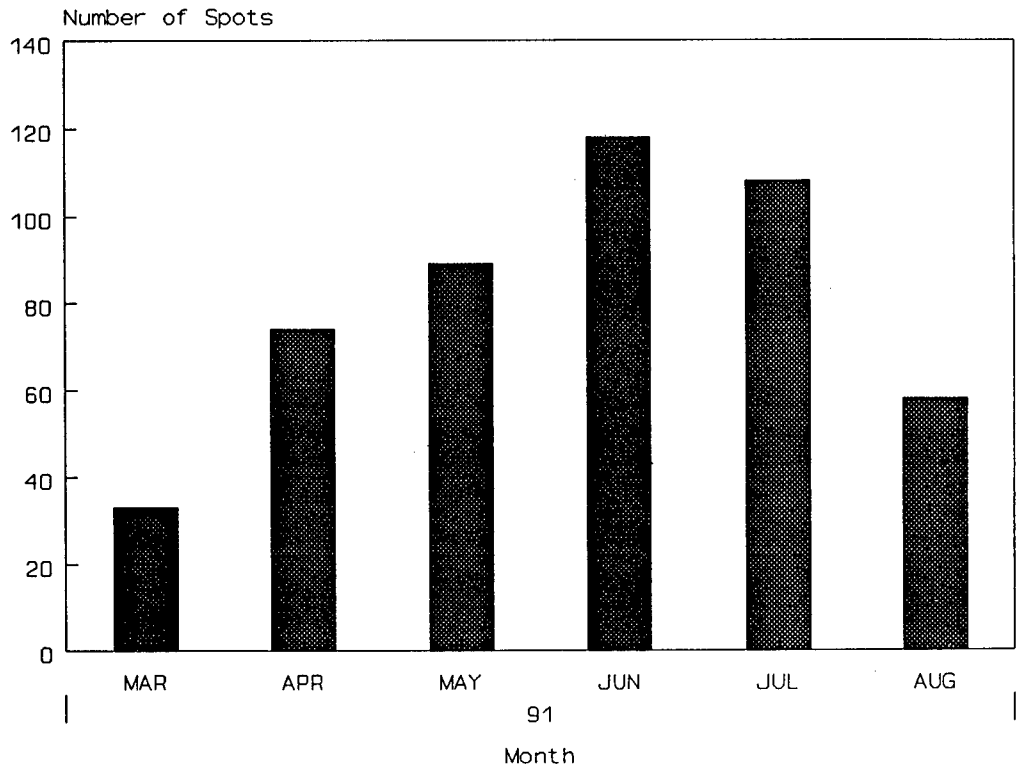


Drinking-Driving. In Knoxville, the percentage of those who had heard a DWI message declined from 49% to 43% to 40% These declines are statistically significant. "Decrease in risk of a DWI getting caught" increased very significantly from 2% in the first wave to 7% in the second wave and 5% in the third wave; and "increase in risk of a DWI getting caught" increased marginally significantly from 51% in the first wave to 57% in the second wave and 60% in the third wave. Thus, there is no consistent picture. Responses "yes" to *increased drunk driving enforcement* declined significantly from 50% in the first wave to 45% in the second wave and then went up again to 52% in the third wave.

The *frequency of drinking-driving* showed a strong pattern in Knoxville. "Never" dropped very significantly from 91% in the first wave to 80% in the second wave, and all categories of drinking-driving increased, sometimes very significantly. In the third wave, "never" went up again to 89%, only marginally less than the initial value. *Change in drinking driving* showed a similar pattern, but there were too few reporting "more often" to allow a comparison. There was no significant change in "less often" and a significant increase in "about the same" from 7% in the first wave to 12% in the second wave, and back to 6% in the third wave. The percentage "do not drive after drinking" dropped very significantly from 86% in the first wave to 77% in the second wave, and went back to 87% in the third wave.

In Chattanooga, there was no change between the first two waves with respect to those who had heard a DWI message, but a significant increase from 36% to 43%

Figure 11: Number of Television Spots Played by Knoxville Station WBIR-TV by Month, March, 1991 - August, 1991



during the third wave. "Decrease in risk of a DWI getting caught" showed only a small (from 4% to 5%, and back to 4%) but significant change. *Increased drunk driving enforcement*, showed a very significant drop of "yes" from 55% to 43%, and a return to 49%, which is still significantly lower than 55%. The responses to these two questions were reasonably consistent.

The frequencies of responses to *frequency of drinking-driving* show no overall pattern of changes in Chattanooga, though some of the individual categories have significant or marginally significant changes. Similarly, the responses to *change in frequency of drinking-driving* show no change of pattern.

In sum, Chattanooga shows what one would expect, no change in drinking and driving, even if the perception of DWI enforcement declined. In Knoxville, there was a significant decline in DWI message recollection. There was also no perception of increased enforcement in Knoxville, and no indication of a drop in drunk driving.

Table 5 summarizes these results with respect to changes in awareness, perceived enforcement, and self-reported behavior in Knoxville and Chattanooga. The two columns labeled "Change in %" show the changes in percentage from wave 1 to wave 2 (W2-W1), and from wave 1 to wave 3 (W3-W1). The last two columns of the table show the differences in these changes between Knoxville and Chattanooga.

Table 5: Summary of Survey Results in Knoxville and Chattanooga - DWI

Measure	Site	Wave 1 %	Wave 2 %	Wave 3 %	Change in %		Difference in % Change[1]	
					W2-W1	W3-W1	W2-W1	W3-W1
Awareness of DWI Messages	Knoxville	48.8	42.6	40.0	-6.2	-8.8	-7.7	-14.3
	Chattanooga	35.6	34.1	41.1	+1.5	+5.5		
Belief that DWI Enforcement Increased	Knoxville	50.4	45.4	52.1	-5.0	+1.7	-2.9	+7.5
	Chattanooga	54.8	42.7	49.0	-2.1	-5.8		
Belief that Risk of a DWI Getting Caught Increased[2]	Knoxville	53.6	49.5	54.0	-4.1	+0.4	-1.2	+1.8
	Chattanooga	54.2	51.2	52.8	-2.9	-1.4		
Never Drink & Drive[3]	Knoxville	90.6	79.7	89.1	-10.9	-1.5	-9.5	-0.5
	Chattanooga	90.3	88.9	89.3	-1.4	-1.0		
Drinking-Driving Decreased[4]	Knoxville	7.2	9.6	6.3	+2.9	-0.9	+1.6	-2.5
	Chattanooga	5.6	6.9	7.2	+1.3	+1.6		

[1] Net % change for Knoxville minus net % change for Chattanooga

[2] Net increase is shown and is equal to % reporting risk increased minus % reporting risk decreased

[3] Response to question on drinking-driving frequency

[4] Net decrease is shown and is equal to % reporting drinking-driving decreased minus % reporting drinking-driving increased

The table indicates the clear (and statistically significant) decrease in reported awareness of DWI messages in Knoxville compared to reported awareness of DWI messages in Chattanooga. This difference is clear after wave 2 and even more pronounced after wave 3. The very small changes in perceived DWI enforcement in Knoxville compared to perceived enforcement of DWI in Chattanooga was not statistically significant. The same was true for self-reported drinking-driving in Knoxville compared to drinking-driving in Chattanooga: the relative changes shown in the table were not significant.

Speeding. In Knoxville, there was no significant change in the percentage of respondents reporting a speed message. Only about 3% recalled a speeding message in any of the three waves.

Knoxville showed a very significant increase in "increase in risk of a speeder getting caught" from 46% in the first wave to 52% in the second wave and remaining there in the third wave. The response "decrease in risk of a speeder getting caught" increased, also significantly, from 3% to 6%, then dropped to 4%, which is still significantly higher than the initial level. Though there is some contradiction, the increases by far exceeded the decreases. Contrary to this, however, responses "yes" to *increased speeding enforcement* showed essentially no change, not even a non-significant one.

Responses to *change in speeding* in Knoxville showed no changes between the first two waves. However, there was a small but significant increase in "more often" from wave two to wave three (1.8% to 2.7%) and a small significant decrease "about the same" from wave two to wave three (39% to 46%).

In Chattanooga, the percentage of respondents reporting speed messages increased dramatically and very significantly from 3% in the first wave to 7% in the second wave, and then dropped to 2% in the third wave.

"Increase in risk of a speeder getting caught" increased dramatically in Chattanooga from 36% in the first wave to 67% in the second wave, and then dropped to 56% in the third wave, still much higher than initially. "Decrease in risk of a speeder getting caught" remained essentially unchanged at 6%, 5%, and 5% in the first, second, and third waves, respectively. Responses "yes" to *increased speeding enforcement* increased very dramatically from 36% in the first wave to 67% in the second wave and then dropped to 59% in the third wave.

The very few Chattanooga respondents who reported "more often" in response to *change in speeding* (1.7%) dropped during the second wave (0.7%), but rebounded in the third wave (1.4%). However, there was a very clear effect in the response "less often," which increased from 17% in the first wave to 25% in the second wave, and was still 21% in the last wave. These very significant changes were primarily at the expense of the "about the same" response.

In sum, there was an increase in reporting messages about speeding in Chattanooga, much more than in Knoxville, but initially at the same low level, and finally dropping to a lower level than in Knoxville. There was a much greater increase in "increase in risk of a speeder getting caught" in Chattanooga than in Knoxville, and responses "yes" to *increased speeding enforcement* showed an dramatic increase in Chattanooga, versus no change in Knoxville. Despite the much greater increase in perceived enforcement in Chattanooga, self-reported speeding changes followed essentially the same pattern in Knoxville as in Chattanooga.

A summary of the results of the survey with respect to speeding in Knoxville and Chattanooga over the project period in presented in Table 6. The table indicates the no significant change in reported awareness of speeding messages in Knoxville compared to reported awareness of speeding messages in Chattanooga. As indicated above, a large decrease in the awareness of speeding messages in Knoxville relative

to awareness in Chattanooga did occur from the first wave to the second wave. The very large *decrease* in perceived speeding enforcement in Knoxville compared to perceived enforcement of speeding in Chattanooga (about 20 to 30%) was statistically significant. Knoxville also fared slightly worse than Chattanooga with respect to self-reported speeding.

Table 6: Summary of Survey Results in Knoxville and Chattanooga - Speeding

Measure	Site	Wave 1 %	Wave 2 %	Wave 3 %	Change in %		Difference in % Change[1]	
					W2-W1	W3-W1	W2-W1	W3-W1
Awareness of Speeding Messages	Knoxville	2.8	2.7	3.7	-0.1	+0.9	-5.0	+1.7
	Chattanooga	2.5	7.4	1.7	+4.9	-0.8		
Belief that Speeding Enforcement Increased	Knoxville	47.5	46.7	48.7	-0.8	+1.2	-32.2	-22.0
	Chattanooga	35.7	67.1	58.9	+31.4	+23.2		
Belief that Risk of a Speeder Getting Caught Increased[2]	Knoxville	42.4	46.5	48.8	+4.1	+6.4	-27.9	-19.5
	Chattanooga	30.4	62.4	56.3	+32.0	+25.9		
Self-Reported Speeding Decreased[3]	Knoxville	18.0	21.5	16.8	+3.5	-1.2	-5.0	-5.6
	Chattanooga	15.4	23.9	19.8	+8.5	+4.4		

[1] Net % change for Knoxville minus net % change for Chattanooga

[2] Net increase is shown and is equal to % reporting risk increased minus % reporting risk decreased

[3] Net decrease is shown and is equal to % reporting speeding decreased minus % reporting speeding increased

Seatbelt Use. In Knoxville there was a very significant drop in the awareness of seatbelt messages from 37% in the first wave to 29% in the second wave, and a rebound to 32% in the third wave, still significantly lower than the initial value.

Nevertheless, "increase in risk of getting caught for not using a seatbelt" was very significantly higher in Knoxville, increasing from 24% in the first wave to 34% in the second wave, and 31% in the third wave. "Yes" responses to *increased seatbelt enforcement* increased very significantly from 19% in the first two waves to 24% in the third wave. Self-reported seatbelt use showed some individually significant changes, but no clear pattern of changes.

In Chattanooga, awareness of seatbelt messages showed a significant increase to 30% from 28% in the first two waves to 32% in the third wave.

"Decrease in risk of getting caught for not using a seatbelt" in Chattanooga showed no change, but "increase in risk of getting caught for not using a seatbelt" dropped significantly from 24% to in the first wave to 17% in the second wave, and then returned to 26% in the third wave. There was also a very significant drop of "yes" in response to *increased seatbelt enforcement* from 18% in the first wave to 11% in the second wave, and a return to 15% in the third wave. Fitting this pattern, responses "more often" to *change in seatbelt use* dropped significantly from 21% in the first wave to 18% in the second wave, and went back to 21% in the third wave. "Less often" responses to this question increased from 2.5% in first wave to 4% in the second wave and remained there.

The results of the survey with respect to seatbelt use are summarized in Table 7. The table indicates the clear and significant increase in perceived enforcement of seatbelt non-use in Knoxville in relation to that in Chattanooga, *despite a significant relative decrease in awareness of seatbelt messages in Knoxville*. The highest increase in perceived enforcement in Knoxville relative that in Chattanooga was in wave 2 which occurred in March, 1991, toward the end of the child-safety PI&E campaign in Knoxville. The table indicates no significant change in self-reported seatbelt use in Knoxville relative to that in Chattanooga.

Measured Speed

Speed measurement waves four through seven were included in this period. Again, we analyzed sets of figures showing the coefficients of the wave variable relative to the baseline wave (wave one). For Knoxville, results for the sixth wave showed that all measures of speed were higher than their baseline value, sometimes much higher and very significantly so. However, at the seventh wave, all measures were very significantly lower than at the first. Waves four and five showed a mixed pattern. Average speed showed no significant differences, but an increasing trend. The percentage of speeders showed a similar, but stronger trend, and a significant increase; the percentage five mph over the limit showed a similar, but weaker pattern. Decreases were suggested in the excess speed, but not significantly so, and in the percentage 10 mph over, and for the fourth wave. If one excludes the single location with a 30 mph limit, the pattern for the percentage 10 mph over becomes stronger: the percentage below the baseline for the fourth and fifth wave are significantly below the baseline. However, we found no defensible reason for excluding that location.

The only certain conclusions for Knoxville are that wave six had higher values than the baseline, and wave seven had much lower values.

In contrast, Chattanooga showed a very clear picture: waves four to seven (when the speed enforcement campaign was in effect) had lower, sometimes very significantly lower, values on all measures.

Table 7: Summary of Survey Results in Knoxville and Chattanooga - Seatbelt Use

Measure	Site	Wave 1 %	Wave 2 %	Wave 3 %	Change in %		Difference in % Change[1]	
					W2-W1	W3-W1	W2-W1	W3-W1
Awareness of Seatbelt Messages	Knoxville	37.4	29.3	32.0	-8.1	-5.4	-7.8	-9.0
	Chattanooga	28.0	27.7	31.6	-0.3	+3.6		
Belief that Seatbelt Enforcement Increased	Knoxville	18.2	19.3	24.0	+1.1	+6.2	+7.7	+8.7
	Chattanooga	17.8	11.3	15.3	-6.5	-2.5		
Belief that Risk of Getting Caught for Not Using a Seatbelt Increased[2]	Knoxville	18.0	27.3	24.1	+9.3	+6.1	+16.4	+6.1
	Chattanooga	16.1	9.0	16.1	-7.1	+0.0		
Self-Reported Use of a Seatbelt Increased[3]	Knoxville	16.5	10.3	18.9	-6.2	+2.4	-1.6	+3.2
	Chattanooga	18.1	13.5	17.3	-4.6	-0.8		

[1] Net % change for Knoxville minus net % change for Chattanooga

[2] Net increase is shown and is equal to % reporting risk increased minus % reporting risk decreased

[3] Net increase is shown and is equal to % reporting use increased minus % reporting use decreased

Figure 12 illustrates the above results for the percentage of vehicles of all types traveling 10 mph or more over the speed limit. Figure 13 shows the percentage of *passenger cars* more than 10 mph over the speed limit. The general pattern for passenger cars is the same as it was for vehicles of all types, except that the Knoxville data are displaced downward slightly. The reduction for passenger cars in Knoxville in the seventh wave was statistically significant.

Observed Restraint Usage

Figure 14 shows the usage rates for all adult occupants versus wave for Knoxville and Chattanooga. At the seventh wave (Late October and early November), the change in usage rate was practically the same in both sites.

Figure 12: Change in Percentage of All Vehicles Traveling at 10 mph or More Over the Speed Limit in Knoxville and Chattanooga, March 1991 - November, 1991

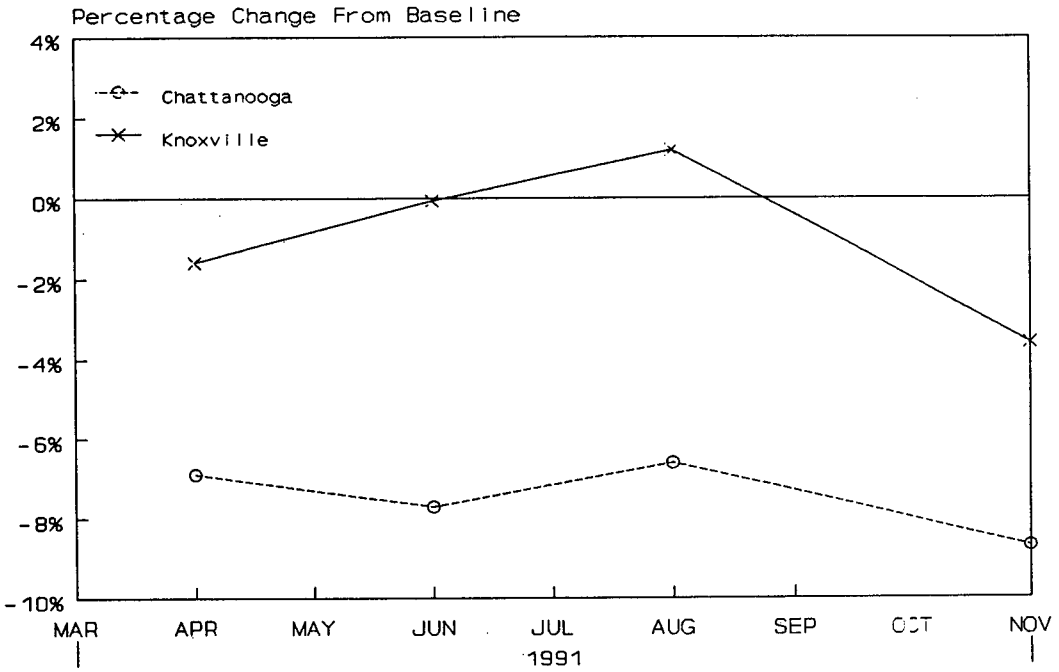


Figure 13: Change in Percentage of Cars Traveling at 10 mph or More Over the Speed Limit in Knoxville and Chattanooga, March, 1991 - November 1991

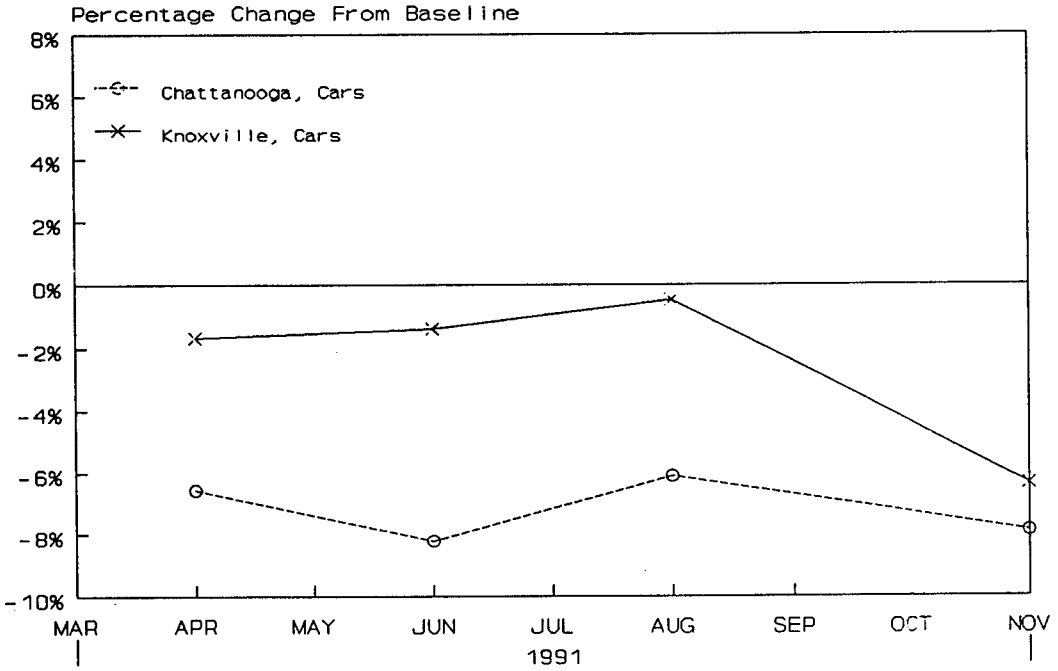
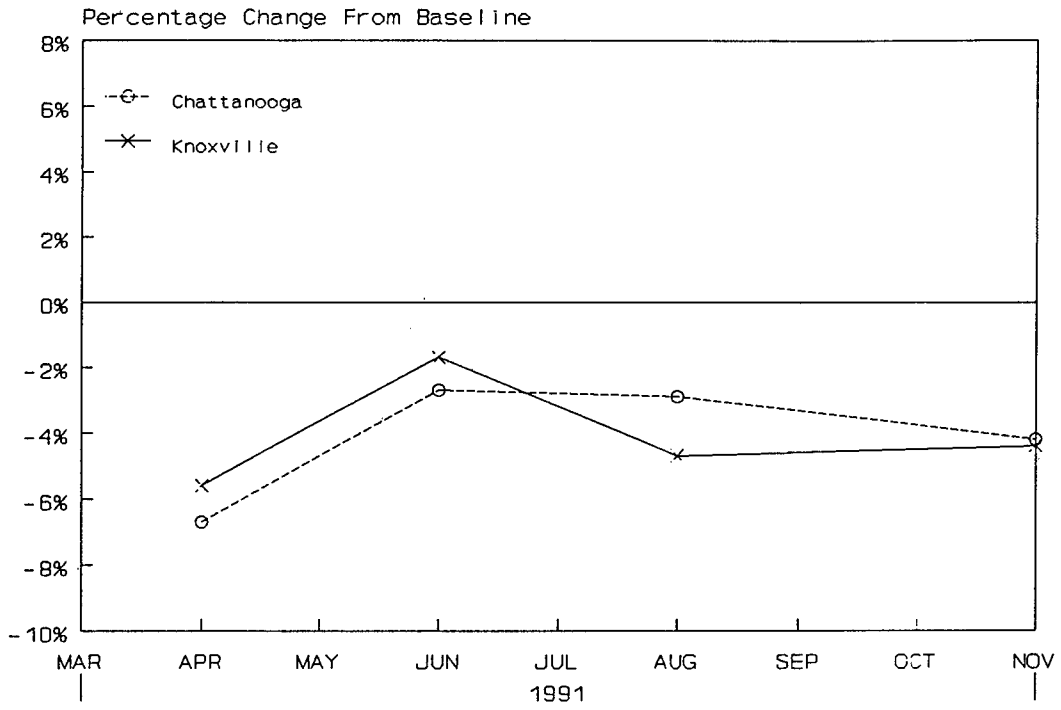


Figure 14: Change in Percentage of Seatbelt Users in Knoxville and Chattanooga, March, 1991 - November, 1991



Accidents

The analysis of Knoxville accident data indicated no significant changes in any of the variables or ratios defined above to measure the program's effect on speeding, seatbelt use, and DWI. The analysis Chattanooga accident data found that the only significant effect of its speeding campaign (p=.07) was on the ratio of number of injury accidents to number of accidents of all types.[6] This is most likely due to the lower speeds that were observed in Chattanooga, since there was no increase in seatbelt use. The intervention reduced this ratio by .022 (average value = .271), which is about 8%. To make sure that this was not a spurious effect due to a reduction in all accidents, without a change in injury accidents, these were also analyzed separately. All accidents showed a non-significant increase of 7 (compared with an average of 821), and injury accidents a reduction of 17 (compared with an average of 227), which is 7%, not quite significant at 20%. This supports the hypothesis that the effect of the intervention on the ratio is indeed due to a reduction in injury accidents alone.

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[6] Another injury-related ratio, the number of minor injuries plus serious injuries divided by the number of all accidents, showed a similar effect, but at a lower level of significance (p=0.11).

Figure 15: Ratio of Injury Accidents to All Accidents, Chattanooga

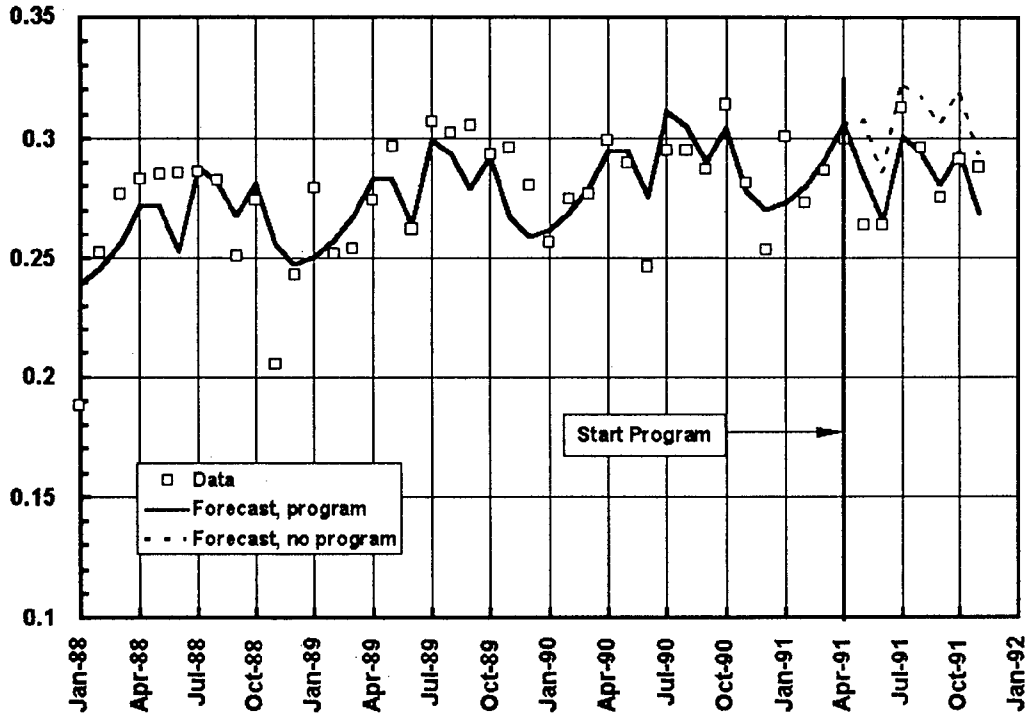


Figure 15 compares the model for the ratio of number of injury accidents to number of accidents of all types with the data before and after the intervention. The figure illustrates the abrupt drop in this ratio shortly after the intervention.

SYNTHESIS AND INTERPRETATION OF RESULTS

By comparing the first six months of data from Knoxville with data from the first six months of Chattanooga, the effect of the Knoxville combined-enforcement program *relative to the Chattanooga nominal-enforcement effort* was estimated. The data showed essentially no change in various measures of speeding in either site during this period: neither Knoxville's combined enforcement program nor Chattanooga's nominal enforcement effort had any measurable effect on speeding. There was also no measurable change in seatbelt use at either site, nor in accidents that might be related to speeding, DWI, or seatbelt use. Only one survey wave was conducted during this period, so only the field measurements of speed and seatbelt use were of concern in analyzing *relative* changes in driving behavior from the pre-project baselines. Survey responses in *Knoxville alone* during the first six months of the project indicated a decrease in awareness of DWI and seatbelt messages, and no change in awareness of speeding messages.

We also estimated the effect of the Knoxville combined-enforcement program relative to the *Chattanooga single-violation enforcement effort*. This was accomplished by comparing the second six months of data from Knoxville with the second six months of data from Chattanooga. The speed-measurement data showed that the

percentage of vehicles exceeding the speed limit by at least 10 mph in Knoxville increased slightly and then dropped after the Knoxville project period. Meanwhile, the percentage of vehicles exceeding the speed limit by at least 10 mph in Chattanooga dropped sharply shortly after the start of its speeding enforcement campaign. This effect was maintained throughout the Chattanooga campaign and continued on beyond the campaign for another two months when data collection ceased. The Knoxville changes were not statistically significant, but the Chattanooga changes were.

Separate analyses of of the percentage of *passenger cars* exceeding the speed limit by at least 10 mph revealed similar relationships, except that figure for Knoxville *in the seventh and last wave* of measurements dropped about six percentage points below its baseline value. This reduction was statistically significant, but was of insufficient duration to attribute to the Triple Jeopardy program. By contrast, Chattanooga experienced a statistically significant drop of about six to eight percentage points *throughout its speeding campaign.*

Again, there was no measurable difference in seatbelt use or in accidents related to seatbelt use at the two sites during the second six months of the project. Also, there was no significant change in self-reported incidence of drinking-driving or in alcohol-related accidents at either site.

The survey data support the hypothesis that the relative decrease of speeding in Chattanooga was due to its speeding enforcement campaign. Perceived enforcement of speeding in Chattanooga was some 20 to 30 percentage points higher than in Knoxville. The survey data also indicated that Knoxville's combined-enforcement program had little or no effect on awareness and self-reported behavior with respect to any of the three target violations. By contrast, the single-strategy program in Chattanooga which concentrated on speeding had a significant positive effect on awareness of *speeding* messages and self-reported speeding. These positive effects in Chattanooga were achieved with no apparent negative effect on the perceived enforcement or self-reported behavior with respect to DWI or seatbelt use.

An analysis of accident data in Chattanooga also suggests that the speeding reductions measured there had a positive significant effect on speeding-related accidents. *The percentage of all accidents in which there was one or more injuries decreased by about 8% shortly after the speeding campaign began.* Since there was no increase in seatbelt use in Chattanooga, it is logical to attribute this reduction to the reduction in speeding.

The factors that were responsible for these differences in outcome between the two sites are less clear, but some insights may be gained from Table 8. First, the Knoxville program mounted a significant PI&E effort emphasizing the combined enforcement concept. However, Knoxville's enforcement effort did not always focus on the enforcement strategy being stressed in a given PI&E campaign. Chattanooga also fielded a significant PI&E effort, but concentrated on speeding alone and backed it up with a large-scale speed-enforcement effort. Chattanooga's enforcement effort was made possible by a substantial increase in funds to pay for police overtime.

Table 8: Summary of Project Activity and Outcome in Knoxville and Chattanooga With Respect to Speeding

Item	Project Phase	
	First Six Months	2nd Six Months
Knoxville		
Activity		
Enforcement Level	No change	No change
PI&E	Large increase	Large increase
Outcome		
Awareness	No change	No change
Perceived Enforcement Risk	Small increase	Small increase
Self-Reported Speeding	No change	No change
Measured Speeding	No change	No change
Accidents	No change	No change
Chattanooga		
Activity		
Enforcement	No change	Large increase
PI&E	No change	Large increase
Outcome		
Awareness	No change	Large increase
Perceived Enforcement	No change	Large increase
Self-Reported Speeding	Small decrease	Decrease
Measured Speeding	No change	Decrease
Accidents	No change	Decrease

Clearly, the major difference between Chattanooga's effective program and Knoxville's ineffective program was that Chattanooga used a single-violation enforcement approach and heavily-increased enforcement, and Knoxville used a combined-enforcement approach with no increase in enforcement intensity. At this point, it cannot be said whether the single-violation approach or the increase in enforcement was responsible for the effectiveness of Chattanooga's program. Possibly, both factors were involved.

5 - CONCLUSIONS

The major conclusions of the Knoxville field test are:

1. *Knoxville's combined-enforcement program*

   a) was neither less effective nor more effective against any of the target violations and related crashes than was its prior enforcement program;
   b) was neither less effective nor more effective against any of the target violations and related crashes than was Chattanooga's nominal-enforcement program; and
   c) was less effective against speeding and related crashes than was Chattanooga's single-violation speeding program.

2. *Chattanooga's single-violation speeding program*

   a) was more effective against speeding and related crashes than was its prior nominal enforcement program; and
   b) achieved its positive effects against speeding with no apparent negative effects on perceived enforcement or self-reported behavior with respect to DWI or seatbelt use. There were also no negative effects on observed use of seatbelts.

The Knoxville project was based on a design concept requiring:

- use of high-intensity, combined-enforcement strategies incorporating both new and traditional techniques; and

- heavy use of public information and education tailored to match each of the combined-enforcement strategies.

As implemented, the Knoxville project employed combined-enforcement strategies but was not accompanied by an increase in enforcement intensity (as measured by number of citations and number of officers assigned to enforce the target violation). Also, while the project did include a comprehensive PI&E campaign, the phasing of that campaign did not coincide with the phasing of the various combined enforcement strategies. *Therefore, the basic requirements of the combined-enforcement concept were only partially met in Knoxville.* By contrast, Chattanooga's single-violation enforcement approach was supported by heavily-increased enforcement intensity and by a PI&E campaign that coincided with the enforcement effort.

Thus, Knoxville's project differed from Chattanooga's project not only in the use or non-use of combined enforcement, but also in the way in which those two enforcement approaches were executed. Therefore, it cannot be said that the reason for Knoxville's lack of success and for Chattanooga's success was that Knoxville used combined enforcement and Chattanooga used single-violation enforcement.

If the combined-enforcement approach was responsible or partly responsible for Knoxville's lack of success, then it could be because efforts targeted at multiple unsafe Knoxville's driving behaviors diluted Knoxville's enforcement effort and made it more difficult for the public to grasp the combined-enforcement concept. Messages aimed at several unsafe driving behaviors are inherently more complex and thus more difficult to publicize and to capture hard news coverage. Public awareness of combined-enforcement messages may have become clouded and the enforcement effort diluted in trying to maintain a high level of enforcement for three violations at once instead of just one. This might have resulted in a perception of "business as usual" by the Knoxville public.

If the lack of increased enforcement intensity played a significant role in the results of the Knoxville project, then additional support is provided for the findings of some prior research that PI&E campaigns with enforcement themes should be backed up by a credible enforcement threat. Knoxville mounted an impressive PI&E campaign, but did not increase its enforcement of the target violations. A combined-enforcement approach may require a large increase in enforcement intensity to be effective. Conceivably, a combined-enforcement approach with increased enforcement intensity could be even more effective than a single-violation approach with an equivalent increase in enforcement intensity. Results from the other two field tests being conducted under this project should shed more light on the relative role of enforcement approach and enforcement intensity in the effectiveness of this kind of traffic law enforcement program.

APPENDIX A - PI&E MATERIALS

Triple Jeopardy

Speeding, Drunk Driving & Belt Use

In Knoxville, if you're stopped for 1, you're checked for all 3.

Triple Jeopardy

A Traffic Safety Program of the Knoxville Police Department

Triple Jeopardy

Speeding, Drunk Driving & Belt Use

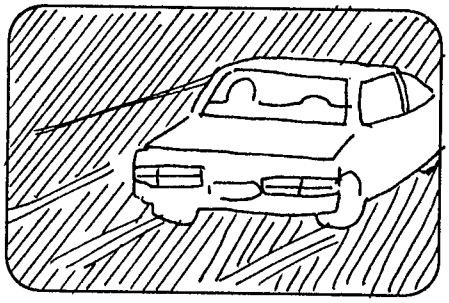
In Knoxville, if you're stopped for 1, you're checked for all 3.

Triple Jeopardy

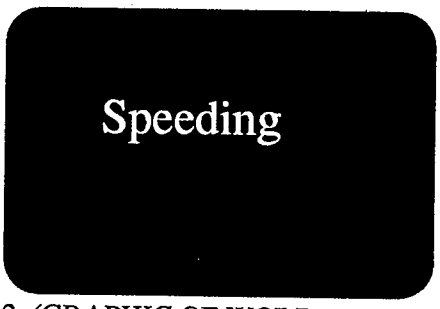
A Traffic Safety Program of the Knoxville Police Department

Figure 6. Bus Posters.

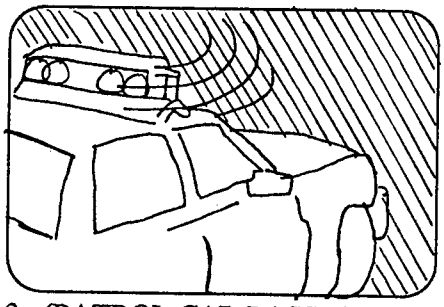
:30 PSA Triple Jeopardy



1. (NIGHTTIME SCENE. CAR SPEEDS BY CAMERA.)

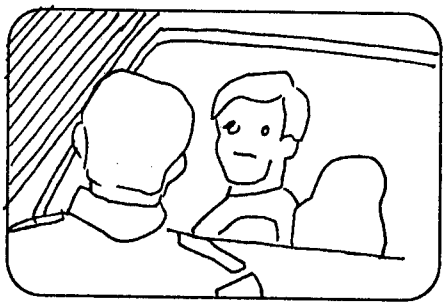


2. (GRAPHIC OF WORD SPEEDING.)



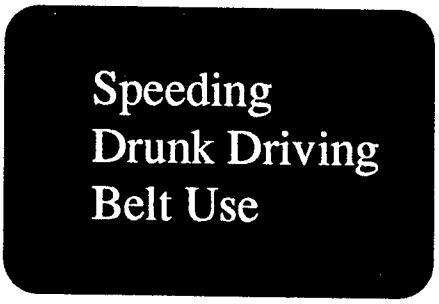
3. (PATROL CAR PASSES BY CAMERA WITH BLUE LIGHT FLASHING.)

VO: In Knoxville, speeders are playing Triple Jeopardy.



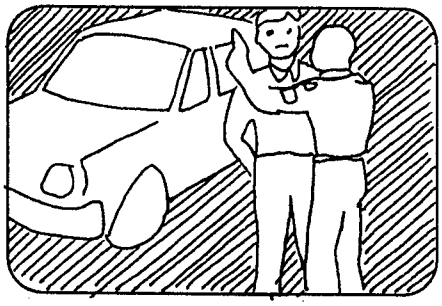
4. (OFFICER GETTING LICENSE FROM MOTORIST.)

VO: Because anyone stopped for speeding. . . .



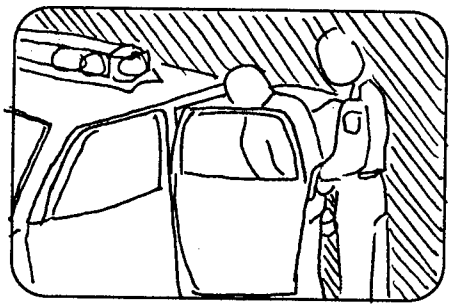
5. (GRAPHIC OF THE WORD SPEEDING, FOLLOWED BY ADDITION OF THE WORD DRUNK DRIVING, THEN BELT USE.)

VO: . . . will be observed for drunk driving and belt use.



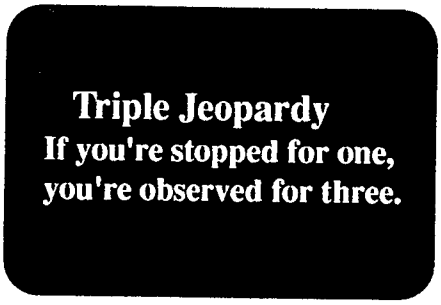
6. (OFFICER GIVING GAZE NYSTAGMUS TEST.)

VO: Don't play Triple Jeopardy. Slow down. Put a sober driver behind the wheel. And buckle up.



7. (OFFICER ARRESTING DRIVER.)

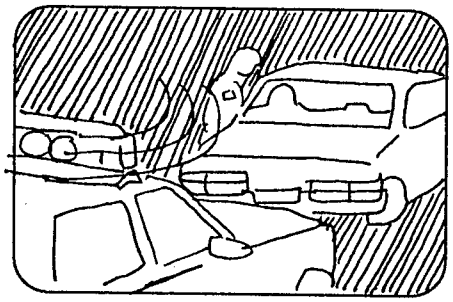
VO: Because if you're stopped for one, you're observed for all three.



8. (GRAPHIC OF TRIPLE JEOPARDY)

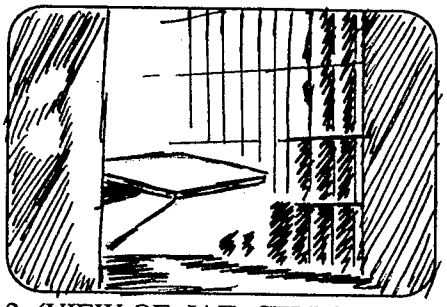
TV STATION TAG LINE.

:30 PSA Reservations



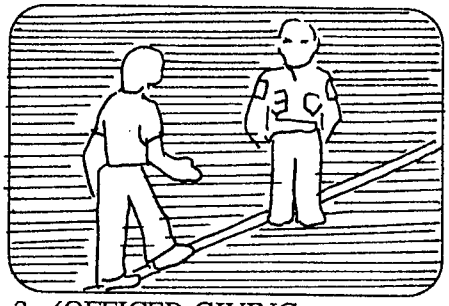
1. (NIGHTTIME SCENE. OFFICER TALKING TO DRIVER.)

VO: Have you made your reservations for the Knoxville Jail?



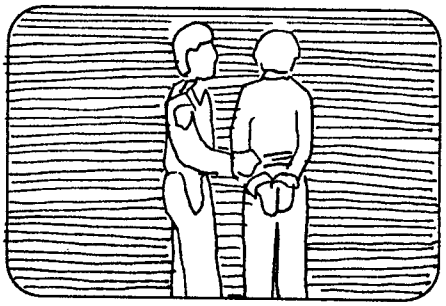
2. (VIEW OF JAIL CELL.)

VO: We offer secure rooms and the opportunity to meet interesting and unusual people.



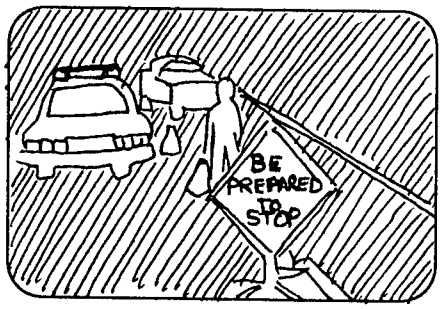
3. (OFFICER GIVING SOBRIETY TEST.)

VO: To qualify, all you have to do is drink and drive. The Knoxville Police Department will handle the rest.



4. (OFFICER CUFFING MOTORIST.)

VO: There's more. To make sure this special offer doesn't miss anyone. . .

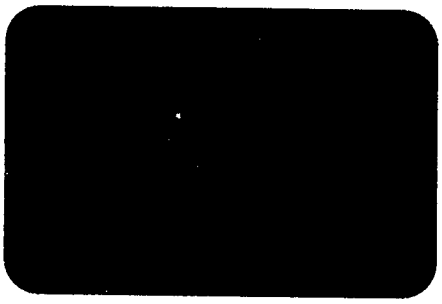


5. (PULL OUT TO SEE THAT ARREST IS PART OF A CHECKPOINT.)

VO: . . . we are setting up checkpoints at locations where drinking drivers are likely to be.

6. (OVERVIEW OF CHECKPOINT.)

VO: No qualified driver will be turned away. Officers are standing by.



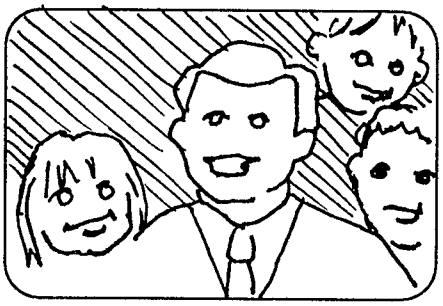
7. TV STATION TAG LINE.

DRAFT

:30 PSA Child Safety Seats

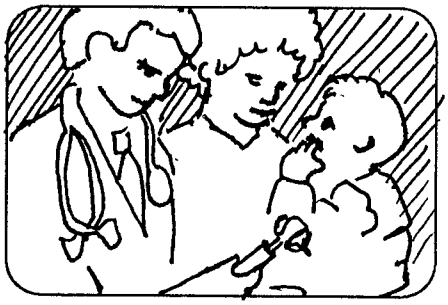
1. (MS OF CHIEF KEITH SITTING AMONG CHILDREN)

CHIEF: Tennessee was the first state to pass a law requiring children to ride in safety seats.



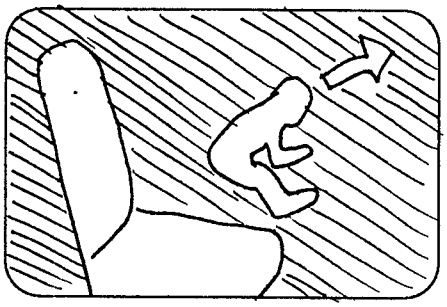
2. (CU OF CHIEF AND CHILDREN)

CHIEF: And Knoxville leads the state in enforcing the safety belt law.



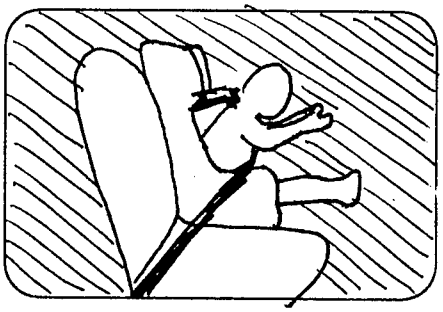
3. (PARENT AND TODDLER IN DOCTOR'S OFFICE)

CHIEF: Some people believe childhood diseases are the number one killer of children. They're wrong.



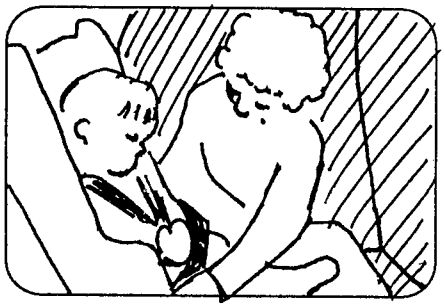
4. (CRASH-TEST CLIPS OF UNBELTED CHILDREN)

CHIEF: Many more children are hurt or killed because they do not ride properly buckled up.



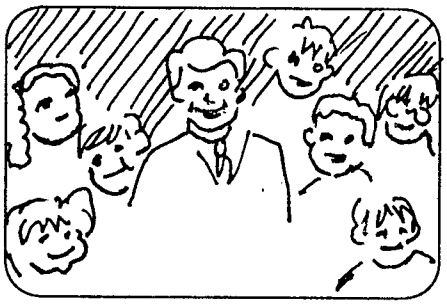
5. (CRASH-TEST CLIP OF CHILDREN IN SAFETY SEATS)

CHIEF: Children must be buckled into safety seats and the safety seats buckled to the car.



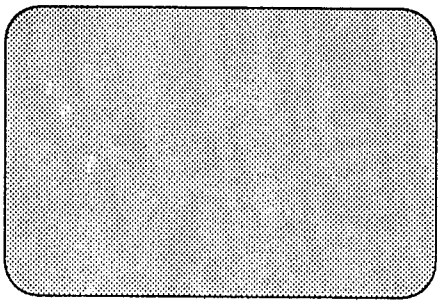
6. (CU OF PARENT BUCKLING UP TODDLER.)

CHIEF: Protect Knoxville's most precious resource.



7. (CU OF CHIEF AND KIDS)

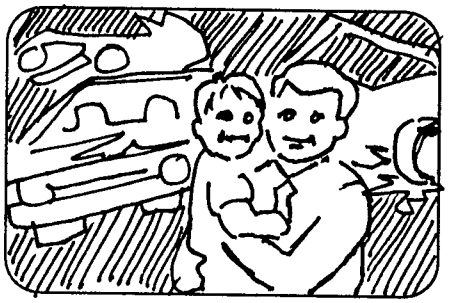
CHIEF: After all, they're number one.



8. TRIPLE JEOPARDY LOGO AND TV STATION TAG LINE.

D R A F T

:15 PSA Triple Jeopardy - Children II

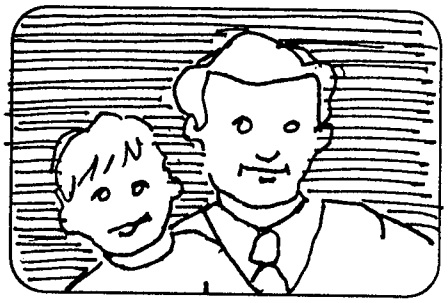


1. (MCU OF CHIEF KEITH HOLDING CHILD AND WALKING THROUGH JUNKYARD)

CHIEF: Speeding and drunk driving cause accidents that injure and kill.

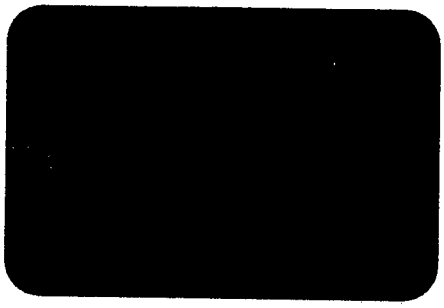
2. (CU OF CHIEF INTERACTING WITH KID)

CHIEF: Buckling up is our best defense against these accidents.



3. (CHIEF LOOKING INTO CAMERA.)

CHIEF: In Knoxville, we're serious about speeding, drunk driving and belt laws. If you're stopped for one, you're checked for all three.



4. (GRAPHIC OF TRIPLE JEOPARDY LOGO)

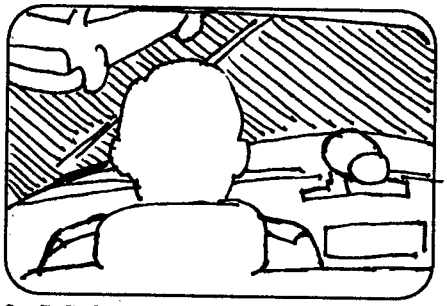
TV STATION TAG LINE

D R A F T

:30 PSA Saturation Patrols

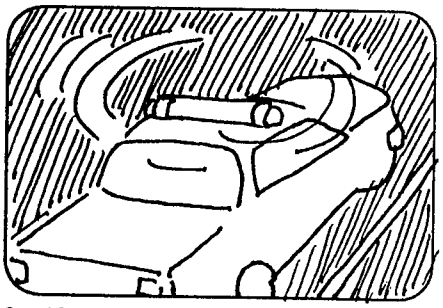
1. (XLS OF NIGHTTIME SCENE OF INTERSTATE TRAFFIC.)

VO: The places where speeders and drinking drivers are likely to be . . . .



2. (LS OF OFFICER USING RADAR.)

VO: . . . are the places where we put officers - lots of them.

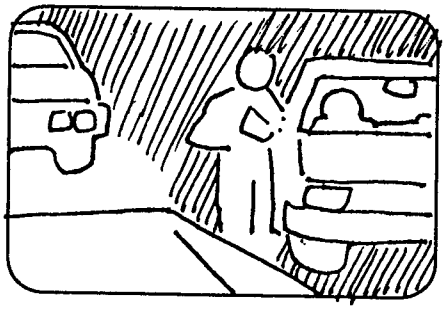


3. (OFFICER PULLS OUT TO STOP PASSING CAR. BLUE LIGHT FLASHING.)

VO: They're called saturation patrols and its part of the Knoxville Police Department's enforcement program called Triple Jeopardy . . .

4. (GRAPHIC OF THE WORD SPEEDING, FOLLOWED BY ADDITION OF THE WORD DRUNK DRIVING, THEN BELT USE.)

VO: . . . in which anyone stopped for speeding is checked for drinking and belt use.



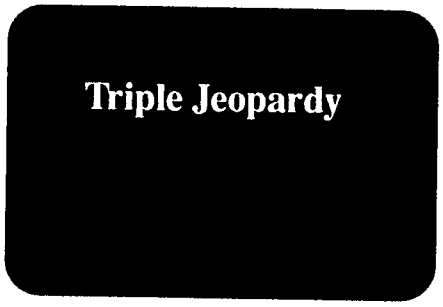
5. (VIEW FROM PASSING CAR TO OFFICER TALKING TO DRIVER OF STOPPED CAR.)

VO: Don't play Triple Jeopardy. Slow down. Put a sober driver behind the wheel. Buckle up.

6. (PULL OUT TO VIEW LONG STRETCH OF INTERSTATE. FLASHING LIGHTS FROM SEVERAL PATROL CARS.)

VO: And, if you pass one officer. Don't kid yourself, there's more.

7. (XLS OF FLASHING BLUE LIGHTS. HELICOPTER VIEW?)



8. (GRAPHIC OF TRIPLE JEOPARDY)

TV STATION TAG LINE.

D R A F T

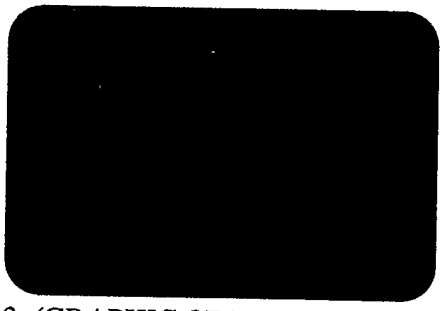
:15 PSA Holiday/Saturation Patrols

1. (XLS OF NIGHTTIME SCENE OF TRAFFIC.)

VO: This holiday season, the places where speeders and drinking drivers are likely to be . . .

2. (PULL OUT TO SHOW FLASHING LIGHTS FROM PATROL CARS.)

VO: . . . are the places where officers are patroling. It's no coincidence. Buckle up and have a safe holiday.

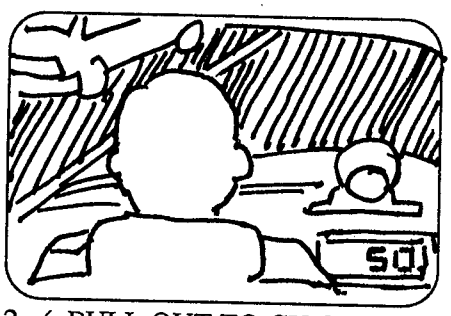


3. (GRAPHIC OF TRIPLE JEOPARDY)

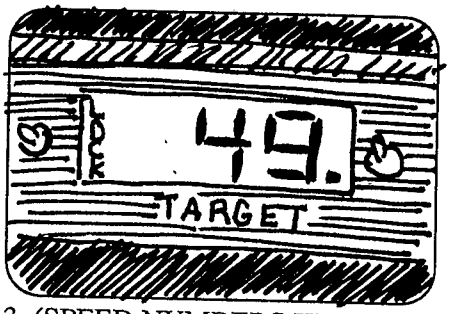
DRAFT

:30 PSA Radar at High Accident Locations

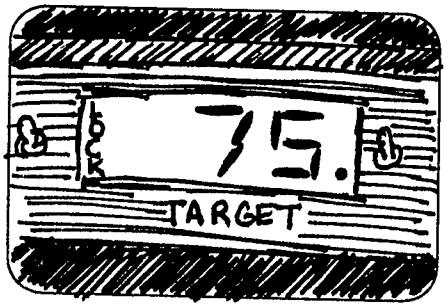
1. (CU OF RADAR UNIT DISPLAYING SPEEDS)



2. (, PULL OUT TO CU OF OFFICER MONITORING UNIT)
VO: There are a lot of good officers working to prevent accidents in Knoxville.

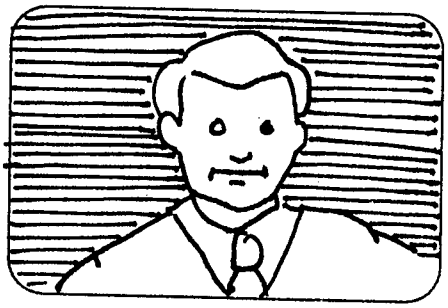


3. (SPEED NUMBERS KEEP COMING UP ON RADAR UNIT.)
VO: Through a program called Triple Jeopardy, we are concentrating speed enforcement at locations where accidents occur.



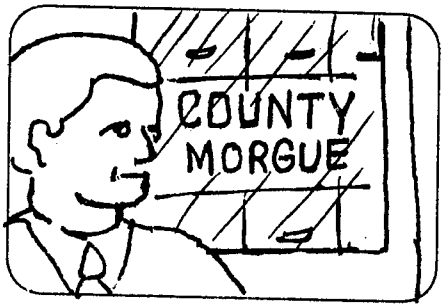
4. (HIGH SPEED COMES UP - SIREN - OFFICER TAKES OFF.)

VO: Anyone stopped for speeding, is checked for DWI and belt use as well.



5.(CUT TO CU OF CHIEF)

CHIEF: You may not believe the number of people killed in crashes caused by speeding and drunk driving . . .



6. (PAN TO VIEW THRU GLASSWINDOW IN DOOR TO SHOW MORGUE)
CHIEF: . . . but here is where they keep the final statistics. Slow down, put a sober driver behind the wheel and buckle up.

7. TRIPLE JEOPARDY LOGO AND TV STATION TAG LINE.

VO: Let's not meet by accident.

TRIPLE JEOPARDY RADIO PSA'S

30 Second Spot

In Knoxville, speeders are playing Triple Jeopardy. Because anyone stopped for speeding will be observed for drunk driving and belt us. Don't play Triple Jeopardy. Slow down. Put a sober driver behind the wheel. And buckle up. Because if you're stopped for one, you're checked for all three.

30 Second Spot

Have you made your reservations for Knoxville's jail? We offer secure rooms and the opportunity to meet interesting and unusual people. To qualify, all you have to do is drink and drive. The Knoxville Police Department will handle the rest. There's more. To make sure this special offer doesn't miss anyone we are setting up sobriety checkpoints at locations where drinking drivers are likely to be. No qualified driver will be turned away. Officers are standing by.

COVER OF HANDOUT
FOLDER

TRIPLE JEOPARDY

Speeding, Drunk Driving & Belt Use

A TRAFFIC SAFETY PROGRAM OF THE KNOXVILLE POLICE DEPARTMENT

INCLUDED IN HANDOUT FOLDER

KNOXVILLE POLICE DEPARTMENT

PHIL E. KEITH
CHIEF OF POLICE
(615) 521-1229
FAX (615) 971-1412

THE CITY OF KNOXVILLE, TENNESSEE
VICTOR ASHE, MAYOR

DRUG AND ALCOHOL FACT SHEET

Tennessee has one of the toughest DUI (driving under the influence) laws in the United States.

First Offense: The person will be fined $250 to $1,000 and shall be confined to county jail or workhouse for 48 hours to 11 months and 29 days. The court shall prohibit the person from driving in the State of Tennessee for one year.

Second Offense: The person will be fined $500 to $2,500 and shall serve 45 days to 11 months and 29 days in the county jail or workhouse. The court shall prohibit the person from driving in the State of Tennessee for 3 to 10 years.

In 1989, alcohol was the contributing factor in 40 percent of the fatalities that occurred in the City of Knoxville.

In the State of Tennessee, 53 percent of the fatalities occurred in alcohol related crashes.

Approximately 50 percent of drivers in fatal crashes in Tennessee had a blood alcohol concentration of .06 percent or higher.

In Tennessee, it is against the law for people under twenty-one to possess or consume alcoholic beverage.

Teenagers between 13 and 17 years of age that have alcohol in their possession will lose their license for one year or until the age of 17, whichever is longer.

Teenagers that are caught twice, will lose their licenses for two years or until they are 18 years old.

Since October 1, 1989, through July 31, 1990, 205 teenagers in the Knoxville-Knox County area have lost their license through the Drug Free Youth Act.

INCLUDED IN HANDOUT FOLDER

KNOXVILLE POLICE DEPARTMENT

PHIL E. KEITH
CHIEF OF POLICE
(615) 521-1229
FAX (615) 971-1412

THE CITY OF KNOXVILLE, TENNESSEE
VICTOR ASHE, MAYOR

SPEED FACT SHEET

In Tennessee, speed related crashes were second only to alcohol related crashes for being the leading contributing factor in highway fatalities.

In 1989, 31 percent of the fatalities that occurred on Tennessee highways were speed related.

The contributing factors in 20 percent of the vehicle crashes were speed and alcohol related.

The chances of a person becoming a fatality in the vehicle crash doubles with every 10 m.p.h. traveled over 50 m.p.h. (National Safety Council).

There were 24 highway fatalities that occurred in the City of Knoxville in 1989.

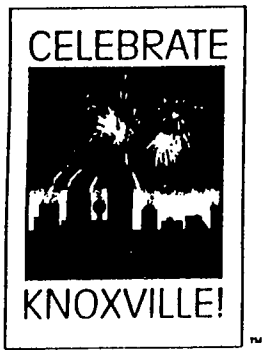
Of the fatalities, 15 percent were speed related and 20 percent were speed and alcohol related.

Each year between 45,000 and 52,000 Americans die as the result of traffic crashes and another 2 million are disabled or seriously injured (National Safety Council).

The epidemic is due in part to bad driving.

The drivers that speed or drink and drive are a very large part of the epidemic.

INCLUDED IN HANDOUT FOLDER



KNOXVILLE POLICE DEPARTMENT

PHIL E. KEITH
CHIEF OF POLICE
(615) 521-1229
FAX (615) 971-1412

THE CITY OF KNOXVILLE, TENNESSEE
VICTOR ASHE, MAYOR

SAFETY BELT AND CHILD RESTRAINT FACT SHEET

Tennessee enacted a safety belt use law on April 23, 1986.

All front seat occupants of motor vehicles manufactured after 1968 are required to buckle up.

The law has the following exemptions:
- those with medical waivers
- rural mail carriers
- utility workers, water, gas, and electric meter readers
- auto salespersons or mechanics test driving a motor vehicle
- newspaper delivery people during delivery.

In 1989, 24 highway fatalities and 2,391 personnel injury accidents occurred within the City of Knoxville.

Of the motor vehicle fatalities, 87 percent were not wearing safety belts.

In Tennessee, 928 motor vehicle fatalities occurred on our highways and 85 percent were not wearing safety belts.

If 70 percent of all Tennessee motorists would buckle up, approximately 400 lives could be saved each year.

Correct belt use reduces a person's chances of being killed or seriously injured by 50 percent or more.

The lap belt should be worn snugly across the pelvis and the shoulder belt should be across the collar bone.

The shoulder belt should never be worn under the arm because of the possibility of breaking ribs or causing internal injuries and the lap portion of the belt should not be worn across the stomach.

Tennessee's Child Restraint Law requires all children under the age of four to be transported in a child safety seat.

Since January 1, through September 5, 1990, thirteen children under the age of four have been killed on Tennessee's highways. Eleven of the thirteen children were not in child safety seats.

Appendix B - Driver Survey Questionnaire

The Tennessee Department of Safety needs your help in providing information about highway safety issues. Your answers will be used for statistical purposes only. Please do not write your name on this form.

1. Why are you at the driver's license office? (CIRCLE ONE)

   a. To get first license
   b. To renew currently valid license
   c. To have license reinstated
   d. To get an I.D. only
   e. other

2. Your sex? (CIRCLE ONE) a. Male b. Female

3. Your age? (CIRCLE ONE)

   a. under 18
   b. 18-20
   c. 21-24
   d. 25-29
   e. 30-49
   f. 50-65
   g. Over 65

4. What messages about enforcement of laws on drunken-driving, speeding, or not using a seatbelt have you heard, seen, or read in the last three months (on TV, radio, in the newspaper, posters, etc.)? Please, write in.

The message	Where seen, heard, or read
_____	_____
_____	_____
_____	_____

5. Have you noticed any increase in enforcement of any of the following traffic laws in the past three months? (CIRCLE ALL THAT APPLY)

   a. Drunk driving b. Speeding c. Not using a seatbelt

6. How often do you drink beer, wine or liquor? (CIRCLE ONE)

   a. Every day
   b. Several times a week
   c. Once a week
   d. Once a month
   e. Less than once a month
   f. Never

7. Within the last three months, how often do you think you may have driven after drinking too much? (CIRCLE ONE)

   a. Every day
   b. Several times a week
   c. Once a week
   d. Once a month
   e. Less than once a month
   f. Never

8. A. Compared with three months ago, are you *driving after drinking*: (CIRCLE ONE)

   a. More often? b. Less often? c. About the same? d. Do not drive after drinking

   B. If it changed, please say why:

   _____
   _____

9. A. Compared with three months ago, are you *speeding*: (CIRCLE ONE)

a. More often? b. Less often? c. About the same? d. Do not speed

B. If your speeding changed, please say why:

_____

_____

10. A. Compared with three months ago, are you *using your seatbelt*: (CIRCLE ONE)

a. More often? b. Less often? c. About the same? d. Always use seatbelt

B. If your seatbelt usage has changed, please say why:

_____

_____

11. Compared with three months ago, would you say that the chances of a *drunken driver* getting caught by the police have: (CIRCLE ONE)

a. Increased? b. Decreased? c. Stayed about the same?

12. Compared with three months ago, would you say that the chances of a *speeder* getting caught by the police have: (CIRCLE ONE)

a. Increased? b. Decreased? c. Stayed about the same?

13. Compared with three months ago, would you say that the chances of a *person not using a seatbelt* getting caught by the police have: (CIRCLE ONE)

a. Increased? b. Decreased? c. Stayed about the same?

APPENDIX C - STANDARDIZATION OF SURVEY DATA

A total of 4,143 responses were obtained, broken down as shown in Table 10. In both jurisdictions, most drivers came to the drivers license station to renew their license (Table 11). Roughly half of the drivers in each jurisdiction were males and half were females (Table 12). The age distributions of the samples in the two jurisdictions were also, in general, similar overall (Table 13).

The tabulations in Table 11 through Table 13 indicated some obvious trends:

Question 1 (Why in driver license station): At both sites, the response "other" (which includes all vehicle transactions) about doubled from wave 1 to wave 3; 19% to 37% in Chattanooga, 19% to 43% in Knoxville, with intermediate values in wave 2.

Question 2 (Sex): The percentage of women declined over time at both sites, from 51% to 46% in Chattanooga and 50% to 47% in Knoxville, with intermediate values in wave 2.

Question 3 (Age): At both sites, the percentages of drivers in the age classes up to 30 tended to increase, and the percentages in the classes above 30 tended to decrease.

Since these trends were very similar at both sites, they are extremely unlikely to be sampling fluctuations. It is much more likely that the population of drivers coming to the driver license stations really changed over time; possibly due to economic trends.

These changes may have affected the responses, though it is not obvious in which direction that may have occurred. The trend in Question 1, for example, suggests that more owners of vehicles may have visited the office than previously. How their responses may differ from those of drivers who do not own vehicles is not at all clear.

To reduce any potential effect of such demographic shifts, the data were weighted to standardize them to the overall distribution (for each city separately) of the demographic factors. As demographic factors for the post-stratification implicit in the weighting, "why" and age were used. Using sex in addition would have resulted in too small cell frequencies and some empty cells. In order to avoid these problems, a simple cross-classification of the two factors was used. The relatively rare responses "first license" and "get i.d." were used as separate strata, without further cross-classification by age. Only the two most common responses "renew license" and "other" were cross-classified separately, by age. Because the age classes under 18 and over 65 were relatively rare, the first was combined with the 18-20 class, and the latter with the 50-65 class. (These combinations were used only for the calculation and application of weights. For all other purposes, these classes were kept separate.)

APPENDIX D - SPEED STANDARD ERRORS

Typical values of standard errors in speed measurements were:

Measure	Range of Errors	Mean of Errors
Average speed	0.3 - 0.9	0.55
Excess speed	0.2 - 1.0	0.50
Percentage over limit	0.01- 0.07	0.04
Percentage ≥ 5 mph over limit	0.01 - 0.08	0.04
Percentage ≥ 10 mph over limit	0.01 - 0.06	0.03

The model used in most analyses of speeds in a given city had the following structure:

$$Measure = a + b_{location} + c_{wave} + d_{shift}$$

Some interactions were explored, but not included because they were either not significant, or if marginally significant, seemed to represent only random deviations between model and data.

The following figures give an idea of how well the model represents the data (based on complete data for Knoxville and Chattanooga, and partial data for Lexington). "Error of model" is the mean square difference between the actual data and the modelled data, "error of coefficient" is the standard error of the coefficients of the waves, relative to the first, baseline, wave. These differences are used to measure the effects of the program.

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Table 9: Phasing of PI&E Campaigns in Knoxville and Field Data Collection Activity in Knoxville and Chattanooga

Activity	Month													
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
PI&E														
Kickoff	■													
Campaign 1 - Sobriety Checkpoints	▬	▬	▬											
Campaign 2 - Saturation Patrols				▬	▬	▬								
Campaign 3 - Interstate, Child Safety						▬	▬							
Campaign 4 - Young Drivers								▬	▬					
Campaign 5 - Blitz										▬	▬	▬	▬	
Data Collection														
Attitude Survey	▬					▬								■
Field Measurements	▬	▬			▬		▬		▬		▬			■

Table 10: Survey Sample Size

	Survey wave						ALL	
	1		2		3			
	N	PCT	N	PCT	N	PCT	N	PCT
Site Name								
Chattanooga	999	51.84	857	71.54	460	45.19	2316	55.90
Knoxville	928	48.16	341	28.46	558	54.81	1827	44.10

Table 11: Reasons for Being in the Drivers License Station

	Survey wave						ALL	
	1		2		3			
	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille
Why in DL Office?								
First lic.	5.78	6.46	5.94	7.16	8.80	6.75	6.43	6.68
Renew lic.	65.74	65.72	51.07	37.31	38.60	38.50	54.92	52.12
Rein. lic.	5.78	5.04	7.13	8.36	9.03	4.20	6.92	5.40
Get ID	3.72	3.94	4.75	5.37	6.09	7.48	4.57	5.29
Other	18.99	18.84	31.12	41.79	37.47	43.07	27.15	30.51

Table 12: Subject Sex

	Survey wave							
	1		2		3		ALL	
	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille
Subject sex								
Male	48.78	50.38	49.88	51.93	54.22	52.98	50.26	51.46
Female	51.22	49.62	50.12	48.07	45.78	47.02	49.74	48.54

Table 13: Subject Age

	Survey wave							
	1		2		3		ALL	
	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille
Subject age group								
<18	3.23	3.46	4.24	3.81	5.75	4.37	4.10	3.80
18-20	6.56	5.84	10.12	10.26	8.19	9.47	8.20	7.77
21-24	9.08	10.28	12.35	17.60	12.61	12.75	10.99	12.40
25-29	13.93	13.53	11.53	15.54	15.04	15.12	13.26	14.39
30-49	48.94	47.51	43.18	39.00	44.91	46.81	46.01	45.70
50-65	15.64	15.80	14.47	10.56	9.73	8.93	14.04	12.73
Over 65	2.62	3.57	4.12	3.23	3.76	2.55	3.40	3.20

In Chattanooga, weights ranged from 0.54 to 2.03 and in Knoxville from 0.41 to 2.43.

Because of the weighting, errors for the column percentages in the tabulations, which are the quantities of interest, are not easily directly calculated. Therefore, so-called "jackknife" estimates, using half-samples and 20 replications, were used to estimate errors.

An examination of the standardized tabulations of *drinking frequency* showed a disturbing pattern. In Knoxville, the percentage of respondents who drink once a month or more was 34% in the first wave, 43% in the second, and 32% in the last. Indeed, all responses in the classes "once a month" or "more often" showed a usually-significant increase in the second wave and a return to essentially the original value in the third wave. In Chattanooga, the distributions of the responses in waves 1 and 2 were essentially the same. There was a slight increase in the frequency of "once a week" or "more often" during the third wave, from 24% to 28%.

One can not reasonably expect that the project in Knoxville increased the frequency of drinking in general. One would expect a reduction of drinking and driving and a small, if any at all, reduction of drinking. The strong increase in drinking during the second wave suggests that the population in wave 2 was really different from those of the other two waves. Since "drinkers" may differ in their reactions to the project from non-drinkers (including those drinking less than once a month), we also developed a stratification and weighting scheme for Knoxville, which added weights for drinking frequency. To reduce the number of low cell frequencies and too many empty cells (they could not be completely avoided), we distinguished only two classes of drinking frequency; less than once a month or never, and once a month or more often. This weighted data set was used in the subsequent analysis.

The tabulation of *drinking frequency* for Knoxville shows that the weighting reduced the discrepancy of the second wave, but did not completely eliminate it (Table 14). This is not surprising considering that only two levels of drinking frequency were used.

Table 14: Drinking Frequency (Adjusted for Drinking Frequency, Age, and Reason for Being in the Drivers License Station)

	Survey wave							
	1		2		3		ALL	
Frequency of drinking	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille	Chatt-anooga	Knoxv-ille
Every day	2.34	1.32	1.56	2.67	1.86	2.04	1.96	1.80
Sev. times/week	7.30	7.29	8.65	7.53	9.76	6.62	8.29	7.13
Once/week	12.89	17.22	13.62	20.44	16.02	14.98	13.78	17.15
Once/month	9.09	8.49	9.60	11.88	7.53	8.83	8.97	9.23
< Once/month	19.94	23.48	19.32	17.61	18.90	21.11	19.50	21.65
Never	48.45	42.20	47.24	39.87	45.93	46.42	47.51	43.04

APPENDIX D - SPEED STANDARD ERRORS

Typical values of standard errors in speed measurements were:

Measure	Range of Errors	Mean of Errors
Average speed	0.3 - 0.9	0.55
Excess speed	0.2 - 1.0	0.50
Percentage over limit	0.01- 0.07	0.04
Percentage ≥ 5 mph over limit	0.01 - 0.08	0.04
Percentage ≥ 10 mph over limit	0.01 - 0.06	0.03

The model used in most analyses of speeds in a given city had the following structure:

$$Measure = a + b_{location} + c_{wave} + d_{shift}$$

Some interactions were explored, but not included because they were either not significant, or if marginally significant, seemed to represent only random deviations between model and data.

The following figures give an idea of how well the model represents the data (based on complete data for Knoxville and Chattanooga, and partial data for Lexington). "Error of model" is the mean square difference between the actual data and the modelled data, "error of coefficient" is the standard error of the coefficients of the waves, relative to the first, baseline, wave. These differences are used to measure the effects of the program.

Measure	Error of Model	Error of Coef-ficient
Average speed	1.1	0.3
Excess speed	0.8	0.2
Percentage over limit	0.07	0.03
Percentage ≥ 5 mph over limit	0.08	0.02
Percentage ≥ 10 mph over limit	0.06	0.02