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PROJECT REPORT FOR GHSP PROJECT (1989-90):

Increased Seat Belt Use Through Police Actions

by

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INTRODUCTION

Since the mid-1970's, North Carolina has had a most vigorous and coordinated program aimed at increasing the use of occupant restraints as well as child safety seats. The primary initial effort in North Carolina was in the area of child restraints following Tennessee's enacting a child restraint law in 1979. North Carolina was one of the early states to pass a child restraint law which initially covered infants under the age of two and subsequently in 1985 was revised and upgraded to cover all children up to age six with those under the age of three being required to be in an approved child safety seat.

Following North Carolina's success with their child restraint law passed in 1982, efforts mounted for passage of legislation requiring all occupants of front seats of passenger vehicles to be properly restrained using existing seat belts. This law was passed in the spring of 1985 and became effective October 1, 1985 with a 15-month warning ticket phase. Starting in January, 1987, $25 citations were issued to violators of this law.

One condition for the law was that the effectiveness of the legislation with respect to increasing belt use of the population-at-risk as well as reducing injuries and fatalities be evaluated by the Governor's Highway Safety Program. This evaluation was carried out by the UNC Highway Safety Research Center and resulted in a report of the three-year evaluation entitled, "North Carolina's Occupant Restraint Law: A Three-Year Evaluation," by D.W. Reinfurt, B.J.Campbell, J.R. Stewart and J.C. Stutts. This report reflected very favorably on the legislation.

Examination of the long-term effects of the North Carolina belt law was reported on in the project report to GHSP entitled, "Increased Seat Belt Use Through Police Actions," (Hunter, Reinfurt, Stutts, St.Cyr, Hall, 1989). This study presents results for population-at-risk belt use, trends in injury and fatality data, survey of automatic seat belt usage in North Carolina, and evaluation of enforcement activities at both the Highway Patrol and local municipal levels.

The current project has extended even these activities associated with the belt law. It has involved the following:

(1) Further tracking of the statewide belt use rate through two observational surveys of front seat occupants of passenger vehicles at 72 designated sites scattered across North Carolina;

(2) An examination of the use and misuse of automatic seat belts;

(3) Trends in injuries and fatalities among occupants covered by the law compared with non-covered occupants as well as non-occupants;

(4) A survey of local enforcement practices associated with the belt law along with trends in Highway Patrol enforcement efforts;

(5) Support for three other belt projects aimed at law enforcement strategies as well as restraint usage by rural residents and by children. These three projects are entitled:

   (a) "Demonstration of Alternate Strategies for Implementing Community-Level Occupant Protection Law Enforcement Programs";

   (b) "Strategies to Educate and Increase Occupant Protection Usage Among Rural Drivers and Passengers"; and

   (c) "Comprehensive Program for Increasing Use of Safety Seats and Seat Belts for Children and Younger Adults", respectively.

In addition, the project provided support to distribute TAD damage rating manuals to police officers across the State. The resulting vehicle damage severity ratings provided by police officers yields excellent statewide data for carrying out evaluations of a variety of types including belt effectiveness studies.

STATEWIDE BELT USE DATA

Background

In order to assess seat belt usage in North Carolina for legislative purposes, intermittent surveys have been conducted over the past five years. As previously cited, "North Carolina Occupant Restraint Law: A Three-Year Evaluation" (Reinfurt, et al., 1988) specifically addresses the issues of survey design, observational procedures, and includes results of the data analysis for the first three years of the law.

The construction of the initial analyses was used as a model in conducting this year's survey, and as this is discussed in the earlier work, will not be specified here. To summarize, 72 permanent sampling sites were observed for 90 minutes in each of two sampling waves of January and September 1990.

For those vehicles covered by the law, data were gathered on the sex, race, and belt status of the occupants of front seat positions, in addition to the vehicle type. Site specific data include starting and finishing times of observations, pavement type, weather circumstances, whether the area was urban or rural, the month and year of observation, and a diagram of the intersection.

Results

Table 1 (belt usage for drivers) and Table 2 (usage for all front seat occupants) display the results of these surveys. In order to facilitate comparisons, frequencies are presented for previous years findings. As emphasized, the results of the most current 1990 observations are found in the last two columns of each table.

Overall, weighted rates of usage for the driver can be located in Table 1 as 57.5 and 60.6 for winter and summer, respectively. This rate is based on the number of occupants observed in each of these waves which was 24,363 in the winter month of January, and 25,066 for the summer survey. Similarly, for all front seat occupants assessed, usage rates were 55.7 in the winter and 58.7 in the summer (based on 32,035 occupants in January, and 33,505 in September). To offer a visual interpretation of these rates, Figure 1 graphs driver belt usage from September 1985 to September 1990. As can be seen, driver belt usage has remained fairly constant, now leveling off at a rate of 60 percent.

Table 1. **Driver** belt usage rates in North Carolina.

	PRE-LAW	POST-LAW Warning Ticket Phase						
	Sept. 1985 (72 sites)	Nov. 1985 (12 sites)	Jan. 1986 (72 sites)	March 1986 (12 sites)	April 1986 (12 sites)	June 1986 (72 sites)	Aug. 1986 (12 sites)	Oct. 1986 (72 sites)
Overall Usage %:								
Observed	25.4	45.0	41.9	45.4	47.7	43.7	40.8	43.8
[Weighted]	[25.5]	[46.5]	[44.3]	[47.0]	[49.0]	[44.8]	[41.0]	[44.8]
(No. occupants)	(18,212)	(6734)	(19,927)	(3380)	(3339)	(19,159)	(4260)	(21,859)
Rural/Urban								
Rural	22.1	40.5	38.2	41.3	42.8	41.0	36.5	40.5
Urban	28.4	49.0	45.4	48.8	51.6	47.0	43.9	47.6
Region								
Mountains	23.5	40.8	43.7	40.5	42.2	41.9	34.5	41.9
Piedmont	27.6	48.5	44.2	47.6	50.4	46.5	45.2	46.6
Coast	25.1	49.2	37.9	50.8	51.3	42.5	44.0	43.4
Time of Day								
Commuting	27.2	47.3	43.2	42.6	47.3	46.3	42.1	47.0
Non-Commuting	24.0	44.0	41.1	46.7	47.9	41.8	40.1	41.6
Vehicle Type								
Car	26.6	45.8	45.1	48.1	50.4	46.5	43.3	47.4
Van	25.9	49.3	34.2	48.8	48.2	45.2	44.1	44.5
Pickup	18.5	39.0	30.1	33.3	36.8	31.3	28.8	30.5
Other	31.1	50.4	43.2	51.3	42.2	51.3	45.5	42.7
Sex of Occupant								
Male	23.7	43.0	37.2	41.8	45.9	39.9	38.8	38.8
Female	28.0	47.7	49.2	50.4	50.5	49.9	43.7	51.3
Race of Occupant								
White	26.5	45.1	43.0	45.3	47.9	44.5	41.3	44.7
Non-white	15.5	43.8	34.9	46.0	46.8	35.7	38.1	36.0

Table 1. **Driver** belt usage rates in North Carolina. (Con't)

	POST-LAW Citation Phase							
	Jan. 1987 (72 sites)	March 1987 (12 sites)	April 1987 (12 sites)	June 1987 (72 sites)	Aug. 1987 (12 sites)	Oct. 1987 (72 sites)	Jan. 1988 (72 sites)	March 1988 (12 sites)
Overall Usage %:								
Observed	77.7	71.3	67.4	64.0	63.1	62.7	60.0	60.2
[Weighted]	[77.9]	[69.9]	[66.6]	[66.6]	[60.6]	[64.7]	[61.6]	[60.0]
(No. occupants)	(15,847)*	(3042)	(3150)	(17,971)	(3537)	(21,423)	(21,341)	(3802)
Rural/Urban								
Rural	75.7	69.7	61.8	59.3	61.6	58.7	54.6	57.8
Urban	80.1	72.4	71.5	69.2	64.7	67.4	65.0	62.3
Region								
Mountains	71.9	63.8	59.9	56.9	57.4	53.7	46.8	51.0
Piedmont	78.9	75.3	74.7	69.5	68.2	67.8	65.3	66.3
Coast	81.1	76.3	68.3	64.3	63.4	65.8	66.6	66.6
Time of Day								
Commuting	80.2	70.5	66.3	65.8	61.4	66.1	62.2	60.1
Non-Commuting	75.5	72.2	68.4	62.5	64.3	60.0	57.4	60.2
Vehicle Type								
Car	80.3	75.4	70.6	68.1	67.4	66.4	64.7	65.2
Van	72.9	63.7	69.4	55.7	51.9	51.7	52.3	41.4
Pickup	69.5	58.3	53.5	50.1	48.6	50.3	43.7	45.6
Other	76.7	70.3	64.8	66.6	53.8	64.9	59.8	56.6
Sex of Occupant								
Male	73.8	67.4	64.3	59.6	58.7	57.5	53.5	55.2
Female	84.4	77.3	72.0	71.0	69.9	70.3	69.9	68.2
Race of Occupant								
White	77.2	70.6	65.9	63.8	62.3	62.7	58.8	59.6
Non-white	80.4	74.0	73.6	65.7	66.4	62.8	65.4	62.9

*Survey methodology modified to collect only for vehicles completely stopped.

Table 1. **Driver** belt usage rates in North Carolina. (Con't)

	POST-LAW Citation Phase						
	April 1988 (12 sites)	June 1988 (72 sites)	Aug. 1988 (12 sites)	Jan. 1989 (72 sites)	June 1989 (72 sites)	**Jan. 1990 (72 sites)**	**Sept. 1990 (72 sites)**
Overall Usage %:							
Observed	59.8	62.4	62.7	55.6	56.9	**53.5**	**57.5**
[Weighted]	[58.6]	[65.0]	[63.6]	[59.7]	[61.3]	**[57.5]**	**[60.6]**
(No. occupants)	(4089)	(24,183)	(3768)	(24,317)	(25,775)	**(24,363)**	**(25,066)**
Rural/Urban							
Rural	55.1	58.5	60.6	48.5	51.1	**46.8**	**51.9**
Urban	63.7	66.5	65.1	62.9	63.1	**60.6**	**63.6**
Region							
Mountains	50.2	55.5	58.1	48.7	49.8	**47.1**	**50.6**
Piedmont	68.2	67.7	66.7	61.8	62.7	**59.7**	**63.7**
Coast	63.1	64.0	64.7	55.2	57.7	**52.7**	**57.9**
Time of Day							
Commuting	59.1	63.3	62.0	57.9	57.7	**55.6**	**59.1**
Non-Commuting	60.5	61.6	63.3	53.8	56.2	**51.7**	**56.3**
Vehicle Type							
Car	63.7	67.1	68.4	60.3	61.9	**58.8**	**63.3**
Van	54.9	47.6	49.3	45.6	41.4	**36.5**	**39.3**
Pickup	45.4	47.5	44.4	38.7	39.8	**35.8**	**40.0**
Other	64.4	64.0	63.7	57.9	58.4	**53.2**	**55.1**
Sex of Occupant							
Male	54.7	56.5	57.0	49.5	51.3	**47.0**	**51.8**
Female	67.3	70.9	71.5	64.8	65.2	**62.9**	**66.1**
Race of Occupant							
White	58.5	62.0	61.9	55.4	56.4	**53.2**	**57.3**
Non-white	66.5	65.1	67.1	57.1	60.0	**55.4**	**59.3**

Table 2. **Front seat occupant** belt usage rates in North Carolina.

	PRE-LAW	POST-LAW Warning Ticket Phase						
	Sept. 1985 (72 sites)	Nov. 1985 (12 sites)	Jan. 1986 (72 sites)	March 1986 (12 sites)	April 1986 (12 sites)	June 1986 (72 sites)	Aug. 1986 (12 sites)	Oct. 1986 (72 sites)
Overall Usage %:								
Observed	24.1	42.3	39.7	42.8	45.8	42.2	38.9	42.0
[Weighted]	[24.1]	[44.1]	[42.6]	[45.0]	[47.1]	[43.3]	[39.7]	[43.3]
(No. occupants)	(25,084)	(8858)	(26,722)	(4647)	(4549)	(26,546)	(5675)	(29,982)
Rural/Urban								
Rural	21.2	38.0	35.8	38.7	41.9	40.0	34.9	39.0
Urban	27.0	46.5	43.6	46.4	49.1	45.3	41.9	45.5
Region								
Mountains	22.5	38.4	41.8	38.2	41.2	41.2	33.4	40.4
Piedmont	26.2	46.8	42.3	44.5	48.7	44.6	42.6	44.3
Coast	23.8	45.4	35.2	48.5	47.9	40.6	42.3	41.5
Time of Day								
Commuting	25.8	44.1	40.7	39.5	45.4	44.4	39.5	45.3
Non-Commuting	22.9	41.6	39.1	44.5	45.9	40.7	38.6	39.8
Vehicle Type								
Car	25.5	43.3	42.9	45.3	48.5	45.1	41.6	45.5
Van	24.8	45.4	33.3	49.1	48.8	44.2	40.9	44.0
Pickup	16.3	35.8	27.4	31.1	33.5	29.5	26.3	28.3
Other	30.2	50.3	40.4	47.3	44.6	49.4	43.1	41.6
Sex of Occupant								
Male	22.3	40.3	34.9	39.9	43.5	38.3	36.7	36.8
Female	25.9	44.2	45.7	46.1	48.6	47.0	41.4	47.9
Race of Occupant								
White	25.2	42.7	41.1	42.9	46.3	43.2	39.5	43.1
Non-white	14.4	39.4	31.2	42.7	43.2	32.5	35.5	32.8

Table 2. **Front seat occupant** belt usage rates in North Carolina. (Con't)

	POST-LAW Citation Phase							
	Jan. 1987 (72 sites)	March 1987 (12 sites)	April 1987 (12 sites)	June 1987 (72 sites)	Aug. 1987 (12 sites)	Oct. 1987 (72 sites)	Jan. 1988 (72 sites)	March 1988 (12 sites)
Overall Usage %: Observed [Weighted] (No. occupants)	75.8 [76.4] (21,675)*	69.1 [68.0] (4142)	65.3 [64.3] (4273)	61.7 [64.9] (25,033)	60.4 [58.3] (4870)	60.5 [62.6] (28,946)	57.6 [59.8] (28,467)	59.1 [59.3] (4945)
Rural/Urban								
Rural	74.0	67.6	60.5	57.1	58.7	56.8	52.9	57.5
Urban	78.2	70.3	69.0	67.0	62.1	65.1	62.7	60.7
Region								
Mountains	70.7	62.2	58.3	54.4	55.5	51.7	45.1	50.5
Piedmont	76.9	72.9	72.8	67.6	64.8	65.8	63.0	64.4
Coast	79.0	73.6	65.3	62.0	60.8	63.7	65.3	66.4
Time of Day								
Commuting	78.0	68.1	64.8	63.1	58.0	63.4	60.0	58.6
Non-Commuting	74.1	70.4	65.7	60.6	62.0	58.4	55.5	59.6
Vehicle Type								
Car	78.8	73.3	68.4	65.8	64.8	64.4	62.6	64.3
Van	70.3	61.4	64.8	53.0	45.5	49.1	49.9	39.0
Pickup	66.5	56.1	51.7	47.8	46.1	47.1	41.5	44.0
Other	78.0	68.9	66.2	63.8	50.7	63.4	58.3	58.3
Sex of Occupant								
Male	71.7	65.3	62.0	57.3	56.3	54.9	51.8	53.1
Female	81.3	74.1	69.2	67.1	65.6	67.0	65.0	67.3
Race of Occupant								
White	75.6	68.6	63.9	61.4	59.9	60.6	57.0	58.5
Non-white	77.5	71.1	70.6	63.5	62.7	60.2	61.6	62.1

*Survey methodology modified to collect only for vehicles completely stopped.

Table 2. **Front seat occupant** belt usage rates in North Carolina. (Con't)

	POST-LAW Citation Phase						
	April 1988 (12 sites)	June 1988 (72 sites)	Aug. 1988 (12 sites)	Jan. 1989 (72 sites)	June 1989 (72 sites)	**Jan. 1990 (72 sites)**	**Sept. 1990 (72 sites)**
Overall Usage %: Observed [Weighted] (No. occupants)	57.6 [56.7] (5448)	60.7 [63.7] (32,590)	62.2 [63.5] (5002)	53.5 [57.8] (31,845)	54.8 [59.3] (34,424)	**51.2 [55.7] (32,035)**	**55.4 [58.7] (33,505)**
Rural/Urban							
Rural	53.1	56.9	60.1	46.5	49.6	**44.4**	**50.1**
Urban	61.6	65.1	64.7	60.9	60.9	**58.7**	**61.6**
Region							
Mountains	48.4	53.7	58.5	46.8	48.5	**45.0**	**49.5**
Piedmont	65.5	66.2	65.4	60.0	60.3	**57.3**	**61.3**
Coast	61.2	62.9	63.9	52.8	55.6	**50.7**	**55.4**
Time of Day							
Commuting	56.6	61.1	61.2	55.6	55.5	**53.2**	**56.5**
Non-Commuting	58.6	60.4	62.9	51.9	54.3	**49.6**	**54.6**
Vehicle Type							
Car	61.5	65.6	68.2	58.3	59.8	**56.4**	**61.1**
Van	54.6	45.8	51.3	42.7	38.7	**35.3**	**36.8**
Pickup	42.6	44.9	41.6	35.8	36.9	**33.4**	**37.2**
Other	63.3	63.1	66.4	56.4	57.3	**51.0**	**53.9**
Sex of Occupant							
Male	52.2	54.3	55.4	47.1	48.7	**44.5**	**49.2**
Female	64.4	68.1	70.5	61.4	62.3	**59.4**	**62.9**
Race of Occupant							
White	56.5	60.3	61.7	53.4	54.6	**51.1**	**55.4**
Non-white	63.2	63.5	64.9	54.6	56.2	**51.7**	**55.5**

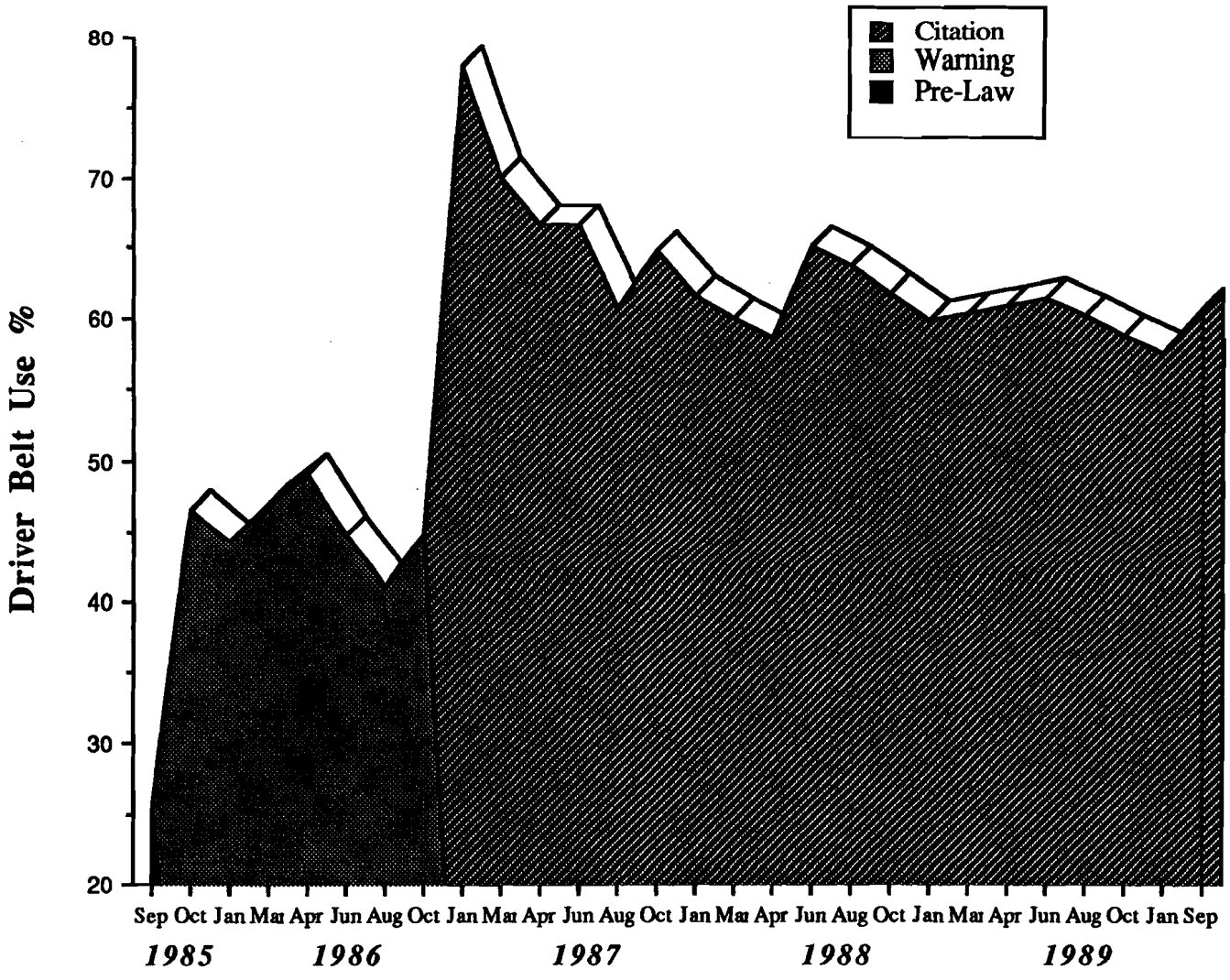

Figure 1. Weighted driver seat belt usage rates.

As Table 1 shows, driver belt usage rates are much higher in urban areas relative to those in rural areas; in the geographical areas of the coast and piedmont as opposed to the mountain regions; greater during commuting times than on the weekends; for drivers of cars compared with van and pickup operators; for females; and lastly for non-whites. Similar findings hold on all front seat occupants shown in Table 2.

Seat Belt Misuse Data

To supplement the information obtained on seat belt usage, data collectors also recorded types of seat belt misuse. This addition has been implemented in the last two years surveys and will continue to be a feature in seat belt assessments. The primary types of misuse dealt with were:

Loose belt - Although shoulder belt is properly routed and fastened, it is excessively slack.

Under arm - Shoulder belt is not properly fit across the shoulder, but instead is worn under the arm.

Behind back - Shoulder belt is not properly fit across the shoulder, but instead is put behind the back.

Hanging belt - Shoulder belt is draped over the shoulders, and not fastened.

Table 3 contains these misuse rates arranged by driver sex and race. Almost two percent of all drivers observed misused their belt by not releasing the excess slack -- the most abundant form of misuse. Closely following, with approximately 1.9 percent of the drivers observed was placing the shoulder belt under the arm. Note that this category is dominated by white females with a misuse rate of three percent. White males and females were more likely than blacks to wear a loose belt, or wear a shoulder belt under the arm, whereas overall females had a greater percentage of misuse than males.

Table 3. Seat belt misuse rates by driver sex and race.

Misuse Category	White Male	White Female	Nonwhite Male	Nonwhite Female	Total
Loose	1.47%	2.88%	1.27%	2.11%	1.99%
Under Arm	1.29%	3.02%	0.72%	1.72%	1.88%
Hanging	0.13%	0.10%	0.18%	0.16%	0.12%
Behind Back	0.05%	0.09%	0.06%	0.16%	0.07%
Total	2.94%	6.09%	2.23%	4.15%	4.06%
(N)	(13,301)	(8,784)	(1,657)	(1,278)	(25,020)

Conclusions

Optimistically, belt usage rates in North Carolina have remained with the highest in the United States. Unfortunately, belt usage does not appear to be increasing as shown by these semi-annual statewide surveys. Although belt usage has stabilized at a relatively high rate, automatically remaining vehicles may prove successful at increasing these rates further, as they become more prominent.

USAGE PATTERNS AND MISUSE RATES OF AUTOMATIC SEAT BELTS BY SYSTEM TYPE[1]

ABSTRACT

This study examined seat belt usage by drivers of 4151 late model cars in North Carolina equipped with a variety of restraint system types. We measured usage by restraint type (automatic belt, air bag, manual belt), by make/model and by driver characteristics (age, sex and race). Usage ranged from a high of 94.2 percent for motorized shoulder belts (but with only 28.6 percent lap belt use in these cars) to 73.9 percent use of manual lap/shoulder belts in cars equipped with air bags. Various types of misuse of the shoulder belt (e.g., excessive slack, detached from the door, placed under the arm) were observed in nearly six percent of the sample.

SEAT BELTS have now been required in passenger vehicles for over two decades; lap belts were required in 1966 and lap and shoulder belts in 1968. The early lap and shoulder belt systems were not connected (a four-point system), but interconnected lap/shoulder belts (a three-point system) became standard in 1974. Through the early 1980's, however, U.S. seat belt use rates were approximately 10-15 percent, so that the vast majority of motor vehicle occupants were electing not to use their available restraints.

The knowledge about design and implementation of air bags in motor vehicles has been available for several decades, yet movement to require these automatic devices has been quite slow. Many highway safety specialists feel that the protracted arguing between seat belt and air bag advocates over which system should be preferred was a major factor in holding down the seat belt use

[1]Paper accepted for publication in Accident Analysis & Prevention.

rate in the U.S. thus maintaining the status quo from around 1975 until 1984. This dichotomy did not exist in Europe and Australia, and many of these countries had high belt use rates in the 1970's and 1980's.

In 1984, Federal Motor Vehicle Safety Standard (FMVSS) 208 was amended to promulgate the use of automatic protection in motor vehicles. A phase-in was set up such that all cars manufactured during the 1990 model year and later would be required to have some form of automatic protection that would meet federal crash test requirements. The four-year phase-in took place in the following manner: 10% of all 1987 model year cars sold in the U.S. were required to have automatic protection; 25% of 1988 model year cars; 40% of 1989 model year cars; and 100% of all 1990 model year cars.

During the early-to-mid 1980's, the auto manufacturers began promoting the passage of mandatory belt use laws (MUL's), no doubt aided by the prospect of possibly not having to meet the automatic protection phase-in schedule if two-thirds of the U.S. population were covered by adequate MUL's. In 1984, New York became the first state to require belt use by drivers and front seat occupants. By the end of 1985, fifteen additional states plus the District of Columbia had passed mandatory use laws. Although there have been repeals of MUL's by four states, as of October 1990 there were belt laws in 34 states plus the District of Columbia that covered more than 85 percent of the U.S. population.

Although much of the U.S. population was covered by belt laws, the federal government on other grounds declined to overturn the amendment to FMVSS 208 that required the automatic protection phase-in. Initially the majority of vehicles with automatic restraints were equipped with automatic seat belts. Now there is an increased production of driver air bags which will eventually also include right front-seat passenger air bag systems. These air bag

restraint systems are supplemental systems designed to activate in frontal and frontal oblique collisions only. Therefore, both the government and the automobile manufacturers urge drivers to use three-point manual belts in cars equipped with air bags.

Relatively little is known about the usage of automatic seat belts by the population-at-risk or the effectiveness of either these systems or air bags in crashes. In 1981, Chi and Reinfurt reported on a study involving some 10,336 Volkswagen Rabbits involved in crashes. The dataset consisted of both manual restraint system Rabbits as well as automatic shoulder belt/knee bolster restraint Rabbits. They concluded that the automatic belt Rabbits experienced between 20 and 30 percent fewer serious and fatal injuries than their counterparts in Rabbits with conventional three-point belt systems. The overriding factor for this reduction was the increase (at least two-fold) in the belt usage rates in the automatic belt Rabbits. This study concluded that, when used, the two belt systems were equally effective in reducing serious injuries.

More recently, Nash (1989) reported on the effectiveness of automatic belts in reducing fatality rates in Toyota Cressidas. Comparing Toyota Cressidas equipped with motor-driven automatic belts since 1981 with similar Nissan Maxima's equipped with three-point manual belts and using data from the Fatal Accident Reporting System, he concluded that the fatality reduction effectiveness for the Toyota automatic belts was approximately 40 percent.

Automatic seat belts are available in three basic designs. VW produced the first automatic belts in its 1975 Rabbit models. These consisted of two-point shoulder belts attached to the upper rear of the front door and connected to a take-up reel located between the front seats. Lower body restraint was provided by a knee bolster since no lap belts were provided. These belts were detachable but an ignition interlock was installed to encourage usage.

With the 1981 Cressida, Toyota introduced a second design which is a two-point motorized automatic belt system. The belt is a motor-driven, non-detachable automatic shoulder harness. Also included is a manual lap belt along with a knee bolster.

The third type of automatic belt, used extensively by General Motors and Honda, is a three-point non-motorized belt mounted near the upper and lower rear edge of the front door of the vehicle. There are variations on these basic systems, such as the two-point automatic shoulder belt along with a manual lap belt found in all 1990 VW's.

Again, as the majority of automatic belt systems are detachable and also are not accompanied with ignition interlock systems, relatively little is known about the acceptance of these systems by the motoring public. Recently, a study conducted by Williams, Wells, Lund and Teed (1989) showed significantly higher belt usage rates in the population-at-risk for drivers with automatic restraints compared with manual belts. Additionally, there were differences with regard to lap belt use among the various automatic systems. The data were comprised of 1987 model year vehicles observed in different suburban areas of Washington, D.C., Chicago, Los Angeles, and Philadelphia. The authors concluded that some manufacturers were indeed more successful than others in providing automatic belt systems that result in high usage rates.

In another study conducted in 1987 and 1988 in conjunction with the NHTSA's annual belt survey in 19 cities, Bowman and Rounds (1989) collected information on a total of 21,308 drivers in automatic belt passenger cars. The results from this study provide usage rates by type of automatic belt system by manufacturer and make/ model. Comparisons are made with manual belt usage and also by model year groups. However, their data are limited to shoulder belt usage only because the cars observed were not necessarily stopped. In

addition, their results are strictly for urban vehicles and do not include information on driver characteristics such as age, race, and sex.

To close some of these gaps in the data, the Highway Safety Research Center collected belt use data in 1986-89 model cars equipped with automatic belts, along with air bag and manual belt vehicles (as a baseline). The goal was to provide knowledge about whether some belt systems were more acceptable (i.e., used) than others, and whether drivers with air bags actually use their available belts. Comparisons are made with the U.S. DOT 19-city survey where appropriate.

METHOD

To obtain data on the use of restraints in cars equipped with automatic restraints (lap/shoulder belts and/or air bags), supplemental data were collected in January-February, 1989, June-July, 1989, and January-March, 1990 as part of an on-going statewide belt use survey for North Carolina. Observers were sent to signal- or stop-controlled intersections scattered across the State, both in rural and in urban locations. The requirement for signal- or stop-controlled intersections was made to enable the data collectors to correctly ascertain lap belt use -- an essential ingredient of this survey.

Starting with model year 1986, passenger cars have been required to have center, high-mounted rear brake lights. And starting with the 1987 model vehicles, some of the new cars were also required to have passive restraints -- either automatic seat belts or air bags. Thus, the observers focused on cars with center, high-mounted brake lights with the exception of VW Rabbits, which have had a portion of their vehicles equipped with automatic belts since model year 1975. Since only 10 percent of the 1987 model year cars were required to have automatic restraints, 25 percent of the 1988 models and 40 percent of the 1989 models, the data collectors were trained to recognize the various makes

and models likely to be equipped with automatic restraints by visiting automobile dealer showrooms and studying the available literature. However, the data were not restricted only to automatic seat belt or air bag vehicles, as information was needed for new model vehicles equipped only with manual belts which would serve as baseline data.

The data collectors worked in pairs at these various controlled intersections. One observer recorded age, (under 25, 25-54, 55 and older), sex, and race (white, non-white) of the driver; belt type (e.g., motorized automatic shoulder belt vs. manual three-point system); and usage of the shoulder belt and of the lap belt. In addition, this observer recorded misuse of the shoulder belt which included the belt being unhooked from the mounting position, excessive slack, or the belt placed under the arm of the driver.

The second observer, positioned toward the rear of the vehicle, first determined that there was a center, high-mounted brake light present or else that the vehicle was a VW Rabbit and hence an eligible vehicle, recorded the license plate number for cars with North Carolina license plates and provided a description of the car, namely, the make and model as well as body style (e.g., two-door vs. four-door vs. station wagon). The description of the vehicle was necessary to confirm the subsequent match with the North Carolina vehicle registration data since, when there is a vehicle transfer, the license plate stays with the owner. Thus, there is a period of time after this transfer when the old plate is on the new vehicle but the registration file information has not yet been updated. To guarantee that the observed license plate corresponds to the vehicle data on the registration file, this additional description of the car was required. Data on belt use for a total of 4820 cars were collected during these three sampling periods.

To determine the type of restraint system installed in the vehicle, it was necessary to obtain the vehicle identification number (VIN) from the North Carolina registration file. Thus, each of the observed license plate numbers was checked against the vehicle registration file. If the description of the observed vehicle agreed with that on the registration file, then the VIN from the file was recorded for that vehicle. Otherwise it was necessary to exclude that vehicle from the study. Of the initial 4820 cars observed, some 4225 vehicles (or 87.7%) matched the data on the registration file.

Using VINDICATOR, the VIN-decoding software package developed by the Insurance Institute for Highway Safety (IIHS), the sample VIN's were decoded to obtain restraint type. The resulting levels of restraint type provided by this program are manual three-point belts, air bags, or automatic seat belts. Some 4151 VIN's were decoded using the VINDICATOR package (i.e., 86.1% of the original sample).

As with the U.S. DOT study, there was particular interest in the types of automatic seat belts -- the motorized two-point belts, the non-motorized shoulder belt only, and the non-motorized three-point (i.e., automatic shoulder/automatic lap combination) belt. In order to provide this level of detail, the make/model and model year information from the VINDICATOR program was used, along with detailed documentation on specific type of automatic belt system which is provided annually by NHTSA, IIHS, and also Geico Automobile Insurance Company.

RESULTS

The distribution of the study sample of 4,151 late model passenger cars is shown in Table 4 by restraint type system. The majority (74.4%) of the sampled vehicles had automatic seat belts, 5.5 percent had air bags with manual three-

Table 4 - Percent shoulder belted and percent full system usage by restraint type

Restraint Type	Total	Shoulder Belted %	Full System Usage %	19 City Shoulder Belted %
Auto Belt	3090	79.6	68.8	88.7
Motorized:				
Auto S/Manual L	413	94.2	28.6	97.2
Non-Motorized:				
Auto S	148*	83.8	75.7	81.3
Auto S/Auto L	2518	76.9	74.9	76.9
Type Unknown	11	90.9	81.8	--
Air Bag	230	73.9	73.5	
Manual Belt	831	76.3	73.8	
Overall	4151	78.6	70.0	

*148 = 127 (Auto S) + 21 (Auto S/Manual L)

point belts and the remaining 20.1 percent had manual three-point belts without air bags. As there were only 21 cars with a non-motorized automatic shoulder/manual lap belt system, they were combined with the more common automatic shoulder belt only system. The column identified as "Shoulder Belted %" represents drivers where the shoulder belt was in use. The next column, labeled "Full System Usage %" indicates that the entire system was being used. As will be seen, the main instance of misuse was when there was a manual lap belt that was not buckled. The final column presents the results from the US DOT 19-city survey of driver automatic belt use rates (see Bowman and Rounds, 1989).

It should be noted that in both the air bag cars and the manual belt cars, the available restraint system was a manual three-point lap/shoulder belt.

For the full sample, there was at least a shoulder belt used in 78.6 percent of the cases. When looking at "Full System Usage," the percentage drops to 70.0 percent. It should be noted that the rather high usage of manual belts is partly due to the observations focusing on new model cars (basically 1986 and later model years) and also the sampling being carried out in North Carolina where belt usage in the population has been at least 60 percent for the last several years.

Results of applying Pearson's Chi-square test indicate that there is a significant difference in "Shoulder Belted" usage rates among drivers of vehicles equipped with automatic belts (79.6%), manual belts (76.3%), or air bags (73.9%) (Chi-square = 7.5, df = 2, $p = 0.02$). However, from a practical standpoint, these differences are relatively small. Within the automatic restraint systems, there is also a significant difference in "Shoulder Belted" usage rates (Chi-square = 67.7, df = 3, $p < .001$) among the generally non-detachable motorized systems (94.2%), the non-motorized automatic shoulder belt system (83.8%), and the non-motorized three-point automatic shoulder/lap belt combination (76.9%).

A special feature of this study was the determination of not only shoulder belt usage but also lap belt use. This is particularly important in cases where the lap belt must be fastened separately, such as in the Toyota Camry and Cressida and the Ford Tempo and Escort. As is seen in Table 4, in the case of the non-motorized automatic shoulder/automatic lap belt, generally when the shoulder belt is used, the lap belt is also utilized (76.9% vs 74.9%, respectively). For the non-motorized automatic shoulder belt systems, the drop from 83.8 percent belted to 75.7 percent is mainly attributable to the 21 vehicles for which the lap belt must be buckled manually.

However, for the increasingly popular motorized automatic belts where the shoulder belt is motor-driven and a separate lap belt must be manually attached, there is a 70 percent reduction going from 94.2 percent shoulder belt usage down to 28.6 percent where the lap belt is also manually attached. Often motorists would tell the data collectors that "they just forgot to buckle the lap belt" or even that "they didn't know that they had a lap belt." For whatever the reason, it is clear that the drivers with the motorized shoulder belts are more often than not neglecting to use the important manual lap belt. See Figure 2 for usage rate comparisons across restraint types.

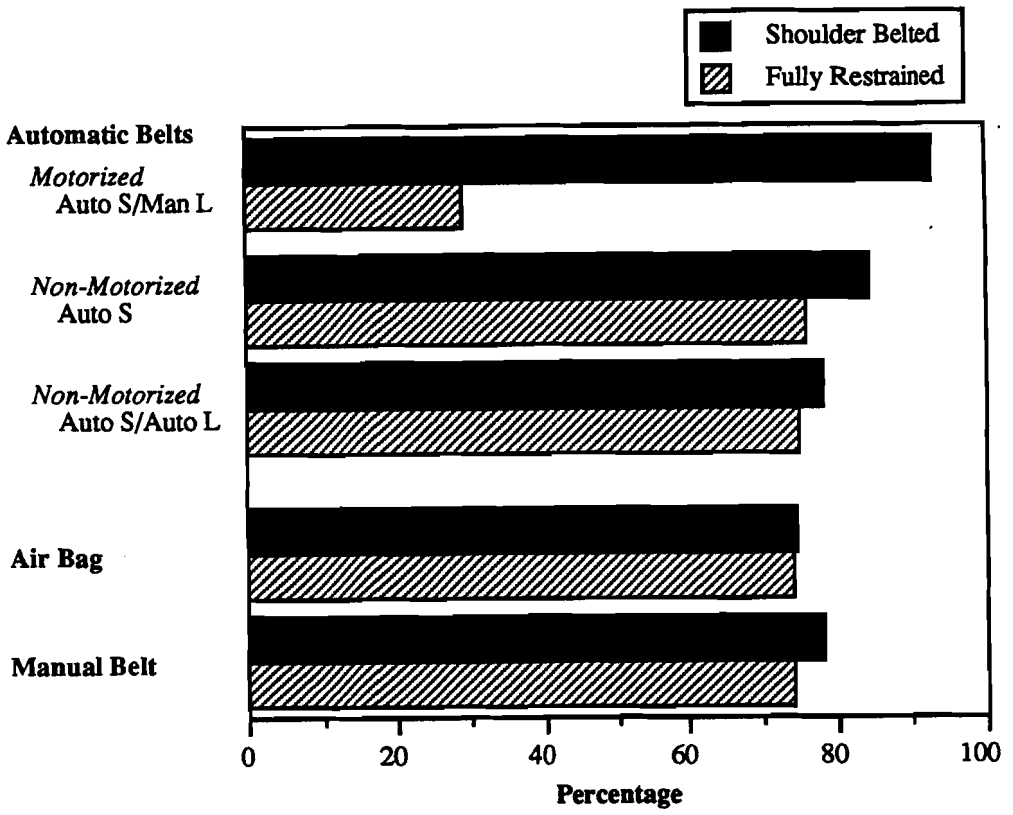

Figure 2. Percent Shoulder Belted vs. Percent Fully Restrained by Restraint Type

Comparing the second and final columns of Table 4, it is of interest to note that the results from the urban DOT study are relatively similar to those found in North Carolina. Again, highest shoulder belt use rates (97.2% DOT vs 94.2% N.C.) were seen with the motorized automatic belts and lowest for the non-motorized automatic shoulder/ automatic lap belt combination (identical at 76.9%).

Note was made by the observers of obvious misuse of the shoulder belt portion. Categories of misuse included (1) belts that were unhooked from the door mounting, (2) shoulder belts with obvious excessive slack (i.e., being "too loose" with at least six inches of extra belt webbing) and (3) shoulder belts worn under the arm. The most common form of misuse was the shoulder belt being "too loose." In 3.0 percent of the cases (i.e., 126 drivers), there was obvious excessive slack in the shoulder belt. In an additional 1.5 percent of the cases, the driver was wearing the shoulder belt underneath the arm. And in another 1.3 percent of the cases, the driver had detached the shoulder belt from the door mounting. Thus, overall nearly six percent of the drivers observed in this survey were wearing their shoulder belt incorrectly.

The next two tables deal with belt use by car manufacturer and by make and model within automatic belt type, where results are limited to those subgroups with reasonable sample sizes. Table 5 displays belt usage by restraint type across manufacturer. First, for each manufacturer, the percentage distribution by restraint type is given. For example, in our survey 21.6 percent of the Chrysler products had automatic belts and 19.8 percent had air bags with the remaining 58.6 percent having only manual belts. Consistent with the previous table, the first three listed automatic belt manufacturers (i.e., those with motorized belts) have high shoulder belt use rates ranging from 83 percent to 97 percent. However, too often the manual lap belt is not being used resulting

Table 5 - Belt usage by restraint type across manufacturer

Restraint Type	Manufacturer (%)*	Total	Shoulder Belted %	Full System Usage %
Auto Belt				
Motorized	Chrysler (21.6)	35	82.9	37.1
	Ford (61.1)	181	94.5	26.0
	Toyota (93.1)	122	96.7	28.7
Non-Motorized	VW (97.0)	98	87.8	87.8
	GM (91.8)	2337	76.9	74.8
	Honda (72.6)	193	77.7	76.7
Air Bag				
	Chrysler (19.8)	32	68.8	68.8
	Ford (9.5)	28	78.6	78.6
	Toyota (.76)	--	--	--
	VW (0)	--	--	--
	GM (.08)	--	--	--
	Honda (3.8)	10	50.0	50.0
	Mercedes (80.2)	93	68.8	68.8
	Volvo (21.9)	40	90.0	90.0
Manual Belt				
	Chrysler (58.6)	95	71.6	70.5
	Ford (29.4)	87	72.4	69.0
	Toyota (6.1)	--	--	--
	VW (3.0)	--	--	--
	GM (8.2)	208	80.3	76.0
	Honda (23.7)	63	77.8	76.2
	Mercedes (19.8)	23	69.6	69.6
	Volvo (78.1)	143	80.4	79.7

*Restraint type percent within manufacturer.

in a sizable decline to a "Full System Usage %" ranging from 26 percent to 37 percent.

Although the shoulder belt usage rate for the non-motorized automatic belt is lower than that for the motorized system, these systems are much more likely to be fully used. Here the range in usage of the shoulder belt is from 77 percent to 88 percent with little decline for full system usage, namely 75 percent to 88 percent.

For the air bag cars as well as the manual belt cars, the usage rates of the manual three-point belts are somewhat lower but there is very little difference between the percentage indicated as shoulder belted versus having the entire belt system being used.

Table 6 gives a further breakdown for the automatic belt systems for various make/model combinations and compares the results of the North Carolina study with that done by the U.S. DOT. Note the similarity in the results between the shoulder belted percent in North Carolina and in the 19-city survey except for the VW Rabbit/Golf, where older model Rabbits with lower use rates were included only in the North Carolina sample. Again all four make/models with motorized shoulder belts show high shoulder belt usage (93% to nearly 99%), but with a dramatic decline when accounting for full system usage. Within the non-motorized belt categories, there is relatively little difference between make/model combinations other than for the VW Rabbit/Golf model. In addition, when used, the non-motorized systems are generally fully used.

The final three tables deal with driver characteristics -- age, sex, and race. With respect to belt usage by type of system, overall frequencies and usage percentages by restraint type are given in the first row of each section of the table to serve as a baseline for comparison.

Table 6 - Belt usage by type of automatic belt system for various make/model combinations

Restraint Type	Make	Model	Total	Shoulder Belted %	Full System Usage %	19 City Shoulder %
Motorized:	Ford	Escort	105	93.3	27.6	97.7
		Tempo	40	97.5	27.5	97.7
	Toyota	Camry	78	98.7	24.3	99.3
		Cressida	42	92.9	35.7	99.6
Non-Motorized:						
Auto S	VW	Jetta	47	95.7	95.7	93.9
		Rabbit/ Golf	49	79.6	79.6	96.2
Auto S/ Auto L	Buick	LeSabre	315	85.4	83.8	76.9
		Regal	114	73.7	71.1	81.2
		Skylark	98	78.6	74.5	81.0
	Chev.	Beretta	150	67.3	62.7	76.9
		Corsica	87	71.3	70.1	81.8
	Olds.	Calais	170	70.6	68.2	67.7
		Cutlass	99	77.8	74.7	81.3
		Delta 88	254	81.5	80.3	77.0
	Pont.	Bonneville	195	81.0	80.5	79.4
		Grand AM	446	72.2	70.2	74.4
		Grand Prix	123	74.8	67.5	84.0
	Honda	Accord	110	72.7	71.8	75.3
		Prelude	68	83.8	83.8	67.0

Belt use by driver age is shown in Table 7, where the percentage of "Shoulder Belted" drivers of cars with automatic seat belts is lowest for the

Table 7 - Belt use by restraint type by age of driver

Restraint Type	Age	Total	Shoulder Belted %	Full System Usage %
Auto Belts		3090	79.6	68.8
	Under 25	343	74.6	57.4
	25-54	2016	79.9	69.1
	55 and over	731	81.3	73.2
Air Bags		230	73.9	73.5
	Under 25	9	66.7	66.7
	25-54	162	75.3	75.3
	55 and over	59	71.2	69.5
Manual Belts		831	76.3	73.8
	Under 25	55	83.6	78.2
	25-54	562	74.4	72.2
	55 and over	214	79.4	76.6

youngest drivers. For air bags and manual belts, the small sample sizes limit drawing conclusions for the younger drivers. The decline in percentages when accounting for full system usage is generally greater for the younger drivers, dropping to below 60 percent for those younger drivers in automatic belt cars.

Table 8 provides results of belt usage by restraint type according to driver sex. Shoulder belt usage is higher for female drivers in both the air bag cars with three-point manual belts and in the manual belt cars -- some six to 12 percentage points higher, which is consistent with most surveys dealing with belt usage by driver sex. Similar comments apply to the "Full System Usage" percentages by driver sex. However, for the automatic belt category, both the percentage of drivers using at least the shoulder belt as well as the

Table 8 - Belt use by restraint type by sex of driver

Restraint Type	Age	Total	Shoulder Belted %	Full System Usage %
Auto Belts		3090	79.6	68.8
	Male	1371	79.4	69.3
	Female	1719	79.8	68.4
Air Bags		230	73.9	73.5
	Male	125	71.2	70.4
	Female	105	77.1	77.1
Manual Belts		831	76.3	73.8
	Male	413	70.2	68.8
	Female	418	82.3	78.7

percentage of drivers using the full system are about the same for both male and female drivers.

Finally, Table 9 examines belt use by driver race. In North Carolina, since the seat belt law with a $25 citation went into effect in January 1987,

Table 9 - Belt use by restraint type by race of driver

Restraint Type	Age	Total	Shoulder Belted %	Full System Usage %
Auto Belts		3090	79.6	68.8
	White	2737	79.4	69.6
	Non-white	353	81.3	62.0
Air Bags		230	73.9	73.5
	White	217	74.2	73.7
	Non-white	13	69.2	69.2
Manual Belts		831	76.3	73.8
	White	719	77.1	74.5
	Non-white	112	71.4	68.8

the wearing rates of non-white drivers has consistently been slightly greater than that for their white counterparts. In this survey of new model cars, the wearing rates for the non-white driver are somewhat lower in both the air bag cars and the manual belt cars. For all three restraint types, the percentage of drivers using the full belt system is lower for the non-white driver, ranging from nearly five to eight percentage points.

DISCUSSION

Since all 1990 model year cars are required to be equipped with passive restraints (e.g., automatic seat belts or air bags) following a gradual phase-in which started in 1987, and since relatively little is known about public acceptance of these new devices, an opportunity was seized upon to capture data on driver belt usage for new model cars in North Carolina. This survey was carried out in conjunction with our periodic statewide survey of belt use being done to help evaluate North Carolina's belt use law.

For the most part, the sample of 4,151 drivers were driving 1986 and later model year cars selected on the basis of having center, high-mounted brake lights. Some 74.5 percent of the sample were in automatic belt cars, 20.0 percent in cars equipped with manual three-point belts and the remaining 5.5 percent in air bag cars with manual three-point belts.

Shoulder belt usage rates for all systems (automatic belts 79.6%, air bags 73.9%, manual belts 76.3%) exceeded the statewide average of approximately 60 percent largely because these vehicles were nearly all new model cars. Within the automatic belt group, shoulder belt usage was highest (94.2%) for the motorized automatic shoulder/manual lap belt system, intermediate (83.8%) for the non-motorized system with automatic shoulder belts and lowest (76.9%) for the non-motorized automatic shoulder/automatic lap belt system. These results

are quite consistent with the 19-city U.S. DOT survey rates of 97.2 percent, 81.3 percent, and 76.9 percent, respectively.

There are several features of this survey which are unique. First, observations were made in both urban and rural areas. Secondly, data were collected on two types of automatic belt system "misuse". The first type consisted of drivers not fully utilizing the restraint system available. The second kind dealt with misuse of the shoulder belt -- namely, belt being detached from the door mounting, excessive slack in the belt, and shoulder belt being placed underneath the arm. The final area in which this survey is unique is that it compares usage rates by various driver characteristics, namely, age, sex and race.

With respect to the first type of misuse, that is, failing to utilize the full restraint system provided, this problem was primarily experienced by drivers in vehicles equipped with motorized shoulder belts and manual lap belts such as the Ford Escort and Tempo and the Toyota Camry and Cressida. Here, there was a 70 percent decrease in "usage" (from 94.2% "Shoulder Belted" to 28.6% "Fully Restrained"). The corresponding drop in percentages for the other systems (non-motorized automatic belts as well as three-point systems available in both the air bag cars and in the manual belt cars) was relatively minor -- generally, only several percentage points.

The most common form of incorrect usage of the shoulder belt was having too much slack (3.0% of the sample) followed equally by the belt being detached from the door mounting (1.3%) and the shoulder belt being placed underneath the arm (1.5%). These rates of misuse totaling nearly six percent are very consistent with those which have been observed in the on-going North Carolina statewide surveys of all cars.

With respect to driver age, the younger driver (under 25) generally had lower usage rates than other age groups, which is consistent with past seat belt usage surveys conducted in the U.S. The decline accounting for full system usage is likewise greatest for the under 25 year old dropping to 57.4 percent.

As has been seen in other surveys, females tended to wear their three-point belts more frequently than males in both the air bag cars and the manual belt cars. However, usage of automatic belts by female drivers was the same as that of the male drivers.

In our North Carolina surveys covering cars of model years 1968 and newer, belt usage has consistently been higher for non-white drivers than for white drivers since implementation of the North Carolina seat belt law in January 1987. In this survey involving newer model cars, belt usage for non-white drivers was slightly higher in the automatic belt cars but generally somewhat lower in the air bag and manual belt cars. For all three restraint systems, "Full System" usage rates for non-white drivers were lower than the rates for their white counterparts.

Several points bear mentioning. First, many cars are being produced with motorized shoulder belt systems. However, in this survey, even though the shoulder belt was nearly always in use (94.2%), fewer than 30 percent of the drivers were getting the full protection available which included buckling the lap belt. Sometimes this was likely a result of ignorance while perhaps more often it was the result of not developing the special habit required. Evidently, having the motorized belt fall into place often gives drivers of these cars the feeling of being buckled up.

Secondly, the three-point non-motorized automatic belt systems were defeated nearly 25 percent of the time. Motorists indicated that it is very

easy to disconnect these systems and often if they elect to use them, they use them as manual belts; in other words, they disconnect them as they get out of the car and reconnect them once they have entered the car for the next trip. On the other hand, there was relatively high usage of the three-point manual belts in air bag cars (namely, 73.9%). Air bags are designed to be supplemental systems in that they do not protect the occupant in many crash modes such as side impacts or rollovers. From data collectors talking with drivers in air bag-equipped cars, it was clear that many did appreciate the fact that they needed to use the manual three-point belts. However, some drivers were not even aware that their car was equipped with an air bag!

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STATEWIDE ACCIDENT DATA

Background

With the implementation of the seat belt law, injuries due to vehicle accidents have decreased. The observed change in injury rates was studied in this segment of the project. Reinfurt, Campbell, Stewart and Stutts (1988) studied reportable crashes in North Carolina from January 1981 to June 1988, and detailed the procedure used in this earlier work. Descriptive analyses showed a changing trend over this period, and subsequent time series models confirmed the results showing a downward slope.

As a first area of interest, injury patterns associated with the pre-law period were compared to the injury distribution during the 15-month warning phase. Following the warning phase, injury rates were contrasted with the period of a $25 citation which began on January 1, 1987.

To classify those included in the analyses, the following categories were employed:

1. Covered occupants: front seat occupants of vehicles targeted by the law.

2. Non-covered occupants: rear-seat occupants of vehicles targeted by the law; occupants of other vehicles not covered by the law; and

3. Non-occupants: pedestrians, bikers, etc.

Results

Accident and injury data gathered during the current project year were modeled with the descriptive analysis described in Reinfurt, et. al. (1988) as is shown by Figure 3. There is a significant decrease in the serious or worse injury percentages following the implementation of the warning phase of the seat belt law. Likewise, there is a break beginning with the citation phase in January 1987. The distributions retain the seasonal variances with winter involving fewer serious or worse injuries, and summer typically involving more.

For covered occupants of front seat positions, figures 4 and 5 reveal a stabilizing of fatal injuries through the enforcement phase and indicate the continuing success of the seat belt law.

For non-covered occupants, those described as occupants of a non-covered vehicle (e.g., larger trucks and buses) or rear passengers of a covered

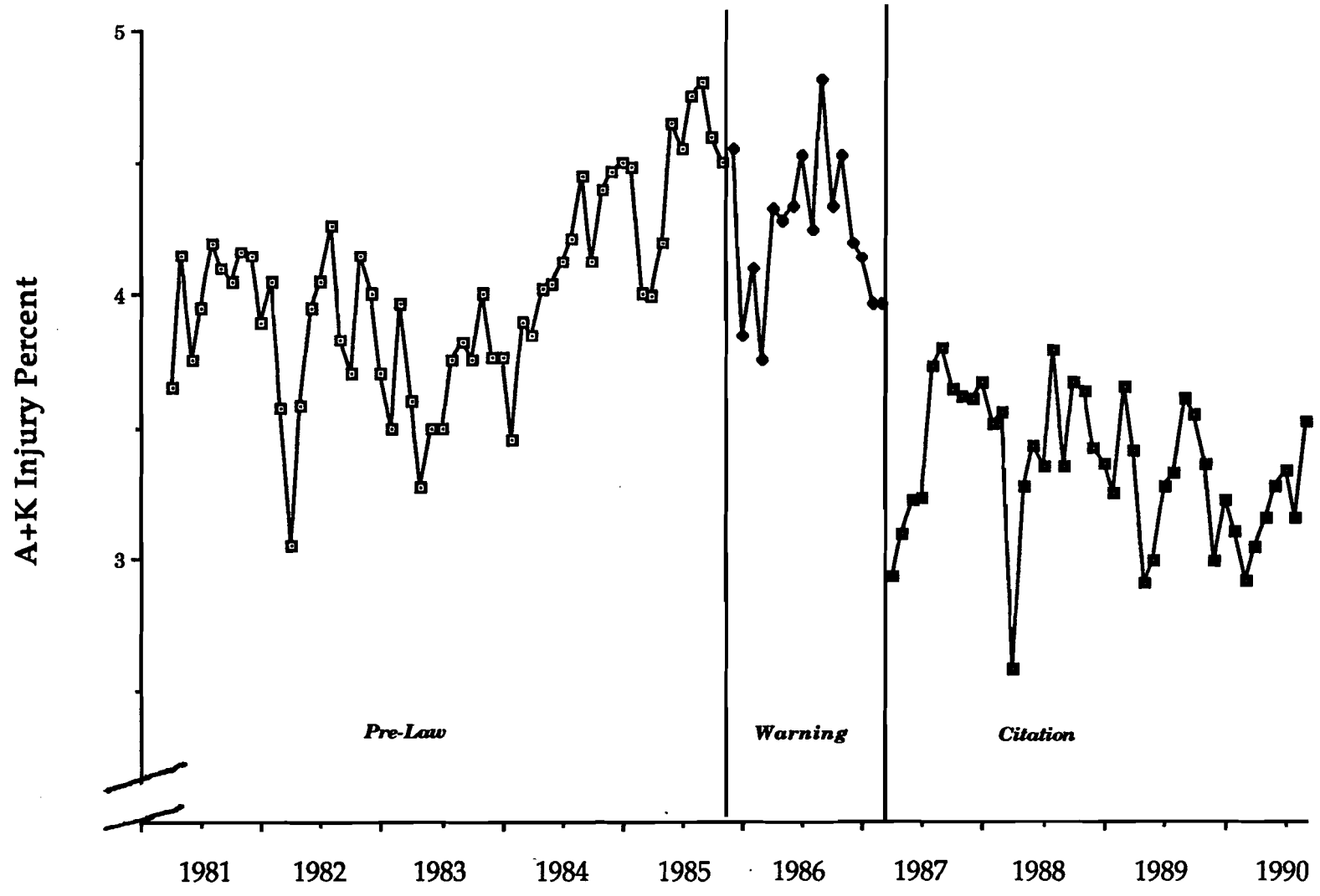

Figure 3. Injury distribution for covered occupants.

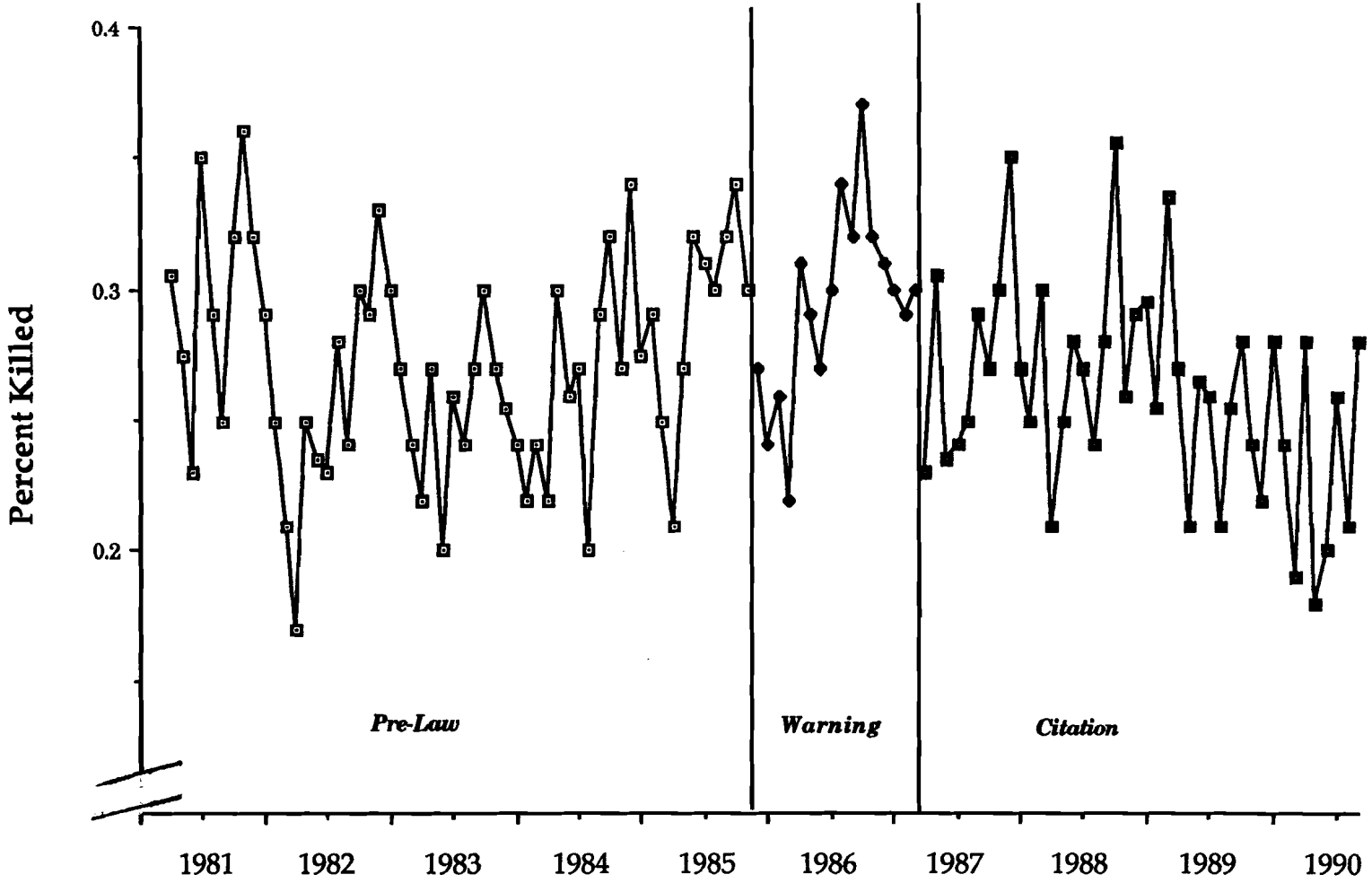

Figure 4. Percent of front seat covered occupants killed - through Enforcement Phase.

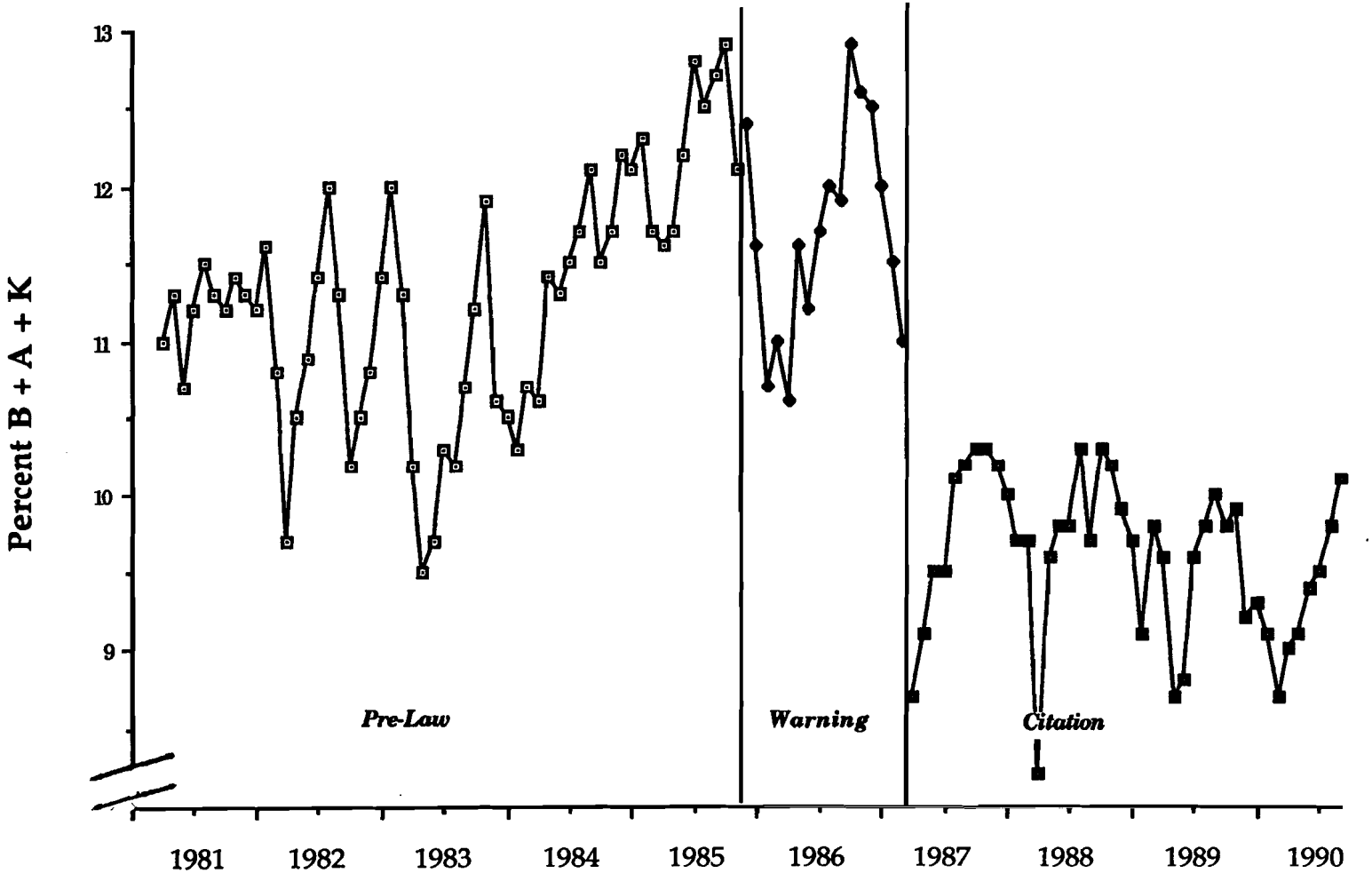

Figure 5. Percent of front seat covered occupants with moderate or worse injury.

vehicle, the serious injury data is plotted in Figure 6. As these occupants are not required by the law to be restrained, there is a more constant rate of injury experience over these phases for this group. The inclusion of the most current data through June 1990 does not alter this trend and the injury percentage is shown to be between 2.1 and 3.5.

For the non-occupant group, one would not expect to notice a decline in serious or fatal injuries. Non-occupants (e.g., bikers or pedestrians) are not directly affected by the law since their safety does not involve seat belt usage. As Figure 7 depicts, this injury rate has remained fairly steady over time. Notice that the data from the most recent study is plotted to June 1990.

From these findings of descriptive statistics, an important question presents itself -- "How much of an injury reduction occurred compared to the level expected, had the seat belt law not been introduced?" In other words, what amount of the injury reduction can be attributed to the seat belt law. Reinfurt, et. al. (1988), includes detailed time series analysis that seek to answer this question by using the computer program STAMP (Structural Time Series Analyzer, Modeller and Predictor) accommodating seasonal variances, cycles, slopes and other nuances, this model compares the crash data of one month to every other month.

Sizable changes were found in the initial report concerning serious and fatal as well as moderate or worse injuries. The estimated percentage of reductions were 11.6 for fatal injuries, 14.6 for serious and fatal and 11.6 for moderate or worse. As similar decreases were not found in non-covered occupants or in non-occupants, these reductions may be attributed to the implementation of the seat belt law.

Additional time series analyses were carried out to update the Reinfurt et. al. (1988) projections. In the recent analysis, it is estimated that injury and fatality reductions for the period January 1987 through June 1990 attributable to the belt law are as follows:

509 fewer fatalities
5,742 fewer serious injuries
4,360 fewer moderate injuries

These, in turn, translate into sizable savings to North Carolina.

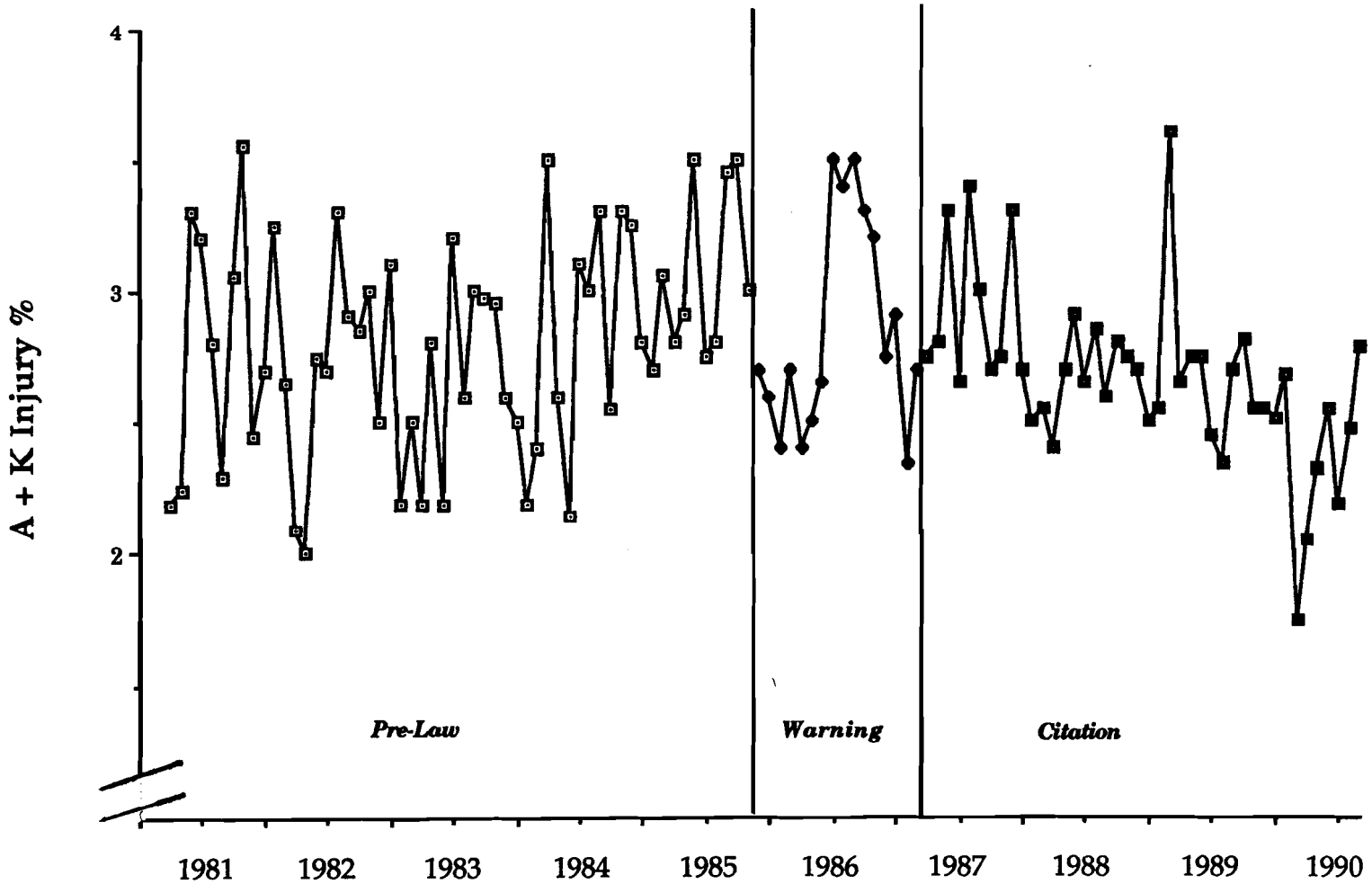

Figure 6. Injury distribution for non-covered occupants.

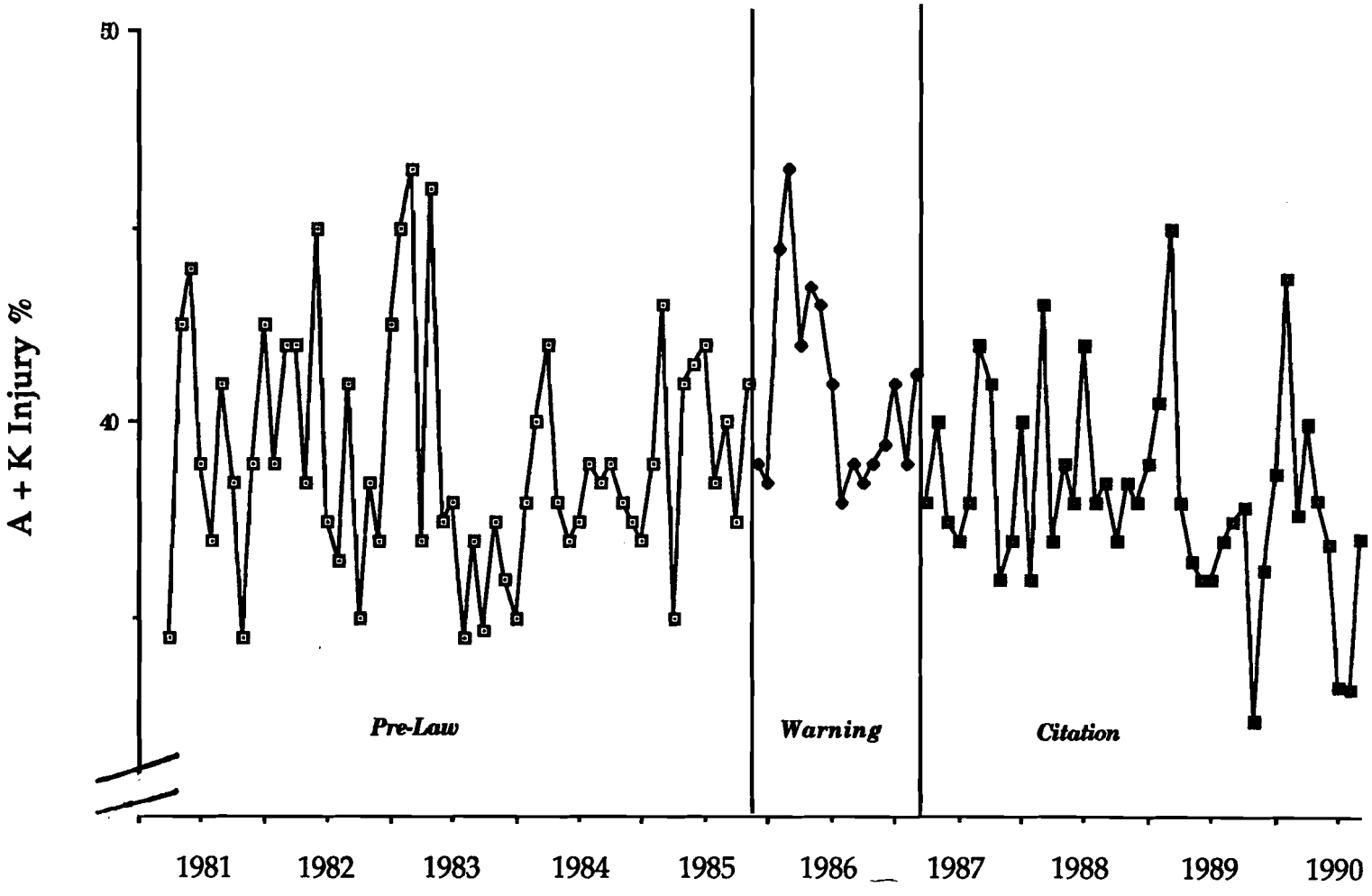

Figure 7. Injury distribution for non-occupants.

Conclusions

Based on the trends shown in Figures 3, 6, and 7 and a consistent statewide usage rate of 60 percent, the seat belt law has maintained a positive effect on vehicle injuries. Supporting this conclusion is the fact that there have been significant changes in the injury distribution only for occupants covered by the law, and that this change appears to "jump" at the beginning of each enforcement phase. Further, these trends continue through survey periods.

ENFORCEMENT EVALUATION

Enforcement activity continues to be monitored with respect to the North Carolina seat belt law and, to a lesser degree, the child passenger safety law. This has included obtaining data on the number of seat belt citations issued by the N.C. State Highway Patrol as well as surveying local police departments for information on their enforcement efforts.

In this effort, numbers of warnings issued by the N.C. State Highway Patrol were compiled during the period October 1, 1985 - December 31, 1986, while numbers of $25 citations issued have been compiled since January 1, 1987. The statewide evaluation of the seat belt law (Reinfurt, et al., 1988) reported that nearly 10,000 warnings were issued each month during the warning ticket phase of the seat belt law and that over 3,100 $25 citations were issued each month during calendar year 1987.

The number of seat belt citations issued monthly by the Highway Patrol since January 1, 1988 is shown in Figure 8. The peaks in the data generally correspond to months containing the holidays of Memorial Day, July 4th, and Labor Day, with the two highest points spanning Memorial Day weekends coinciding with North Carolina Lifesavers' Month.

The figure clearly shows an overall increase in enforcement activity by the N.C. State Highway Patrol. During 1987, a total of approximately 37,620 seat belt citations were issued by the Patrol. For 1988, the total was 64,075 citations, 65,798 citations were issued during 1989, and 80,694 citations were issued through September of 1990. The corresponding monthly averages are 3,135 citations per month for 1987, 5,340 for 1988, 7,285 for 1989 and 8,966 for 1990. These numbers demonstrate a strong level of commitment by the N.C. State Highway Patrol to enforcement of the seat belt law.

To obtain enforcement data at the local level, a mail survey was sent to all police departments in North Carolina as has been done in previous years (see the Appendix for a copy of the survey). The survey was mailed out in July to a total of 378 police departments. Returns were received from 226 departments for an overall response rate of 60 percent. Table 10 shows the number and percentage of returns by size of community. While there was over 90 percent participation by the largest communities, the response rate decreased for the smaller communities, particularly those with populations less than 2,500. This may reflect the situations where many of the police departments

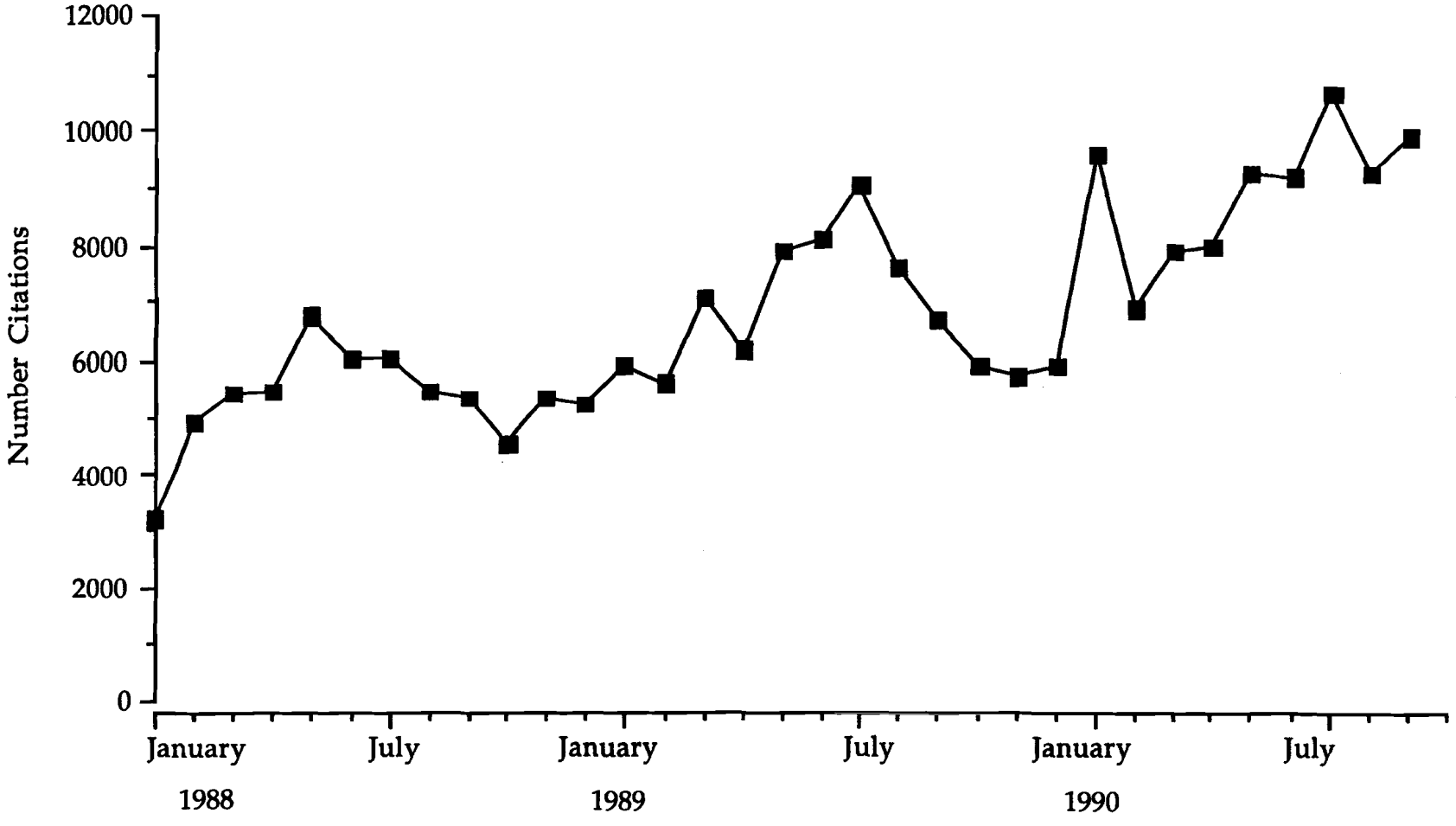

Figure 8. Monthly seat belt citations issued by the North Carolina State Highway Patrol, January 1988 - September 1990.

Table 10. Distribution of 1990 enforcement survey returns by population of community.

Population	Surveys Mailed	Surveys Returned	Percent Returned
<2,500	221	112	50.7
2,500-9,999	106	70	66.0
10,000-49,000	39	33	84.6
50,000+	12*	11	91.7
Overall	378	226	59.8

*Includes two county police departments.

in the very smallest communities have only one or two officers (sometimes part-time) and do not engage in routine enforcement of traffic laws.

It should be noted at this point that this survey is repeated annually with different departments responding but also with different officers in departments completing the surveys each year. For these reasons, the current survey responses will differ from the results from other years.

Table 11 presents information on the average number of seat belt citations issued each month by size of community, based on the total of 226 survey responses. (Note that totals less than 226 reflect unavailable or missing information. Thus, 79 of the departments were unable to provide information for 1987, 68 for 1988, 43 for 1989, and 24 for 1990). As expected, number of citations increases with size of community: in 1990, 65 percent of communities with populations <2,500 averaged less than one citation per month, compared with 47 percent of communities with populations of 2,500-10,000 and only one community with a population over 50,000. Similarly, only two of the 99 smallest communities averaged 10 or more citations per month, compared with 64 percent for communities with populations over 50,000.

These numbers clearly show enforcement activity, at least in terms of citations issued, to be related to size of community. It should be noted, however, that on a per capita basis, the smaller sized communities are not necessarily any "less active" than the larger communities. Indeed, the level of enforcement is quite variable, even among the largest cities. Table 12 presents information on the average number of citations issued monthly by North Carolina cities with populations of 20,000 or greater that responded. (All but

Table 11. Average number of seat belt citations issued monthly by population of community.

Ave. No. Citations Per Month	Communities with Population < 2,500	2,500-9,999	10,000-49,999	50,000+	Total
1987 Seat Belt Citations					
< 1	57 (83.8)[1]	24 (54.6)	6 (22.2)	0 (0.0)	87 (59.2)
1-4	10 (14.7)	15 (34.1)	7 (25.9)	1 (12.5)	33 (22.4)
5-9	0 (0.0)	3 (6.8)	6 (22.2)	2 (25.0)	11 (7.4)
10+	1 (1.5)	2 (4.5)	8 (29.7)	5 (62.5)	19 (12.8)
Total	68	44	27	8	147[2]
1988 Seat Belt Citations					
< 1	55 (78.6)	29 (58.0)	2 (7.1)	0 (0.0)	86 (54.4)
1-4	12 (17.1)	14 (28.0)	10 (35.7)	1 (10.0)	37 (23.4)
5-9	2 (2.9)	4 (8.0)	4 (14.3)	4 (40.0)	14 (8.9)
10+	1 (1.4)	3 (6.0)	12 (42.9)	5 (50.0)	21 (13.3)
Total	70	50	28	10	158[2]
1989 Seat Belt Citations					
< 1	61 (71.8)	30 (53.4)	2 (6.5)	0 (0.0)	93 (50.8)
1-4	21 (24.7)	20 (35.8)	12 (38.7)	2 (18.2)	55 (30.1)
5-9	2 (2.4)	3 (5.4)	8 (25.8)	2 (18.2)	15 (8.2)
10+	1 (1.1)	3 (5.4)	9 (29.0)	7 (63.6)	20 (10.9)
Total	85	56	31	11	183[2]
1990 Seat Belt Citations					
< 1	64 (64.7)	28 (46.7)	2 (6.3)	1 (9.1)	95 (47.0)
1-4	30 (30.3)	23 (38.3)	15 (46.9)	2 (18.2)	70 (34.7)
5-9	3 (3.0)	5 (8.3)	3 (9.4)	1 (9.1)	12 (5.9)
10+	2 (2.0)	4 (6.7)	12 (37.5)	7 (63.6)	25 (12.4)
Total	99	60	32	11	202[2]

[1]Column percent
[2]Totals less than 226 reflect unavailable or missing information

Table 12. Average number of seat belt citations issued each month for larger N.C. communities. [Rates per 10,000 capita in brackets.]

	Population (June 1987) Estimate	1987		1988		1989		1990	
Charlotte	388,995	94.2	[2.4]	36.1	[0.9]	37.3	[1.0]	7.0	[0.2]
Raleigh	213,879	157.9	[7.4]	160.3	[7.5]	101.3	[4.7]	296.7	[13.9]
Greensboro	184,098	--[1]	[--]	122.8	[6.7]	342.9	[18.6]	404.3	[22.0]
Winston-Salem	150,246	--	[--]	--	[--]	88.3	[5.9]	107.0	[7.1]
Fayetteville	73,043	26.7	[3.7]	99.2	[13.6]	57.5	[7.9]	113.5	[15.5]
High Point	67,060	12.3	[1.8]	12.8	[1.9]	25.6	[3.8]	15.3	[2.3]
Asheville	60,429	2.8[2]	[0.5]	1.2[2]	[0.2]	1.0[2]	[0.2]	0.5[2]	[0.1]
Wilmington	55,458	12.7	[2.3]	8.5	[1.5]	3.8	[0.7]	2.8	[0.5]
Gastonia	54,606	8.3[2]	[1.5]	8.3	[1.5]	7.2	[1.3]	3.5	[0.6]
Rocky Mount	49,191	13.4	[2.7]	5.6	[1.1]	1.0	[0.2]	0.3	[0.1]
Greenville	43,130	21.3	[4.9]	3.3	[0.8]	5.2	[1.2]	11.0	[2.6]
Cary	39,094	20.0[2]	[5.1]	20.0[2]	[5.1]	30.0[2]	[7.7]	30.0[2]	[7.7]
Burlington	38,798	30.2	[7.8]	18.9	[4.9]	32.1	[8.3]	28.5	[7.4]
Chapel Hill	37,688	8.6	[2.3]	4.2	[1.1]	1.3	[0.3]	1.5	[0.4]
Goldsboro	34,722	6.8	[2.0]	10.2	[3.0]	8.3	[2.3]	8.0	[2.3]
Kannapolis	32,431	16.8	[5.2]	18.8	[5.8]	31.0	[9.6]	62.5	[19.3]
Jacksonville	29,547	0.3[2]	[0.1]	0.2[2]	[0.1]	1.8[2]	[0.6]	1.3[2]	[0.5]
Concord	28,408	8.0	[2.8]	3.6	[1.3]	4.2	[1.5]	3.5	[1.2]
Salisbury	23,966	--	[--]	3.6	[1.5]	41.3	[17.2]	46.5	[19.4]
Lumberton	20,087	1.3	[0.6]	1.0	[0.5]	2.9	[1.4]	1.8	[0.9]
Statesville	19,755	8.0	[4.0]	9.0	[4.6]	6.5	[3.3]	28.5	[14.4]

[1]Indicates information not available or unknown.
[2]Numbers reported as "approximate".

two of these cities responded to the survey.) As is clearly evident from the table, larger population size does not always correspond to higher monthly average seat belt citations. Also, there is considerable variability from one year to the next.

Table 13 presents the average number of total citations issued by size of community.

Table 13. Average number of total seat belt citations issued by population of community per year (1/2 year for 1990).

Population of Community	1987	1988	1989	1990*
<2,500	7.9	11.0	13.1	14.6
2,500-9,999	20.5	30.4	33.3	37.2
10,000-49,000	96.9	104.9	125.5	167.4
50,000+	480.3	555.1	759.8	1080.2

*Numbers are based on mid-year estimates.

In addition to information on citations issued, departments were asked whether they had engaged in other seat belt enforcement or education activities since January 1990. Table 14 lists these activities, along with the percentage of police departments responding positively to each. Departments were most likely to report that they had conducted seat belt checks at roadblocks, etc. (53% "yes") and that they had given seat belt presentations to school, civic, business or church groups (52% "yes"). No other type of activity was conducted nearly as frequently as these two. The next most prevalent type of activity, issuing press releases, news stories, etc. about seat belts, was carried out by only about a fourth of the departments. Twenty percent had sponsored special events or activities in connection with Child Passenger Safety Awareness Week, Buckle Up America Week, or Lifesavers' Month and only a few (5.3%) were conducting education programs about automatic restraints.

Table 14. Participation by local police departments in other seat belt enforcement or education activities since January, 1990.

Seat Belt Enforcement/Education Activity	% Responding "Yes"
Conducted seat belt checks at roadblocks, etc.	52.7%
Issued press releases, news stories etc, about seat belts	23.0%
Made presentations to school, civic, business or church groups	52.2%
Sponsored special activities or events for 1990 Child Passenger Safety Awareness Week (February 11-17)	19.9%
Sponsored special activities or events for 1990 Buckle Up America Week or Lifesavers' Month (May)	19.9%
Conducted public education programs concerning air bags or automatic seat belts	5.3%

One question that was new to last year's survey concerned whether the department had conducted any public education programs concerning air bags or automatic belt systems. Only three percent responded that they had. This figure increased slightly to five percent this year. Related to this, eleven percent of the departments responded that their officers had investigated crashes involving air bags. Six of the 24 departments that responded "yes" to this question also responded to the open-ended question asking if there was anything spectacular or unusual to report on these crashes. Two indicated that they felt injuries were reduced by the air bag, two felt that the air bag only partially inflated and serious injuries were not prevented, and two indicated that the air bag did not deploy at all when it was supposed to but there was no report of the injury outcome. These responses suggest that the local officers need more information about the function of air bags and what their limitations are in different types of crashes.

A final enforcement-related question on the survey was an open-ended question that asked, "If you wanted to increase the seat belt use rate in your community, what do you think would be the most effective approach to take?" As was the case for last year's survey, the approach most often cited was stricter enforcement of the law itself, i.e., increased ticketing (see Table 15).

Table 15. Approaches suggested to increase the level of belt use in communities.

Approach	% Responding
Stricter enforcement/more tickets	32.8%
More education/public awareness	22.4%
Seat belt checks at roadblocks	12.6%
More media awareness/reporting	10.9%
Target efforts at children	3.8%
More warning tickets	3.3%
Other methods	10.4%
None needed	3.8%

Nearly a third of the police departments indicated that they thought this would be the most effective way of increasing their community's belt wearing rate. Next most often cited was increased education and public awareness ("PI&E"), advocated by 22 percent of the respondents. Thirteen percent of the departments felt that increased use of seat belt checks and roadblocks would be the most effective approach to increase belt use, while an additional 11 percent noted increased media attention to seat belts. Four percent felt that efforts should be targeted at children while four percent felt that no additional efforts were needed.

In summary, the results of the June 1990 law enforcement survey indicate continued widespread variability in the level of enforcement of the North Carolina seat belt law by local police departments. At the same time, there is evidence that the overall level of enforcement is increasing. The State Highway Patrol has continued to vigorously enforce the law, and again in 1990 the level of enforcement has continued to increase over time. Both trends are encouraging, since the effectiveness of seat belt laws are closely tied to the level of enforcement accompanying them (Campbell, et al, 1987). At the same time, the need continues to exist for working with local police departments to help them identify the "best" combination of seat belt enforcement, education, and public information activities to promote a positive attitude towards seat belts and a high wearing rate in their own unique setting.

AN OVERVIEW OF ACTIVITIES ASSOCIATED WITH THE PROJECT ENTITLED "SAFETY BELT LAW DEMONSTRATION GRANT PROGRAM"

In September of 1988, the Highway Safety Research Center was officially awarded a demonstration grant sponsored by the National Highway Traffic Safety Administration. This two-year effort is focused on seat belt law enforcement in local communities. The goal is to use "soft" enforcement strategies to increase the local belt use rate. The main elements of the enforcement strategies include: (1) the widespread use of seat belt "salutes," where a police officer grabs the shoulder belt and gives a "thumbs up" reminder sign to an unbelted motorist, (2) a modified incentive program whereby properly restrained motor vehicle drivers and their passengers can win prizes when observed by local police, and (3) a comprehensive public information and education (PI&E) campaign to keep the community informed about the program. Belt use data will be collected in experimental and comparison communities to determine if the strategies have been successful.

Because of the labor intensive nature of this demonstration program, this GHSP project has provided support for the demonstration. This has provided an interlocking program arrangement with the goal of increasing the seat belt use rate in North Carolina. Grants from 402-funds were also provided by GHSP to the experimental communities to offset local promotional costs. The remainder of this section will describe the activities and progress of the demonstration program from October 1, 1989 through September 30, 1990.

Site Selection and Subsequent Planning

During the first project year, Albemarle and Gastonia were selected as experimental sites and Statesville as a comparison site. The themes selected by the experimental communities were:

Albemarle: Albemarle Clicks - Buckle Up and Survive the Drive!

Gastonia: Protect the Best - Gastonia Buckles Up!

Artwork suitable for brochures, logos, banners, etc. was prepared by the HSRC media specialist. The layout and text for brochures were also prepared by HSRC staff. Each community used all of the items mentioned above and others to help promote their campaigns.

Local Police Training

Just prior to the mid-November, 1989 kick-offs, the HSRC principal investigator familiarized the patrol officers of both the Gastonia and Albemarle police departments about the plans for the project. These were the individuals who would be giving the seat belt "salutes" and interacting with the public for the on-street or in-traffic activities. The importance of their participation in the project was conveyed, and each training session was completed by giving the officers a chance to ask questions about belts and their effectiveness. The HSRC video entitled, "The Need for Safety Belts," prepared especially for police, was used to reinforce various concepts about belts and the importance of police always "buckling up".

Program Kick-Offs

The official kick-off occurred for "Albemarle Clicks" on November 15, 1989 at Albemarle Senior High School. NASCAR driver Kyle Petty was a featured guest, and Chief Charles McManus was the master of ceremonies. Bill Hunter, the HSRC principal investigator, explained the project, and Vince and Larry and McGruff all helped to generate enthusiasm. Kyle Petty made some very appropriate remarks about why belts are so important. Immediately after the kick-off, a seat belt checkpoint was set up near the police station and campaign literature handed out by local officers, assisted by Vince and Larry and McGruff. Banners set up at four locations around the community also helped to spread the message. Various media were present for both events. All things considered, the HSRC staff felt it was the best project kick-off with which we had ever been involved.

The "Protect the Best" kick-off for Gastonia was held on November 20, 1989, at the City Council Chambers in City Hall. The kick-off was a press conference and included remarks by Chief Jack Postell, Bill Hunter of HSRC, Paul Jones of the NC GHSP, Romell Cooks of NHTSA, and featured guest Mike McKay, who is a popular weatherman for one of the Charlotte, N.C. television stations and has been a seat belt spokesperson since surviving a severe crash by being belted. Master of ceremonies was Cpt. Danny Cochran, project coordinator for the Gastonia Police Department. After the press conference, a seat belt checkpoint was set up outside the city hall and campaign literature and T-shirts handed out. Vince, Larry, McGruff, and local officers participated. A number of local print media were present, but no local

television stations. News staff for Mike McKay's station apparently had a conflict and did not cover the event. Because Gastonia's population is larger and less contained than Albemarle's population, it is more difficult to "get the word out," and we feel that lack of television coverage diminished the potential effectiveness of this kick-off. The belt use results reported below probably may reflect this.

Prior to the kick-offs, many details were handled. Lauren Marchetti of HSRC played a particularly important role in contacting media, preparing project brochures and press kits, and providing other art work and valuable suggestions. The Albemarle project coordinator, Cpt. Matt Cagle, arranged for a variety of promotional items to be available on kick-off day, including very popular T-shirts and hats.

Program Activities and Monitoring

The programs in Albemarle and Gastonia continued through June 1990. During this time, HSRC staff offered suggestions, consultation, and encouragement and monitored all aspects of the programs.

Both communities were quite busy with program activities. Below is a partial list for each:

Albemarle
"Albemarle Clicks"

Use of seat belt salutes
Seat belt check points
Seat belt display at YMCA
Radio spots
Good newspaper coverage
Health Fair at middle school
Program at First Baptist Church
"Mayfest" program using Vince & Larry
Albemarle High School Career Day program
Child Care (Seat Belt) program at Senior Center
Start-up of child seat rental program
"Albemarle Clicks" signs at entrance to community
4-color T-shirt with Vince & Larry
Lifeguard program at Albemarle High School

Gastonia
"Protect the Best"

Seat belt check points
Radio PSA's and interviews
Good newspaper coverage
Flier promoting program in local utility bills
Drawings for prizes
Program for 6th graders with prizes
Adopt-a-Cop program for school children with prizes
Seat belt program at Trinity Church
Elementary school poster contest
High School PSA contest
Parking lot handouts of fliers promoting "automatics"
Parking lot handouts of fliers promoting belt use in pickup trucks
Booth at mall with local scouts
Display, handouts at "Pit Stop for Kids" NASCAR display at local mall
Start-up of child seat rental program
Lifeguard program at both local high schools

Several of these items merit further comment. Both communities initiated a "lifeguard" program at local high schools. This involved student groups monitoring belt use in school parking lots. Students were dressed to look like lifeguards and worked from a regular lifeguard chair or stand. Prizes consisting of inexpensive sunglasses (with the popular neon frames) and other beach-like items were given to randomly selected vehicles. The program was active for 3-4 weeks at two Gastonia high schools, but only a day or two at Albemarle Senior High School. The belt use rate exceeded 70 percent at Gastonia Ashbrook while the program was in place. The HSRC staff has been promoting this concept for some time and was very pleased that this activity could be tried. The concept was fun for participants, as well as successful in significantly raising the belt use for the high school drivers and passengers in Gastonia.

Another activity was the development of fliers both to educate the drivers and possible purchasers of vehicles equipped with automatic restraints and to promote the police program. For cars equipped with motorized shoulder belts, the message is that lap belts are still needed. With air bags, the need is to use the available manual belt system. The method involved using police explorer scouts to visit car dealerships to become familiar with cars equipped with "automatics." Besides leaving a supply of fliers with each dealer and asking each to place a flier on the cars equipped with automatics, the scouts would then go to various parking lots in the community to place the flier under the wiper blade on the windshield of these specially equipped cars. The fliers also referred to the local police program.

In addition to the automatics flier, HSRC prepared another flier that was placed on pickup trucks by the scouts. This flier urged the use of belts by these drivers and passengers, in that the belt use rate for pickups has been appreciably lower than for passenger cars.

Both communities purchased Vince and Larry costumes and used these in various promotions. Seat belt salutes were used by the Albemarle police and were a visible part of the program, but the salutes appeared to be used much less extensively in Gastonia. Local newspaper and radio coverage was also excellent in Albemarle, but effective coverage was less prevalent in Gastonia. The seat belt wearing results reflect these differences.

Data Collection and Results

Local seat belt use data were the primary outcome measure. In Albemarle, a group from an active senior citizens' center were trained to collect the data by HSRC staff and did an excellent job. HSRC collected the data at Gastonia as well as the comparison site in Statesville. The Gastonia police were simply never able to attract suitable candidates to hire as data collectors.

Shoulder belt use data were collected at representative intersections in all three communities. The baseline use rate was 48.5 percent in Gastonia and 51.5 percent in Albemarle. Shown below are the overall belt use rates for each community across time. One additional data point will be collected in Gastonia in October 1990.

Overall Community Belt Use Rates

Albemarle		Gastonia		Statesville	
Baseline = 48.5%		Baseline = 51.5%			
During:		During:			
11/20/89	55.9%	11/28/89	47.9%	6/2/89	53.3%
12/5/89	55.4%	1/2/90	46.4%	10/23/89	54.5%
12/20/89	54.8%	2/6/90	52.2%	11/30/89	51.2%
1/9/90	54.3%	2/28/90	47.4%	12/20/89	53.0%
1/23/90	58.2%	4/11/90	53.1%	1/30/90	53.3%
2/6/90	57.8%	5/1/90	50.9%	3/6/90	52.8%
2/20/90	58.7%	6/19/90	53.2%	4/4/90	50.8%
3/6/90	59.7%			5/23/90	53.2%
3/20/90	64.0%			8/21/90	57.8%
4/10/90	64.5%				
5/1/90	64.6%				
5/22/90	68.2%				
6/12/90	62.4%				
After:		After:			
7/10/90	60.4%	7/31/90	50.4%		
7/31/90	61.2%	8/22/90	48.5%		
8/21/90	62.2%				
9/4/90	63.9%				

The Albemarle program has been quite successful. Some belt use decrease was expected after peak program activity through June 1990, but the decline has been slight. The peak value of 68.2 percent reached in late May 1990 easily exceeded the statewide belt use rate of 57.5 percent recorded in January 1990.

The Gastonia experience has been less successful, even though it was apparent that increasing the belt use rate in this 60,000 population community would be harder than in Albemarle (population 15,000). Gastonia's peak belt use rate was 53 percent in April and June of 1990, up from a baseline of 48.5 percent. However, the fall-off in the after period returned to baseline levels.

The comparison community of Statesville had a consistent belt use rate of around 52 percent until the most recent data in August, where the use rate climbed to 57.8 percent. However, this followed 4-5 months of active seat belt enforcement in areas of high drug use. Since these seat belt violations are published in the local newspaper (along with other violations), it is felt that this publicity, along with word of mouth in a typically low belt use area, played a prominent role in the last quarter belt use increase. Heavy ticketing was not intended as a program activity in the experimental sites, since the emphasis was on "soft" approaches. This level of ticketing also exceeded what we had expected in the comparison community.

Final Evaluation

During the last quarter of 1990, a full evaluation of the programs will take place. All of the belt data will be analyzed, including examination of race, sex, and vehicle type variables. It will be instructive to see if the increases in Albemarle resulted form increased belt use by pickup truck drivers, by race and sex groups, or some combination of race/sex/vehicle type.

Follow-up interviews are also planned with project coordinators and other police personnel to get their reaction to the program and how they felt it was perceived in the community. All of these results will be documented in a final report. A community guidebook for undertaking similar efforts will also be prepared.

AN OVERVIEW OF ACTIVITIES ASSOCIATED WITH THE PROJECT ENTITLED "STRATEGIES TO EDUCATE AND INCREASE OCCUPANT PROTECTION USAGE AMONG RURAL DRIVERS AND PASSENGERS"

As shown previously in this report, rural belt use percentages are much lower than in the urban areas. For September 1990, this rate was 50.1 percent versus 61.6 percent. Because of this discrepancy, rural areas represent a primary target for education in the area of seat belt usage.

Based on this obvious need, project staff designed a model program used to assess seat belt usage in rural areas, and further, to improve usage rates. This was done by first selecting the appropriate counties in North Carolina to serve as the experimental and control sites. Before, during and after a thorough campaign to increase belt usage in the study site, observations will be made to assess the apparent effectiveness of such a project. This effort is a cooperative project funded through an NHTSA demonstration grant, a GHSP community grant to Bertie County and through the resources of the GHSP seat belt project.

If successful, the resulting program can be used as a model in similar communities to increase education concerning seat belts, and therefore, increase belt use in these more rural communities. As the campaign will officially "kickoff" November 2, 1990, assessments of the effectiveness of the program cannot be made as of yet, although details of the project design are discussed below.

Site Selection

Initial candidates for this study included Hertford, Northampton, Halifax, Gates, Duplin and Bertie counties. Data collectors were sent to each of these areas to collect belt usage at various sites such as in towns, at rural crossroads, and at entrances and exits to major businesses, industries and high schools. Demographic information and potential community resources were also included in these area audits. All of these sites are very rural in nature and have belt usage rates significantly below the state average. Preliminary data suggested that the rural site selected would have a belt usage rate of 30 to 40 percent.

Next, telephone interviews were conducted with agencies in these counties.

Through these surveys, Hertford and Bertie counties were identified as the two sites with the most advantageous combination of support for this project.

The level of enthusiasm and commitment shown from many groups and organizations in the county made Bertie the first choice for the conduct of the program. Representative at the site visit included the sheriff; the police chief from Windsor; the high school principal and several of his staff; the director of emergency medical services; and the county health director.

Needs Assessment

To initially assess the attitudes about seat belts, a survey was administered in May to all 10th and 11th graders at Bertie High School. This survey was administered to high school students in the comparison area (Hertford County High School) in September along with a high school in the rural part of Moore County. Attitudinal data are being collected in Moore County, where rural belt use is high, to see if there are any detectable attitudinal differences that contribute to higher rural belt use.

A similar survey was conducted through the Driver License Office of the North Carolina Division of Motor Vehicles to applicants who had passed the licensing procedures and were waiting for their photographs to be processed. This survey was conducted in Bertie County, the comparison areas of Hertford and Northampton Counties, and in Moore County. This information will be used to: 1) determine how people in Bertie County and eastern North Carolina feel about seat belts and what might motivate them to use belts more frequently; 2) detect differences in responses in high-belt-use rural areas from low-belt-use rural areas to determine if any attitudes or beliefs might contribute to belt use and thus be used in the program; and, 3) examine responses of specific subgroups such as pickup truck drivers to see if campaign strategies could be focused on techniques to increase use among lower-belt-use populations.

Core Program and Public Information Development

The initial coalition of local leaders included the Sheriff's Department, Windsor Police Department, Bertie County High School, the Search Team of the Bertie County Rescue Squad, the Bertie County Rural Health Association, and the County Health Department. Since that time, the Aulander and Lewiston-Woodville Police Departments and **The Bertie Ledger** have joined the coalition called the Bertie Committee for Seat Belt Safety. The inclusion of these two police

departments means that every department in the county is now involved in the program. **The Bertie Ledger**, published on a weekly basis, is the only paper in the county and is read by most county residents.

Through the GHSP community grant awarded to Bertie County, the committee has purchased items for use in the program kickoff. The items include bumper stickers, small incentives such as key chains and travel mirrors, and printed materials such as handout cards and seat belt check road signs. The health department, through a grant from the North Carolina Department of Human Resources, has purchased the Vince and Larry costumes and is sharing them with this project. The theme "Bertie Buckles Up" is being used on all project materials. The following is a brief description of the activities planned by the CORE program leaders:

Law Enforcement. The Windsor, Aulander, and Lewiston-Woodville Police Departments, along with the Bertie County Sheriff's Department, will be conducting seat belt road checks in which belted motorists will be given small prizes. They also will be giving out information, using the Vince and Larry costumes, and working with high school clubs in promotions all around the county.

Newspaper. The Bertie Ledger is running small filler ads which alert people to buckle up because "Starting November 2nd, good things will happen to people who wear seat belts in Bertie County." The paper has also agreed to give extensive coverage to the kickoff and to run at least one major article a month on some aspect of the program, such as what high school students are doing, how the Search Team is collecting use data, how pickup truck drivers need to increase their belt use, etc. They will also give regular updates on the current belt use rates.

Health Department and Office of Emergency Management. These two organizations have teamed up to work with the major employers in the area. The EMS coordinator has worked with many of the safety officers and employers in the county, and as part of the kickoff, educational programs will be given at major employers such as the local poultry processing plant (largest employer in the county), a textile plant, and a lumber yard. These businesses will have belt use recorded on a regular basis and a barometer set up at the plants to monitor each site's progress. They also plan to work with the local agri-business stores (suppliers of seed, fertilizer, equipment for the farming industry). During the off-season, these agri-business centers invite farmers

in for coffee and to hear about the latest products. This is an excellent opportunity to conduct incentive programs in the parking lots and educational programs inside the stores.

High School. The principal of Bertie High School, the only high school in the county, is the head of the community coalition. The school will participate from several standpoints: 1) students and faculty will conduct programs to encourage belt use among the high school students; 2) the students will conduct programs in the elementary schools across the county; and, 3) the students, through clubs and special classes, will provide manpower and resources to the various community programs. The principal and select students have met with representatives from all the county schools to inform them about the program and get ideas on the types of activities to conduct at the schools. Special activities are being planned for high school athletic events (which have a tremendous draw from the county) and an assembly program is being planned to coincide with the kickoff. The shop class has made seat belt check signs for the police departments, and the art department is painting banners. The Smart Moves packages, developed by HSRC for high school programs, has been distributed to student groups as well as the elementary schools and will serve as a framework for developing programs. Using driver education teachers and students, the school will collect its own belt use data.

Data Collection

Three waves of baseline seat belt data have been collected by the Bertie County Search Team at 11 sites in Bertie County that represent school areas, local industrial settings, the downtown areas of communities, and rural crossroads. The first two waves have been analyzed and indicate that the overall usage rates are around 35 percent with the rates somewhat lower in outlying areas. The Search Team will collect data a minimum of 12 times during the project and will be instrumental in the educational programs within the project. Their supervisor is one of the core leaders planning the project.

The comparison sites include the Hertford County High School, local businesses, downtown locations and rural crossroads in Hertford and Northampton Counties. The sites are confined to northern Hertford and Northampton Counties to maintain sufficient distance from Bertie County in order to avoid spillage of the program into the comparison areas. Two waves of data have been collected and analyzed in the comparison sites and usage rates have been

consistently around 33 percent. Data in the comparison site are being collected by HSRC personnel in a pattern similar to that in the experimental site.

Conclusions

The community program will run through June 1991. Data on belt usage in the experimental and comparison sites will continue to be collected through August, 1991. Analyses of the effectiveness of the program along with conclusions and recommendations will be contained in a report to NHTSA to be completed by December 1991.

AN OVERVIEW OF ACTIVITIES ASSOCIATED WITH THE PROJECT ENTITLED "COMPREHENSIVE PROGRAM FOR INCREASING USE OF SAFETY SEATS AND BELTS FOR CHILDREN AND YOUNG ADULTS"

The "Police Actions" project and the GHSP project working to increase the use of safety seats and belts for children and young adults are complementary and have benefited from coordinated efforts. These coordinated efforts have been concentrated in three areas.

The first area has been the development, production and distribution of a seat belt training videotape targeted at law enforcement officers in North Carolina. The premise of this program is to convince officers to wear their own belts, to encourage them to enforce the seat belt and child passenger safety laws, and to provide officers with general information about crash dynamics and how restraint systems work. Input was solicited from the law enforcement community during the planning and production stages.

Two segments of the program were completed under the FY 88 projects. The first encourages the officers to wear their own belts and the second encourages them to actively enforce the restraint laws and informs them of the requirements of both laws.

Two segments were completed under the FY 89 projects. The first of these contains a segment on enforcement tips with examples of public education and enforcement programs being conducted across North Carolina along with research findings about how to affect belt wearing rates. Officers are given the information that they need to help sell people on the need to wear belts and to dispel myths about belt use that they may encounter when dealing with the public. The other segment explains crash dynamics and how safety seats and seat belts work to reduce injuries. It also explains the different types of restraint systems including automatic belts, air bags and various types of safety seats.

The final segment, produced under the FY 90 projects, explains the different types of safety seats and how seat belts should be used with children. It stresses that consistent use of safety seats and belts for infants, toddlers and older children can help to develop strong belt wearing habits that will continue as they become teenagers and start driving or riding with other beginning drivers.

The completed program contains five segments totaling about an hour in length. The format of five short (twelve to eighteen minutes each) segments makes it suitable for roll call training or other short training sessions. The tape was distributed to all local police departments, sheriffs' departments and State Highway Patrol Troop and District offices during April, 1990 as a part of an awareness campaign associated with "Buckle Up North Carolina Week" and "Lifesavers Month"

As previously mentioned, the target audience for the program is police officers. However, it was felt that, to the degree possible, it should be presented in a manner that could also be shown to the general public since it was felt that it would probably be used in this capacity. The 1990 police survey discussed earlier asked how this program was being used and what the departments' plans were to use it in the future. Many indicated that they were using it for the training of their officers and a large number also indicated that they have been or plan to use it for schools, civic clubs and other public audiences.

The second area of cooperative effort between the two projects was to continue to assist with the provision of occupant protection information through an in-state toll-free telephone line referred to as "Belt Line". Initiated in 1981, this service was dedicated to providing information on child safety seats. During the following years, HSRC began receiving more and more calls relating to seat belts for adults as well. With the implementation of the seat belt law in 1985, the level of calls pertaining to adults and the seat belt law rose to a level comparable to that for children. With this change, more HSRC staff became involved in answering calls and it was decided to help support this service through both restraint projects. During this project year, 23.6 hours per month were spent answering public inquiries through this service. Most of these calls resulted in additional written materials being mailed to the callers.

The third area of cooperation was to help cover some of the sizable printing and mailing costs that are incurred in the distribution of materials to the local police departments. This year for North Carolina Lifesavers' Month, all departments were sent the seat belt training tape produced by HSRC. General information as well as other educational and promotional materials were sent to the local law enforcement agencies along with the tapes.

DISTRIBUTION OF TAD MANUALS

From previous GHSP projects, funding was made available to purchase TAD Damage Rating Manuals from the National Safety Council for distribution to North Carolina's law enforcement agencies. The current project provided support for distribution of these manuals to various departments upon request.

During the year, some 1534 TAD manuals were distributed to 24 police departments, the Highway Patrol, and also community colleges that teach accident investigation courses. The police departments that received copies included Charlotte, Carrboro, Monroe, Fayetteville, Gastonia, Smithfield, Fuquay-Varina, Winston-Salem, High Point, Atlantic Beach, White Lake, and Greensboro. Community colleges receiving supplies of TAD manuals included Randolph Community College, Catawba Valley Community College, and Isothermal Community College.

In short, this project has facilitated the continued input of vehicle damage ratings in the North Carolina statewide crash data. As vehicle damage ratings correlate very well with injury severity, they provide excellent data for evaluation studies where it is necessary to control for crash severity. Thus, with the inclusion of TAD ratings, North Carolina police-reported accident data continues to be among the very best in the United States.

SUMMARY

As is clear from the efforts and results described in the preceding sections, this has been a most ambitious effort in getting North Carolinians to increase their seat belt usage. In the area of population-at-risk data, two surveys were conducted during the project year. The first in January of 1990 saw the lowest overall driver usage rate of 57.5 percent that has occurred since the citation phase began in January 1987. However, the subsequent wave carried out in August and September of 1990 shows wearing rates for the driver up to slightly over 60 percent. This usage rate hovering around 60 percent continues to be one of the highest in the nation.

As has been true since the beginning of the data collection, belt usage has been highest in urban areas; in the piedmont region followed by the coast; during commuting hours; in cars (well over 60 percent) as opposed to pickups (at around 40 percent); among females; and also slightly higher for the non-white drivers and front-seat occupants.

As part of the statewide survey of 72 sites, data were collected on usage of automatic seat belts in new model cars. The data collected from three survey periods were analyzed and a journal article prepared which is in press for Accident Analysis & Prevention. Although shoulder belt usage was highest (94.2%) in the motorized automatic shoulder belt system, the use of the manual lap belt in these vehicles was under 30 percent. This is in contrast to the use of the lap and shoulder belt in the non-motorized automatic systems of around 75 percent.

Examination of various injury levels (K, A+K, B+A+K) by comparison group (namely, occupants covered by the seat belt law, occupants in vehicles that are not covered and non-occupants), shows a continued reduced injury experience for those covered by the law. The injury pattern for those non-covered groups has remained virtually unchanged from what it was prior to the law.

With respect to enforcement of the seat belt law, the State Highway Patrol continues a high level of enforcement. In fact, toward the end of this year, the Highway Patrol averaged some 9249 citations per month as opposed to approximately 3300 carrying the first quarter of the 1987 when the $25 citation phase began. There is also some indication that the local enforcement activity has increased but, as previously, there is widespread variability ranging from virtually no enforcement to very aggressive enforcement.

A sizeable number (over 1500) of TAD manuals have been distributed to local police departments, the Highway Patrol, and to community colleges that offer courses in police accident investigation. As a result of this continuing program of providing TAD manuals to the local police, we see excellent vehicle damage severity ratings in the statewide crash data which provide a very useful tool for carrying out research and evaluation.

Finally, this project helped to support three other seat belt projects. The first of these has dealt with nonenforcement techniques by police officers for increasing seat belt usage in the community. The two experimental communities were Albemarle and Gastonia, while the comparison site was Statesville. The programs have been completed and results are now being analyzed. It would appear that the program was especially productive in Albemarle (which is a smaller community) where belt usage rose from a baseline of 48 percent to a high of around 65 to 68 percent and has leveled off at around 62 percent in the post-program phase.

In the second project which deals with increasing usage in rural communities, there has been considerable planning and PI&E development for the effort in Bertie county. The kickoff for the actual program is scheduled for November 2. The comparison counties that will be studied are Hertford and Northampton. The baseline usage rates have been obtained and are in the 33 to 35 percent region for all three counties.

The final project has involved increasing the use of safety seats and seat belts for children and young adults. This project helped support the Toll-free "Belt Line" available to citizens across the State to ask questions about restraints and also to obtain information from HSRC. In addition, printing and distribution costs were supported by this overall project.

In short, a coordinated variety of efforts aimed at getting belt usage rates up in North Carolina was supported by this project. Overall, it would appear that the efforts have been very successful.

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APPENDIX

N.C. SEAT BELT LAW ENFORCEMENT SURVEY FORM

N.C. Seat Belt Law Enforcement Survey
July 1990

1. Name of Department: _____

2. Please tell us the total number of **$25 citations** issued by your department for non-compliance with the N.C. Seat Belt Law (G.S. 20-135.2A) and Child Passenger Protection Law (G.S. 20-137.1):

   (Put a check (✔) in small box if numbers are approximate)

	1987	1988	1989	Jan.-June 1990
Total Number of $25 Seat Belt Citations	☐	☐	☐	☐
Total Number of $25 Child Restraint Citations	☐	☐	☐	☐

3. How well does your local court system uphold your seat belt citations?

   _____

   What types of problems have your officers experienced in this area? _____

   _____

   _____

4. How often do your officers stop vehicles to issue seat belt citations without other violations such as speeding being involved? _____

   _____

5. How often do officers in your department use seat belt violations to establish probable cause for stopping vehicles suspected of other violations such as DWI or possession of drugs?

   ☐ Often ☐ Sometimes ☐ Occasionally ☐ Never

   Any Comments? _____

6. In April as part of the Lifesaver's Month promotional package, a videotape entitled, "Seat Belts - A Program for North Carolina Law Enforcement Officers" was sent to all Chiefs of Police in North Carolina. Did your department receive a copy of this tape? ☐ Yes ☐ No

   If yes, has this tape been used by your department?

   ☐ Yes. How was it used? _____

   ☐ No. Do you plan to use it in the future? Why or why not? _____

   _____

7. Below are listed some seat belt enforcement/education activities. Please indicate whether your Department has engaged in any of these **since January 1990:**

	Yes	No
Conducted "seat belt checks" at roadblocks, etc.	___	___
Issued press releases, news stories, etc. about seat belts	___	___
Made presentations about seat belts to school, civic, business, or church groups	___	___
Sponsored special events or activities in conjunction with Child Passenger Safety Awareness Week, February 11-17, 1990	___	___
Sponsored special events or activities in conjunction with Buckle Up America Week or Lifesavers Month, May 1990	___	___
Conducted public education programs concerning airbags or automatic belt systems (Please describe)_____	___	___
_____		
Other: _____	___	___

8. What do you think the belt use rate is in your community? _____%

9. To increase the seat belt use rate in your community, what do you think would be the most effective approach to take? _____

_____

_____

10. Has your department investigated any crashes involving vehicles equipped with airbags? ☐ Yes ☐ No

If yes, was there anything spectacular or unusual about any of the crashes? Please describe _____

_____

* *

Name and address of person completing this survey, or person we may contact for additional information if necessary:

_____

_____

_____

Telephone: _____
Area Code Number

THANK YOU! Please use back of form for any additional comments or suggestions. Return in the enclosed stamped envelope or mail to:

Don Reinfurt, Associate Director
UNC Highway Safety Research Center, CB #3430
Chapel Hill, N.C. 27599-3430