

**DOT HS-800 859**

# **EFFECTIVENESS OF SAFETY BELT WARNING AND INTERLOCK SYSTEMS**

**Contract No. DOT-HS-200-2-451**

**April 1973**

**Final Report**

**PREPARED FOR:**

**U.S. DEPARTMENT OF TRANSPORTATION**

**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**

**WASHINGTON, D.C. 20590**

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1. Report No. DOT HS-800 859	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Effectiveness of Safety Belt Warning and Interlock Systems	5. Report Date April, 1973	6. Performing Organization Code
	8. Performing Organization Report No.	
7. Author(s) Joel B. Cohen, Ph.D., A. Suzanne Brown	10. Work Unit No.	
9. Performing Organization Name and Address National Analysts, Inc. 400 Market Street Philadelphia, Pa. 19106	11. Contract or Grant No. DOT-HS-200-2-451	
	13. Type of Report and Period Covered Final Report July 1972 - April 1973	
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Washington, D. C. 20590	14. Sponsoring Agency Code	
	15. Supplementary Notes	

16. Abstract

Rental cars in Fayetteville, N. C., were equipped with four seat belt and warning systems: (Phase I) detachable shoulder and lap belt, no warning system; (Phase II) detachable shoulder and lap belt, warning system (January 1, 1972 standard); (Phase III) non-detachable shoulder and lap belt with inertia reel on shoulder belt, warning and logic system; and (Phase IV) non-detachable shoulder and lap belt with inertia reel on shoulder belt, warning, logic, and starter/interlock system (August 15, 1973 standard).

Counters were installed in the cars to measure the respondents' use of seat belts while driving the rental car. Interviews were conducted with rental car drivers to determine drivers' attitudes toward the four systems.

A significant increase in measured use of seat belts was seen from Phase I to Phases II, III and IV, however there was no significant difference in the measured usage rates of respondents in the last three phases. Respondents' claimed use of shoulder belts was significantly higher in Phases III and IV compared to the first two phases. Drivers in Phases I and II voiced more favorable attitudes toward the seat belt and warning systems than did respondents in Phases III and IV.

17. Key Words Seat Belts, Lap Belts, Shoulder Belts, Integral Shoulder Harness, Inertia Reel, Counters, Usage, Acceptance Score, Logic System, Warning System, Starter Interlock System	18. Distribution Statement Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 77	22. Price

## ACKNOWLEDGEMENT

The authors would like to express their appreciation to the numerous persons who contributed their skills and efforts to this research project. The technical direction and assistance supplied by Mr. Peter N. Ziegler (NHTSA), contract manager, and P. Robert Knaff, Ph.D., (NHTSA) aided in the successful completion of this study.

The study would not have been possible without the cooperation of local rental car agency personnel, particularly Messrs. Howard Clark and John Godwin of Hertz, Messrs. Norwood Bryant, Jr. and David Britt of National, and Messrs. Lee Smith and Ed Zawisha of Avis.

The authors also appreciate the assistance and dedication of the personnel from Irvin Industries who designed and installed the seat belt equipment and counter system, particularly Messrs. Merle Nedigh and James Holland who worked on the project in Fayetteville.

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## I. OUTLINE OF THE STUDY

### Background and Purpose

Since January 1, 1972, the Department of Transportation has required a safety belt warning system in all cars manufactured for sale in the United States. DOT has issued a new standard for the safety belt warning system which will be required on automobiles manufactured for sale after August 15, 1973. The new standard includes a logic and starter/interlock system with a non-detachable lap/shoulder belt combination and an inertia reel on the shoulder belt.

This research was conducted to determine the effectiveness of the various components of the new and current seat belt systems, and to assess drivers' attitudes toward these systems.

### Methodology

The research was conducted from September, 1972 through January, 1973 at Fayetteville, N. C., using cars of the local Hertz, National and Avis fleets. The order in which the data on the various components was obtained was:

- Phase I: Three point belt with detachable shoulder harness, no warning system
- Phase II: Three point belt with detachable shoulder harness, warning system
- Phase III: Three point belt with integral shoulder harness and inertia reel, warning and logic systems
- Phase IV: Three point belt with integral shoulder harness and inertia reel, warning, logic and starter/interlock systems.

In addition to the seat belts and warning systems, each car was equipped with counters which recorded the number of times the engine was started and the number of times the seat belt was pulled out of the retractor.

Personal interviews were conducted with renters as they returned their cars to the rental station at the airport, and data from the counter was recorded at this time.

### Sample

All respondents in this project were people who chose to rent a car in Fayetteville and most had travelled to the city on business. The sample, therefore, reflected the attitudes and behavior of people from a broader geographic area than interviewing at a single site normally might yield.

The number of interviews obtained in each of the four phases was:

	<u># of Interviews</u>
Phase I	152
Phase II	300
Phase III	287
Phase IV	94

Little difference existed in the background and demographic characteristics of respondents in the four phases. Slightly more than 95% were male, approximately 4 out of 5 were under 50 years of age, and about 60% had a college degree. Most respondents (86%) claimed to have used the rental car primarily for business purposes. Car ownership and exposure to lap and shoulder belts are comparable in all four phases.

Respondents, though more affluent than the general population, are more typical of the driving population and especially of the new car owner/buyer population.

### Results - Usage and Attitude

#### 1. Usage

The results of the research indicated that a significant increase in use of seat belts occurred from Phase I to Phases II, III and IV. Measured use, as computed from car counters, showed that

Phase I respondents used a seat belt on 22.77% of their trips in the rental car compared to 50.93% of the trips by Phase II respondents, 49.32% by Phase III drivers and 55.88% by Phase IV drivers. It is important to note that while the differences in usage between the latter three phases are not significant, Phases III and IV are distinctly safer systems because they require the use of a shoulder belt. Hence a substantial gain in driver safety was achieved through the use of Phase III and IV systems.

Usage data was also obtained by asking respondents to estimate their own rates of wearing the seat belts in the rental cars. This data is important because it distinguished four separate rates: for lap and shoulder belts, and for trips over and under 25 miles in length. Again, significant increases were seen in the reported use of lap belts from Phase I through Phase IV. Moreover, the impact of Phases III and IV is dramatically evidenced in reported use of shoulder belts as 65% of Phase III respondents and 80% of Phase IV drivers claimed using the shoulder belt on more than half their trips compared to less than 10% of the drivers in Phases I and II.

## 2. Attitudes

Respondents' attitudes toward the seat belt and warning (and interlock) systems were obtained through a series of questions asking for reactions to the systems and any suggestions or changes.

Substantial resistance to any warning (or interlock) system was observed: nearly 1/3 in each phase claimed they would disconnect the system to which they had been exposed, if it were installed in their personal cars. An additional 11% of Phase II respondents, 16% of Phase III and 19% of Phase IV drivers felt they would modify the system if it was installed in their own cars.

The shoulder belt was the most frequently cited item in need of change, or which was objectionable to Phase III or Phase IV respondents. (However, as is noted in the full report, few people in Phase II reported using the shoulder belt since it was detachable, and consequently not as many would have objections to it.) Nearly one out of five respondents in Phases II and III objected to the warning buzzer. Less than 10% of Phase IV respondents objected to the interlock system.



The series of attitudinal questions was used to develop an acceptance score or index of drivers' overall attitudes toward the seat belt systems. A significant difference was seen between mean acceptance scores of Phase II respondents (7.45) and those of Phase III (6.06) and Phase IV (6.15). The latter two groups were less favorable toward the systems they used, though a meaningful difference in attitudes did not exist between drivers in Phase III and Phase IV.

### 3. Usage and Attitudes

The data indicated that the Phase III and Phase IV systems succeeded in creating meaningful behavior change. Impressive numbers of people used safer seat belt systems to a greater degree even though people were less favorable and more critical of the systems. It may be that the effects of rewarded behavior upon acceptance, with its self-sustaining features, have yet to be achieved. Until such time, voluntary use of seat belts (especially integral shoulder harnesses) may not, in and of itself, produce satisfactory usage rates. At present, therefore, the applicable model appears to be one of structured compliance wherein effective seat belt systems are combined with non-voluntary installation and control devices.

## II. BACKGROUND AND PURPOSE

Since January 1, 1972, the Department of Transportation (DOT) has required a safety belt warning system in all cars manufactured for sale in the United States. The warning system consists of a flashing light and buzzer which is activated if the car is placed in gear and the driver and/or front outboard passenger are not wearing a seat belt.

DOT has issued a new standard for cars manufactured for sale in the United States which will be effective August 15, 1973. This system includes a logic and starter/interlock system which requires a three-step sequence to be followed in order to start the car: sit down, fasten the seat belt, start the car. It is hypothesized that this system will increase the use of seat belts because it eliminates two of the most popular methods of defeating the current warning system--leaving the belt fastened and tucking it behind the seat, or tying a knot in the belt so that it is held out of the retractor.

In addition to the logic/interlock system, cars will be required to have a three-point seat belt with an integral shoulder harness (i.e., the shoulder belt cannot be separated from the lap belt), and an inertia reel on the shoulder harness. The inertia reel permits some freedom of movement but locks and restrains the wearer if the car stops suddenly.

A number of related studies have been done in this area. Some of the major findings of these studies are as follows:\*

- . Fisher Body Division of General Motors, Fall, 1972  
"....Only 19 percent buckled their belts but on cars with the buzzer-light reminder system, 43 percent of the drivers were wearing lap belts--a clear indication that the system is encouraging many drivers to buckle up. The same survey revealed that only about 3 percent of all drivers are wearing the shoulder belts." Data was obtained by visual inspection of drivers at vehicle inspection stations in Michigan.

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\*Findings are reported without comment since National Analysts did not conduct a critical review of prior research as part of this study's scope of work.

- . Insurance Institute for Highway Safety, Fall, 1972  
 "The buzzer-light system had no statistically significant effect on the safety belt use rate in equipped vehicles (18%) compared with nonequipped vehicles (16%) under the same conditions...."
  
- . Ford Motor Company "1972 Model Seat Belt Usage Study, Phase I," March, 1972  
 "Observed usage among owners of 1972 Ford/Mercury and Pinto cars equipped with the reminder system was 54% compared to 29% among owners whose new cars were not equipped with the system... Owners of cars equipped with the reminder system had twice as many favorable comments about the system as unfavorable."
  
- . Ford Motor Company "1972 Model Seat Belt Usage Study, Phase III," July, 1972  
 "Observed lap belt usage levels among 3-month versus 1-month owners of Ford/Mercury and Pinto cars equipped with the warning device suggest that usage declines over time. About 17% decrease in belt usage is indicated.... Reactions to the reminder system tend to be the same make-to-make and comparing 3-month with 1-month owners."
  
- . Automobile Club of Southern California "Increased Seat Belt Use as a Result of Improved Seat Belt Systems, Interim Report"  
 "Driver seat belt usage was measured first with the buzzer and light reminder system disconnected and then with it operating.... Seat belt usage increased from an average of 25.5% to 68.4%." The conclusions stated "Seat belt reminder systems are effective in producing a significant increase in seat belt usage. It may be hypothesized that a more sophisticated reminder system would further increase usage."
  
- . National Highway Traffic Safety Administration, February, 1971  
 A study testing interlock devices on GSA cars using government employees as drivers "showed a general acceptance of the interlock device and produced a 95% usage of safety belts."

This research project was conducted to provide evidence as to the effects of the present and proposed seat belt systems on usage rates and attitudes of a reasonable cross-section of the new car driving public.

### III. METHODOLOGY

#### A. Site Selection

Site selection for this research project was difficult. It was desirable to pinpoint a city with all rental agencies housed at the same location in order to eliminate the need to staff several offices. The level of study effort required a fleet of approximately 100 cars. Resources were not available for more than 100 cars, and if a significant number of cars were left "as is," renters would be able to specify the type car (i.e., equipped or unequipped) they wanted to drive. If such a self-selection process were permitted, it is likely that only people favorably disposed to seat belts initially would be included in the project.

Elmira, N. Y. was originally selected as the site for this research, but due to the floods of Hurricane Agnes in June, 1972 the project was conducted in Fayetteville, N. C.

The majority of cars in the Fayetteville Hertz, National and Avis fleets were equipped with the systems to be studied though some were allowed to remain "as is" specifically to be given to renters who planned to return the car to a city other than Fayetteville.

#### B. Phases

The project was designed to include four distinct periods, or phases, which were as follows:

- Phase I: Three point belt with detachable shoulder harness,\* no warning system
- Phase II: Three point belt with detachable shoulder harness,\* warning system
- Phase III: Three point belt with integral shoulder harness and inertia reel, warning and logic systems
- Phase IV: Three point belt with integral shoulder harness and inertia reel, warning, logic and starter/interlock systems.

\*These were usually detached and folded into the overhead hook.

The proposed system for 1974 cars includes both a logic and an interlock system. In order to obtain distinct data on the logic system, it was separated out for study and then tested in conjunction with the interlock. The two control periods (i.e., Phases I and II) produced data with no warning system installed in the car, and comparison data under the current warning system (i.e., flashing light and buzzer). The systems were studied sequentially.

At the start of the research, each car was equipped with a "counter" in the trunk which recorded the number of times the engine was started and the number of times the seat belt was pulled out of the retractor. Programmed into the counter was a three minute delay control to eliminate dual counts if the engine stalled and was immediately restarted, or if the belt had to be returned to the retractor and repulled (e.g. if it was not pulled far enough to be buckled the first time). A detailed description of the counter can be found in Appendix B.

### C. Interviewing

Personal interviews were conducted from September 6, 1972 through January 19, 1973. Respondents were interviewed as they returned their cars to the airport, and the counter data recorded from the car following the completion of the interview. If a renter claimed not to have time for a personal interview, he or she was given a questionnaire to self-administer and mail to National Analysts.

Since most people would not be familiar with the logic and interlock systems used in Phases III and IV, interviewers accompanied renters to their cars and explained the use of these systems to them. Because of the unavoidable delay caused by changing sites, Phases III and IV were conducted in new 1973 cars, which provided a plausible reason for interviewers to explain the unfamiliar seat belt system without alerting renters to their role in a research project prior to their use of the seat belt system.

In addition to the verbal explanation, a written description of the system was attached to the rental contract in case the car was not returned to the Fayetteville agency. A sticker was also attached to the dashboard during Phase IV to alert any driver other than the renter (parking attendant, etc.) to the system.

A copy of the questionnaire, the written description and the sticker are contained in Appendix C, D and E.

#### IV. SAMPLE

The sample for this project was to some degree self-selecting since all respondents chose to rent a car in Fayetteville, N. C. Although some renters were local people, most were residents of some city other than Fayetteville who had come to the city on business. Therefore, the sample reflects the attitudes and behavior of people from a broader geographic area than interviewing at a single site normally yields.

The number of interviews in each of the four phases was dependent upon the number of people renting cars at that time. It was anticipated that approximately 100 interviews would be completed each week, however, that number was never reached.\* Phase IV, which extended from mid-December 1972 through mid-January 1973, yielded the fewest interviews, due to weather conditions which limited or interfered with air travel, and due to the holiday season.

The number of interviews for each of the phases is as follows:

	Number of Interviews		
	<u>Total</u>	<u>Personal</u>	<u>Mail</u>
Phase I	152	148	4
Phase II	300	295	5
Phase III	287	269	18
Phase IV	94	88	6

\*Fewer interviews were obtained for several reasons:

- (1) Some equipped cars were rented in Fayetteville but returned elsewhere. We attempted to avoid this situation by leaving some cars in the fleets unequipped to be used for such trips. Often, however, numbers of cars were out of Fayetteville because of rentals and were not returned for several weeks.
- (2) Some cars were also rented for longer than one week which limited turnaround interviews in one week.
- (3) It was possible to equip only 68 cars in Phases I and II and 83 cars in Phases III and IV rather than 100 per phase.

Due to the small numbers of mail questionnaires, it was decided to tabulate them with the data from the personal interviews rather than attempt any separate analysis.

Little difference exists in the background and demographic characteristics of respondents in the four phases (Table 1). A little over 95 percent were male, approximately four out of five were under 50 years of age, and about 60 percent had a college degree. Most respondents (86%) claimed to have used the rental car primarily for business purposes.

Given this data, the respondents are undoubtedly more affluent than the general population; however, they are more typical of the driving population than a pure probability sample would yield, and they are much more typical of the new car owner/buyer population. Therefore the sample may be more representative of those who will most likely be among the first to be exposed to any new seat belt system. Hence, their reactions to the new seat belt systems would seem to be particularly important as a guide to the initial acceptance of any new system.

Table 1 also indicates that car ownership and exposure to lap and shoulder belts are comparable in all four phases, and therefore that no systematic bias exists across phases.

It appears, therefore, that across the four experimental conditions a "chance" assignment of respondents has yielded comparable groups of car renters. Since, in large measure, the study should be regarded as a field experiment, one would like to approach the "ideal" of completely unbiased assignment over treatment conditions. With evidence that we have not strayed too far from this goal (at least on those attributes measured in Table 1) and that the procedures employed made for a fair experiment, differences in seat belt use and attitudes can then be meaningfully imputed to differences in the seat belt systems used. This examination also satisfies one of the goals of the study--to conduct the experiment with a sample more representative of the driving public than was the case in previous research.

TABLE 1

## Demographic Characteristics of Car Renters

	<u>Phase I</u>		<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	#	%	#	%	#	%	#	%
<u>Sex</u>								
Male	145	(95.4)	282	(94.0)	277	(96.5)	92	(97.9)
<u>Age</u>								
Under 25	4	(2.6)	14	(4.7)	10	(3.6)	2	(2.1)
25-34	40	(26.3)	102	(34.2)	87	(31.0)	33	(35.1)
35-49	80	(52.6)	128	(43.0)	126	(44.8)	35	(37.2)
50 or older	28	(18.5)	54	(18.1)	58	(20.7)	24	(25.6)
<u>Education</u>								
High school or less	21	(13.9)	34	(11.4)	34	(12.1)	16	(17.1)
Some college/trade school	34	(22.6)	62	(20.7)	64	(22.8)	24	(25.6)
Completed college	65	(43.0)	137	(45.8)	119	(42.3)	31	(33.0)
Graduate work	31	(20.5)	66	(22.1)	64	(22.8)	23	(24.5)
<u>Car Ownership</u>								
Own car	148	(97.4)	294	(98.0)	283	(99.0)	91	(96.8)
Has lap belts	143	(96.6)	291	(99.3)	282	(99.6)	90	(98.9)
Has shoulder belts	114	(77.0)	239	(81.3)	219	(77.4)	85	(79.4)
<u>Use of Rental Car</u>								
Business only	132	(87.4)	260	(87.0)	242	(84.9)	81	(86.2)



## V. RESULTS: USAGE DATA

### A. Use of Seat Belts in Drivers' Personal Cars

As a further check on the comparability of drivers in each of the four phases and to provide baseline usage data, the questionnaire included a set of questions designed to measure reported seat belt use in drivers' own cars.

Four separate use rates were obtained: for lap and for shoulder belts, and on trips under and over 25 miles. This baseline data, seen in Tables 2 - 6, reveals the sample to be a relatively high seat belt usage population. One explanation for this (based upon data in Table 1) is that the highly educated and probably relatively affluent respondents in this experiment should include a greater number of new car owners and those likely to have been exposed to the 1972 warning system.

As has already been mentioned, it was important to determine the extent to which drivers were comparable on key attributes across the four phases. We, therefore, conducted statistical analyses of personal use data (using the chi-square test) to determine if the usage rate could be regarded as independent of the "chance" assignment of drivers to phases.\*

In Table 2 a significant difference in reported lap belt use was found across phases. As will be seen, relatively higher use by Phase IV respondents develops into a consistent pattern throughout all questions on belt usage in personal cars. Phase III drivers reported the lowest lap belt usage in their personal cars.

Lap belts are used to a greater extent for longer trips than for those under 25 miles, as is seen by comparing Tables 2 and 3. Once again, a significant difference in usage by phases is observed. Drivers in Phases I and IV claimed to use lap belts with somewhat greater frequency than did drivers in Phases II and III.

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\*The reader will note that the degrees of freedom (d.f.) reported as a part of the chi-square procedure will frequently total "3" for many of the 4 X 4 tables. Due to small cell sizes, the first two and last two rows were frequently combined producing a 2 X 4 data matrix.

TABLE 2\*

Frequency of Wearing Lap Belt  
in Personal Car on Trips less than 25 Miles

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	74	(51.7)	160	(55.0)	138	(48.9)	48	(53.3)
On more than half the trips	16	(11.2)	15	(5.2)	22	(7.8)	12	(13.3)
On less than half the trips	14	(9.8)	19	(6.5)	21	(7.4)	6	(6.7)
Almost never	39	(27.3)	97	(33.3)	101	(35.8)	24	(26.7)

$$\chi^2 = 15.9, 9 \text{ df}, p < .025$$

TABLE 3

Frequency of Wearing Lap Belt in  
Personal Car on Trips 25 Miles or More

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	96	(67.1)	192	(66.0)	187	(66.3)	61	(67.8)
On more than half the trips	15	(10.5)	21	(7.2)	16	(5.7)	9	(10.0)
On less than half the trips	10	(7.0)	23	(7.9)	22	(7.8)	1	(1.1)
Almost never	22	(15.4)	55	(18.9)	57	(20.2)	19	(21.1)

$$\chi^2 = 7.8, 3 \text{ df}, p < .05$$

\*See Appendix A for corresponding figures for many of the tables included in the text of this report.

TABLE 4

Frequency of Wearing Shoulder Belt in  
Personal Car on Trips less than 25 Miles

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	10	(8.8)	27	(11.3)	25	(11.4)	14	(18.4)
On more than half the trips	-	-	4	(1.7)	7	(3.2)	3	(3.9)
On less than half the trips	4	(3.5)	7	(2.9)	9	(4.1)	3	(3.9)
Almost never	99	(87.6)	201	(84.1)	178	(81.3)	56	(73.7)

$$\chi^2 = 7.2, 3 \text{ df}, p < .05$$

TABLE 5

Frequency of Wearing Shoulder Belt in  
Personal Car on Trips of 25 Miles or More

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	14	(12.4)	40	(16.7)	46	(21.0)	18	(23.7)
On more than half the trips	3	(2.7)	7	(2.9)	9	(4.1)	7	(9.2)
On less than half the trips	6	(5.3)	12	(5.0)	9	(4.1)	2	(2.6)
Almost never	90	(79.6)	180	(75.3)	155	(70.8)	49	(64.5)

$$\chi^2 = 9.4, 3 \text{ df}, p < .025$$

Shoulder belt use is dramatically less than lap belt use among all respondents (Tables 4 and 5). However, as with lap belts, the usage is greater for longer trips than for shorter trips. Phase IV drivers exhibit consistently higher usage rates of shoulder belts than drivers in the other three phases, and the overall differences by phases were statistically significant.

Table 6 summarizes the data from the preceding four tables and clearly reveals that Phase IV respondents claim higher use rates of lap and shoulder belts. Differences in the lap belt rates are not nearly as pronounced and it can be assumed that the four groups are reasonably (though not completely) comparable on lap belt usage.

TABLE 6  
Summary of Reported Use of Safety Belts in Personal Car

	<u>Phase I</u> %	<u>Phase II</u> %	<u>Phase III</u> %	<u>Phase IV</u> %
Use <u>lap</u> belts on more than half the trips <u>less</u> than 25 miles	62.9	60.2	56.7	66.6
Use <u>lap</u> belts on more than half the trips <u>more</u> than 25 miles	77.6	73.2	72.0	77.8
Use <u>shoulder</u> belts on more than half the trips <u>less</u> than 25 miles	8.8	13.0	14.6	22.3
Use <u>shoulder</u> belts on more than half the trips <u>more</u> than 25 miles	14.1	19.6	25.1	32.9

However, in terms of shoulder belt usage, the differences between groups, especially between Phase I and Phase IV drivers, are substantial and an increasing trend across phases can be seen. A possible explanation for this pattern, since other data indicate the groups to be relatively matched, is that since the phases were run sequentially, Phase IV drivers have had a relatively greater opportunity to own new cars than other drivers, particularly those in Phase I. Not only might new car drivers be influenced by the greater attention to seat belt systems in the new cars, but the novelty of such systems, especially in the short run, may well have led drivers to try them out as they would other new features in their new cars.

## B. Use of Seat Belts in Rental Cars

This section presents seat belt usage data for respondents while using the rental cars under the four different seat belt systems. In each phase two sets of data were collected: measured usage from the counters and claimed usage which corresponds to the already reported data collected on seat belt use in personal cars. The data in this section may be regarded as the key behavioral results of this experiment.

### 1. Measured Use\*

The data in Table 7 presents seat belt use as measured by the counters across the four phases. Ideally, counter data would provide an extremely accurate recording of seat belt use. However, the counter system is relatively new, and some problems were found to exist with the system. (These are detailed in Appendix B.) As a result, it was not possible to obtain an infallible measure of "true seat belt use". The "truth", as it were, probably is reflected more closely by counter data than by self-report data to be presented shortly. More importantly with respect to counter data, we have no reason not to assume that any inaccuracies which existed operated across all phases and that comparisons across phases, therefore, should reveal whatever differential effectiveness actually existed.

A statistically significant increase is seen in measured usage when data from Phase I is compared to that from Phases II, III or IV. In the first phase the counters indicate that on the average, belts were worn on 23% of the trips compared to 51% of the trips in Phase II, 49% in Phase III and 56% in Phase IV.

The differences in usage between the last three phases, while not statistically significant, favor the Phase IV system.

\*Measured use was computed as a ratio of:

$$\frac{\text{Number of seat belt uses}}{\text{Number of engine starts}}$$

TABLE 7

Percent of Trips Using Seat Belt in Rental Car

	<u>Phase I</u>		<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	#	%	#	%	#	%	#	%
0%	53	(41.7)	20	(8.1)	5	(2.1)	3	(3.9)
1-10%	16	(12.6)	36	(14.6)	22	(9.2)	9	(11.8)
11-25%	11	(8.7)	30	(12.2)	45	(18.8)	4	(5.3)
26-50%	25	(19.7)	32	(13.0)	56	(23.4)	16	(21.1)
51-75%	14	(11.0)	40	(16.3)	52	(21.8)	17	(22.4)
76-99%	4	(3.1)	58	(23.6)	35	(14.6)	20	(26.3)
100%	4	(3.1)	30	(12.2)	24	(10.0)	7	(9.2)
Mean	22.77*		50.93**		49.32**		55.88**	
Median	7		55		50		57	

F = 27.59, p < .001

\*Duncan Multiple Range Test: p < .001

\*\*Duncan Multiple Range Test: p = n.s.

It is important to note that while differences in usage between Phases II, III and IV are not significant, the systems in Phases III and IV are distinctly safer systems for the wearer since both systems require the use of a shoulder harness as well as a lap belt. In this sense, "standing still" (i.e. no statistically significant increase in measured belt usage) is, in actuality, a very positive step toward greater protection for the driver.

It can also be seen that in Phase III the measured use of belts declined compared to Phase II and was less than that in Phase IV. A reworking of Table 7 shows this clearly:

	<u>Phase I</u> %	<u>Phase II</u> %	<u>Phase III</u> %	<u>Phase IV</u> %
Used belt on more than 50% of the trips	17.2	52.1	46.4	57.9

This data suggest that the safer system in Phases III and IV, with an integral shoulder harness, may require more "convincing" to use than the current belt with the warning light and buzzer. The extra "persuasion", of the interlock compared to the warning system in Phase III, may provide the impetus to convince people to wear the shoulder harness.

## 2. Reported Use

Since the counter did not specifically distinguish between lap and shoulder belt (or both) use in Phases I and II nor between trip length, respondents were asked the same series of questions as they were regarding use of belts in their personal cars. This was done to determine: (1) if respondents' behavior changed under these test conditions, and (2) if the Phase II system's success carried over into shoulder belt use or varied by length of trip.

This data, based on reported usage, reveals higher levels of use when compared to the counter data. As discussed previously, the counter data is not perfectly accurate and much additional insight can be gained by a careful inspection of this recall data. The "truth" may, in fact, fall somewhere between the two.

In addition to the question of counter reliability, several other factors aid in the explanation of the discrepancy between the two sets of data. Fallibility of memory coupled with a desire to please or perhaps impress the interviewer may tend to produce an overestimate in reported seat belt use. Also, respondents may not include in their estimate very short "trips"--moving the car in the parking lot, driving one block to a restaurant--while those trips would be counted in the measured data.

Claimed usage, while probably overstated, may be an important indicant of driver acceptance of a seat belt system. To the extent people believe they are engaging in a certain form of behavior, (or believe they are doing so to a greater degree) their subsequent behavior may tend to become more consistent with such beliefs. If one accepts a high degree of seat belt usage as appropriate for himself, possibly due in part to an overestimate of his previous behavior, we would expect his actual seat belt use to increase up to the already accepted level. Therefore, the overestimate of seat belt use by respondents suggests that their seat belt usage may increase in the future.

The data in Table 8 reveal a significant increase in lap belt use from Phase I to Phase IV. In Phase I with no warning system, only one out of two respondents claimed to wear their lap belts on more than half the trips of less than 25 miles. In contrast, 84% of Phase IV respondents claimed to use their lap belts on more than half the trips of less than 25 miles. This same pattern appears in Table 9 for trips of 25 miles or more.

A careful inspection of these two tables raises the possibility of a "ceiling effect" in seat belt use. Some respondents in both Phases III and IV claimed to "almost never" wear lap belts. Since not wearing a belt in these systems required some effort, these data suggest that a hard core of non-users may exist. It is possible that virtually no amount of persuasion will cause this group to wear seat belts.



TABLE 8

Frequency of Wearing Lap Belt  
in Rental Car on Trips less than 25 Miles

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	46	(46.9)	116	(62.4)	143	(69.8)	60	(81.1)
On more than 50% of the trips	4	(4.1)	10	(5.4)	6	(2.9)	2	(2.7)
On less than 50% of the trips	2	(2.0)	4	(2.2)	12	(5.9)	3	(4.1)
Almost never	46	(46.9)	56	(30.1)	44	(21.5)	9	(12.2)

$$\chi^2 = 23.6, 3 \text{ df}, p < .001$$

TABLE 9

Frequency of Wearing Lap Belt  
in Rental Car on Trips of 25 Miles or More

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	57	(59.4)	143	(73.7)	133	(73.5)	49	(81.7)
On more than half the trips	4	(4.2)	5	(2.6)	3	(1.7)	2	(3.3)
On less than half the trips	4	(4.2)	4	(2.1)	4	(2.2)	2	(3.3)
Almost never	31	(32.3)	42	(21.6)	41	(22.7)	7	(11.7)

$$\chi^2 = 9.9, 3 \text{ df}, p < .025$$

The impact of Phases III and IV with respect to the safety of the driver compared to the first two phases is easily discerned from Tables 10 and 11. Three out of four drivers in Phase IV reported they "almost always" wore shoulder belts on short trips and over 78% claimed full-time shoulder belt use for longer trips. In comparison, less than 10% claimed "almost always" using shoulder belts in Phases I and II.

TABLE 10

Frequency of Wearing Shoulder Belt  
in Rental Car on Trips less than 25 Miles

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	3	(3.1)	13	(7.0)	123	(60.3)	56	(75.7)
On more than half the trips	-	-	-	-	5	(2.5)	2	(2.7)
On less than half the trips	3	(3.1)	-	-	12	(5.9)	3	(4.1)
Almost never	92	(93.9)	173	(93.0)	64	(31.4)	13	(17.6)

$$\chi^2 = 235.2, 3 \text{ df}, p < .001$$

TABLE 11

Frequency of Wearing Shoulder Belt  
in Rental Car on Trips of 25 Miles or More

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Almost always	7	(7.3)	14	(7.2)	112	(61.9)	47	(78.3)
On more than half the trips	3	(3.1)	1	(0.5)	4	(2.2)	4	(6.7)
On less than half the trips	2	(2.1)	4	(2.1)	4	(2.2)	2	(3.3)
Almost never	84	(87.5)	175	(90.2)	61	(33.7)	7	(11.7)

$$\chi^2 = 218.6, 3 \text{ df}, p < .001$$

Table 12 summarizes the data on reported use of seat belts in rental cars, and the full impact of the advanced systems is clearly evident. Phase IV respondents report the greatest use of belts compared to drivers exposed to the other three systems. In a nutshell the major effect of Phases III and IV was to greatly increase the use of shoulder belts.

TABLE 12

Summary of Reported Use of Safety Belts in Rental Car

	<u>Phase I</u> %	<u>Phase II</u> %	<u>Phase III</u> %	<u>Phase IV</u> %
Use <u>lap</u> belts on more than half the trips <u>less</u> than 25 miles	51.0	67.8	72.7	83.8
Use <u>lap</u> belts on more than half the trips <u>more</u> than 25 miles	63.6	76.3	75.2	85.0
Use <u>shoulder</u> belts on more than half the trips <u>less</u> than 25 miles	3.1	7.0	62.8	78.4
Use <u>shoulder</u> belts on more than half the trips <u>more</u> than 25 miles	10.4	7.7	64.1	85.0

C. Comparison of Seat Belt Use in Rental Car Vs. Personal Car

The data have already demonstrated that seat belt usage (and most notably shoulder belt usage) was greater in Phase IV than Phase I, but it is also important to determine the degree to which respondents behaved differently under each phase than they did in their own cars. In addition, this is important since the baseline data revealed that Phase IV drivers tended to use seat belts more frequently than drivers in the other phases, and we have as yet made no effort to "cancel out" such initial differences.

Because the sample was self-selecting and not matched as would occur in a laboratory setting, differences in baseline data were anticipated prior to conducting the experiment. Therefore, an attempt was made during the interview to "factor out" these differences and to show any incremental use of seat belts that occurred during the experiment.

The results of this approach are seen in Table 13 which reveals a significant increase in reported incremental use from Phase I to Phase IV. A substantial jump may be seen between Phase II and Phase III. Interestingly, there are more people reporting their usage decreased than increased among Phase I drivers.

TABLE 13

Respondent Comparison of Seat Belt Usage in Rental Car to Usage in Personal Car

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Increased	10	(6.9)	50	(17.2)	107	(38.5)	38	(42.7)
Decreased	19	(13.1)	24	(8.3)	41	(14.7)	9	(10.1)
Remained the same	116	(80.0)	216	(74.5)	130	(46.8)	42	(47.2)

$$\chi^2 = 89.5, 6 \text{ df}, p < .001$$

This overall decrease among Phase I drivers suggests the possibility that when driving by oneself, for instance on a business trip, the full range of motives that lead to seat belt usage may not come into play, whereas when driving with one's family their safety or the wish to set an example for one's children may play a role in the use of seat belts. Also, family pressure to wear belts may not be transferred to driving on business trips. In the light of these or other factors which apparently serve to suppress seat belt use in rental cars compared to personal cars, the corresponding increase in Phases III and IV is all the more impressive and may, in fact, represent an underestimate when generalizing to personal cars.

An examination of the actual percentage difference scores between aggregate baseline data on reported seat belt use in the respondents' personal cars and reported use in the rental cars provides another means of looking at "change" data.\* The results of these comparisons indicate that a net decrease in the use of seat belts occurred among Phase I drivers, as was seen in the previous table, as well as Phase II drivers' use of shoulder belts. The incremental use of shoulder belts by Phase III and IV respondents is well worth noting, particularly by way of comparison with Phase II.

\*Derived by subtracting the data matrix in Table 6 from that in Table 12.

TABLE 14

Difference between Reported Use of  
Safety Belts, Rental Car/Personal Car

	<u>Phase I</u> %	<u>Phase II</u> %	<u>Phase III</u> %	<u>Phase IV</u> %
Use <u>lap</u> belts on more than half the trips <u>less</u> than 25 miles	-11.9	7.6	16.0	17.2
Use <u>lap</u> belts on more than half the trips <u>more</u> than 25 miles	-14.0	3.1	3.2	7.2
Use <u>shoulder</u> belts on more than half the trips <u>less</u> than 25 miles	-5.7	-6.0	48.2	56.1
Use <u>shoulder</u> belts on more than half the trips <u>more</u> than 25 miles	-3.7	-11.9	39.0	52.1

Since Table 14 looks at differences in reported use between personal and rental cars, the initial differences between respondents in the four phases tend to be cancelled out. Phase IV respondents consistently claimed greater use of belts in their personal cars, yet still managed to increase their reported usage a good deal more than any other group.

Also tending to be factored out by the use of difference scores, are the probable overestimates in reported use by respondents. There is no reason to suspect respondents would overestimate using different rates or bases for their personal cars than for the rental cars.

## VI. RESULTS: ATTITUDINAL DATA

The second goal of the Fayetteville research project was to measure drivers' attitudes, suggestions and objections to the four seat belt and warning systems. The results of these inquiries provide valuable insight into drivers' reactions to each of the four systems and aid in understanding some of the usage data.

The first of this series of opinion type questions asked the renter to respond to the statement, "The seat belt system in this rented car is a useful and effective safety device." An interesting pattern of results was produced, since drivers exposed to the Phase I and Phase II systems more frequently agreed with that statement, even though their systems were not as useful and effective as the latter two systems. (Table 15)

There are two possibilities which may have provoked these reactions. The first is, of course, that respondents in Phases III and IV genuinely believed those systems were less effective and useful. But more realistically, we can interpret these data as a means by the drivers of voicing displeasure with the systems, particularly perhaps the "required" shoulder harness and the concept of a "difficult to defeat" system.

TABLE 15

Level of Agreement with the Statement,  
"The seat belt system in this rented car  
 is a useful and effective safety device."

	Phase I		Phase II		Phase III		Phase IV	
	#	%	#	%	#	%	#	%
Agree completely	102	(68.0)	210	(70.7)	144	(51.1)	49	(52.7)
Agree somewhat	39	(26.0)	59	(19.9)	72	(25.5)	20	(21.5)
Disagree somewhat	5	(3.3)	14	(4.7)	34	(12.1)	11	(11.8)
Disagree completely	4	(2.6)	14	(4.7)	32	(11.3)	13	(14.0)

$$\chi^2 = 48.0, 9 \text{ df}, p < .001$$

It may be worth remembering that we were exposing people to a new system, one with which they were inexperienced; that most of the renters were on business trips and quite possibly in a hurry, with other problems on their minds; that many of the renters might not have had an adequate time to become used to the system; and therefore that these conditions should lead to greater annoyance initially with insufficient time to remedy "getting off on the wrong foot".

As a means of further delineating people's reactions to each of the systems, respondents were asked to project what action they would take if the system in the rental car were factory installed in a car purchased for personal use.\* Would they use, modify, or disconnect the warning (or interlock) system?

TABLE 16

Projected Action if the System Were Installed in a Personal Car

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Use	170	(59.6)	142	(49.8)	43	(47.7)
Modify	32	(11.2)	45	(15.8)	17	(18.9)
Disconnect	85	(29.8)	98	(34.4)	30	(33.3)

$\chi^2 = 6.8, 4 \text{ df}, p < .10$

Substantial resistance to any warning or interlock system is observed with nearly one third of the sample (in each phase) claiming they would disconnect the system. (Table 16) Expressed intent to modify the system increased as the systems became more demanding and difficult to defeat: 11.2% of respondents claimed they would modify a system like that of Phase II, compared to 15.8% and 18.9% for Phases III and IV. Some of the most frequently cited specific modifications were to tie the belt in a knot (primarily mentioned by Phase II respondents and some Phase III respondents), or to disconnect the buzzer. (Table 17)

\*Since Phase I had no system to speak of, those respondents were not asked this last series of questions.

Drivers in Phases III and IV were less likely to anticipate using the system to which they had been exposed in a personal car than were drivers of Phase II cars. Perhaps some of this unwillingness would have lessened if these drivers would have had a longer period to adjust to the new and unfamiliar systems. Given the differences in experience and the greater demands for compliance (i.e., an integral lap belt-shoulder belt system coupled with more stringent monitoring and control), the differences in acceptance do not seem unusually large.

TABLE 17\*

Suggested Ways of Modifying the Warning (or Interlock) System

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Disconnect buzzer	10	(3.3)	11	(3.8)	1	(1.1)
Tie belt in knot/ fastened behind	14	(4.7)	10	(3.5)	-	-
Use only for long trips, fasten back for short trips	4	(1.3)	8	(2.8)	3	(3.2)
Eliminate/separate shoulder belt	-	-	4	(1.4)	6	(6.4)
Add manual control switch for warning system	-	-	4	(1.4)	3	(3.2)
Eliminate interlock	-	-	-	-	3	(3.2)

\*Based on total respondents.  
Note small cell sizes.



In a similar vein we went on to ask each respondent if he would suggest any changes in the design of the system, and if so, what specific changes he would suggest.

There was a greater incidence of suggested changes by respondents in Phases III and IV. (Table 18) The specific areas requiring alterations, in these respondents' opinions, are presented in Table 19. Although the shoulder belt was most frequently cited as needing change, the last two items on this table point out that it will be difficult to please everyone.

TABLE 18  
Incidence of Suggesting Changes  
to the Design of the System

	<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Would suggest changes	129	(45.1)	204	(73.1)	57	(62.6)
Would not suggest changes	157	(54.9)	75	(26.9)	34	(37.4)

$\chi^2 = 46.4, 2 \text{ df}, p < .001$

TABLE 19\*

Suggested Changes to the Design of the Seat Belt System

	<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	#	%	#	%	#	%
Lap Belt	30	(10.5)	25	(9.0)	7	(7.7)
Comfort: Longer, allow more free movement	9	(3.1)	13	(4.7)	2	(2.2)
Fastening: Make easier, faster, more convenient	2	(0.7)	5	(1.8)	7	(7.7)
Shoulder Belt	44	(15.4)	103	(36.9)	30	(33.0)
Comfort: Longer, allow more free movement	7	(2.4)	26	(9.3)	8	(8.8)
Eliminate	5	(1.7)	25	(9.0)	9	(9.9)
Position: Lower, too high on neck	3	(1.0)	33	(11.8)	3	(3.3)
Anchor: Relocate, anchor back of seat	1	(0.3)	6	(2.2)	9	(9.9)
Dual harness	8	(2.8)	6	(2.2)	2	(2.2)
Fastening: Make easier, faster, more convenient	7	(2.4)	6	(2.2)	1	(1.1)
Warning System	35	(12.2)	35	(12.5)	4	(4.4)
Eliminate buzzer	28	(9.8)	22	(7.9)	1	(1.1)
Restraint System as a Whole	42	(14.7)	85	(30.5)	32	(35.2)
More convenient to use	12	(4.2)	37	(13.3)	7	(7.7)
Shoulder and lap belts should not be combined (Phases III and IV)	-	-	26	(9.3)	8	(8.8)
Combine as one unit (Phase II)	15	(5.2)	-	-	-	-

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\*Based on total respondents.

When asked if they had objections to the seat belts in the rental car, a significantly greater number of respondents in Phases III and IV voiced discontent than respondents in Phase II. (Table 20) Although more Phase IV drivers had objections than Phase III drivers, this difference is not statistically significant.

The single area cited by more people as being objectionable was the comfort of the shoulder belt. (Table 21) This was mentioned by more respondents in Phases III and IV; but as the earlier data on usage showed, few people claimed to use the shoulder belt in Phase II, so less respondents in that phase might feel the need to object. Also, approximately the same proportion of respondents in Phases III and IV compared to people in Phase II voiced an objection to the lap belt in general, suggesting again that a lack of familiarity with the new integral three point belt could have instigated much of the criticism. A longitudinal study after extended exposure to the new systems may provide a more meaningful basis for judging acceptance.

TABLE 20  
Incidence of Having Objections  
to the Seat Belts

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Had objections	36	(12.3)	121	(42.8)	43	(47.8)
Did not have objections	257	(87.7)	162	(57.2)	47	(52.2)

$$\chi^2 = 79.2, 2 \text{ df}, p < .001$$

TABLE 21\*

Objections to Seat Belts in Rental Car

	<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	#	%	#	%	#	%
Lap Belts	19	(6.5)	55	(19.4)	18	(20.0)
Comfort: Too short, too much tension, too restrictive	6	(2.0)	19	(16.7)	7	(7.8)
Design: Poorly designed/engineered	5	(1.7)	15	(5.3)	5	(5.6)
Use: Difficult, cumbersome, an annoyance	6	(2.0)	10	(3.5)	2	(2.2)
Fasteners: Difficult to use, slow, inconvenient	-	-	6	(2.1)	5	(5.6)
Shoulder Belts	9	(3.1)	64	(22.6)	20	(22.2)
Comfort: Too short, too much tension, too restrictive	7	(2.4)	47	(16.6)	16	(17.8)
Convenience: Should be retractable, buckle separately	3	(1.0)	18	(6.4)	5	(5.6)
Should not be mandatory	1	(0.3)	5	(1.8)	5	(5.6)

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\*Based on total respondents

It may be appropriate at this time to point out that the three point belts with integral shoulder harnesses were specially engineered and installed for this research project. In many cases, modification of the equipment was performed in Fayetteville. It is probably safe to assume that factory-installed equipment will better accommodate the variations that occur between car models than was possible to accomplish for this study.

Objections to the warning system were also requested, and Phase III respondents had the greatest number of objections.

TABLE 22  
Incidence of Having Objections to the Warning  
(or Interlock) Systems

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Had objections	79	(27.4)	114	(40.6)	22	(23.9)
Did not have objections	209	(72.6)	167	(59.4)	70	(76.1)

$$\chi^2 = 14.8, 2 \text{ df}, p < .001$$

Of all the objections to the warning system, the buzzer provoked the greatest number of responses (Table 23). One possible interpretation is that people may dislike a "voice of authority shouting at them," i.e., the buzzer, whereas the interlock, in contrast, may provide a more firm, yet less aversive, stimulus to use the seat belts. During Phase IV the buzzer was activated if the key was turned and the belt was not being used, but since drivers knew they had to use the seat belt to start the car it is safe to assume they had less experience with the buzzer than Phase III drivers. It may be that the "unyielding" firmness of the interlock was more gentle (in the sense of soft-spoken) and more acceptable than the flexibility of the buzzer. This reasoning is admittedly speculative, but we might hypothesize that the influence potential of the system may not be unidimensional but might involve both the amount of power and the mode of influence.

TABLE 23

Types of Objections to Warning System (or Interlock System)

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Object to buzzer	52	(18.1)	55	(19.6)	6	(6.5)
Irritation/system should be removed	15	(5.2)	27	(9.6)	5	(5.4)
Infringement on personal rights or liberty	4	(1.4)	19	(6.8)	4	(4.3)
Object to interlock	-	-	-	-	8	(8.7)

Drivers were also asked if the safety belt and warning systems in the cars functioned properly, and the highest incidence of malfunction reports occurred in Phase III.

TABLE 24

Incidence of Reporting Malfunctions

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
System malfunctioned	46	(15.8)	74	(26.1)	15	(16.0)
System did not malfunction	245	(84.2)	209	(73.9)	79	(84.0)

$$\chi^2 = 10.4, 2 \text{ df}, p < .005$$

Malfunctions were reported for both the warning systems and for the seat belt systems (Table 25). The types of malfunctions reported could have been caused by a lack of familiarity with the systems or because the systems were unique to Fayetteville rental cars and some of the "bugs" not completely worked out. It is interesting to note, also, that Phase III drivers had more objections to the seat belt systems and reported more malfunctions. As to which came first--the objections and then pinpointing the malfunctions, or the malfunctions which led to the objections--cannot be determined, but the two probably affected each other.

It is difficult to know how many of the malfunctions were due to human error (a hurried driver trying to put on an unfamiliar seat belt) and how many were actual breakdowns in the system. Also, a number of cars during Phase III were returned, and discernable tampering with the seat belt system had occurred, which may have led to a system malfunction. Since tampering with the system in Phase IV could possibly produce more than an inconvenience (a jam of the starter interlock--80 miles from Fayetteville), after the experience of Phase III, renters in Phase IV were specifically instructed not to tamper with the system and the possible consequences explained.

TABLE 25

Types of Reported Malfunctions to the Safety Belt System

	Phase II		Phase III		Phase IV	
	#	%	#	%	#	%
Warning System - Any	32	(11.0)	36	(12.7)	4	(4.3)
Red light stayed on	15	(5.2)	19	(6.7)	2	(2.1)
Red light never came on	18	(6.2)	18	(6.4)	2	(2.1)
Belt - Any	4	(1.4)	34	(12.0)	5	(5.3)
Difficult to release from retractor	2	(0.7)	15	(5.3)	1	(1.1)
Retractor/Inertia reel not working	1	(0.3)	10	(3.5)	3	(3.2)
Did not fasten properly	1	(0.3)	10	(3.5)	2	(2.1)

The design of the system in Phase IV suggests that there should be no trips made without wearing the seat belt. However, as has been seen, a 100% use rate did not occur. Nearly one-third of Phase III drivers admitted being able to cut off the warning system and drive without their seat belts fastened around them, and about one-fourth of the Phase IV drivers claimed to circumvent the interlock system (Table 26). The methods of circumventing the system are seen in Table 27.

TABLE 26

Incidence of Driving Without the Seat Belt Fastened

	<u>Phase III</u>		<u>Phase IV</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Drove with warning light and buzzer on	55	(25.8)	10	(11.9)*
Circumvented the warning system and/or interlock system	63	(30.0)	19	(23.5)

TABLE 27

Methods of Circumventing the Warning and/or Interlock Systems

	<u>Phase III</u>		<u>Phase IV</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Fastened belt behind	26	(9.0)	2	(2.1)
Hooked belt on door handle/ arm rest	10	(3.3)	6	(6.4)
Balanced belt between retractor and the inertia reel	7	(2.4)	6	(6.4)
Held belt in hand	9	(3.1)	-	-
Sat on the belt	4	(1.4)	3	(3.2)
Tampered with wiring	3	(1.0)	1	(1.1)

\*If the seat belt is returned into the retractor after the car is started the motor continues running but the warning light and buzzer will be activated.



This data indicates that respondents quickly discovered that the warning and interlock controls related to the retractor system. Placing the control in the buckle may prevent some circumventions; however, the hard core anti-seat belt person would probably discover a way to "beat" that system as well.

### Attitudinal Summary

An acceptance score or index of drivers' overall attitudes toward the seat belt systems was developed based on responses to four questions which asked for reactions to the warning and belt systems. (See Appendix E for the weighting scheme used to generate the acceptance score.)

There is a significant difference between mean acceptance scores of Phase II respondents and those of Phase III and Phase IV respondents, indicating that the latter two groups are less favorable toward the systems they used. However, a meaningful difference does not exist between acceptance scores in Phases III and IV.

TABLE 28

Acceptance Score: Attitude toward Safety Belt/Warning  
System in Rental Car

---

Acceptance Score*	<u>Phase II</u>		<u>Phase III</u>		<u>Phase IV</u>	
	#	%	#	%	#	%
0	5	(1.7)	14	(4.9)	6	(6.4)
1	1	(0.3)	9	(3.1)	2	(2.1)
2	6	(2.0)	15	(5.2)	9	(9.6)
3	19	(6.3)	30	(10.5)	10	(10.6)
4	16	(5.3)	25	(8.7)	5	(5.3)
5	34	(11.3)	32	(11.1)	7	(7.4)
6	19	(6.3)	26	(9.1)	7	(7.4)
7	29	(9.7)	29	(10.1)	8	(8.5)
8	37	(12.3)	33	(11.5)	10	(10.6)
9	23	(7.7)	13	(4.5)	5	(5.3)
10	111	(37.0)	61	(21.3)	25	(26.6)
	Mean Score	7.45*		6.06**		6.15**
	Median Score	8		6		7

F = 19.6, p < .001

\*Duncan Multiple Range Test: p < .05

\*\*Duncan Multiple Range Test: p = n.s.

When the acceptance scores are grouped\*into what may be defined as "acceptors", "neutrals" and "rejectors" there seems little doubt that sizeable numbers of people will be relatively unhappy with the seat belt systems used in Phases III or IV.

TABLE 29

Summary of Attitudes

	<u>Phase II</u> %	<u>Phase III</u> %	<u>Phase IV</u> %
Rejectors (Acceptance score of 0-3)	10.3	23.7	28.7
Neutrals (Acceptance score of 4-7)	32.6	39.0	28.6
Acceptors (Acceptance score of 8-10)	57.0	37.3	42.5

In a final analysis of the data combining measured usage data and acceptance scores, it is easy to see a consistent relationship between behavior and attitudes (Table 27). High users have a more favorable attitude toward the seat belt system in each phase. This result, however, suffers from an ambiguous interpretation regarding cause and effect since the data represent a picture taken at one point in time.

- . Is it that those who had more favorable prior attitudes or experience used the seat belt systems more?

Or

- . Is it that those who used the systems more in the rental cars came to have a more favorable attitude and accept the system to a greater degree?

---

\*These levels are, of course, arbitrary.

TABLE 30

Mean Acceptance Scores of User Groups

	<u>Phase II</u> Acceptance Score	<u>Phase III</u> Acceptance Score	<u>Phase IV</u> Acceptance Score
High users (76-100% of trips)	7.91	7.05	6.89
Medium users (26-75% of trips)	7.36	5.81	5.91
Low users (0-25% of trips)	6.98	5.32	5.31
Mean for phase	7.45	6.06	6.15

Only a longitudinal study can adequately disentangle these effects, though at this point we can surmise that both processes are probably at work. Seat belt education and information acts directly on beliefs and attitudes which can lead to subsequent modifications in behavior. On the other hand, making the seat belt system a more effective and pleasant experience should produce more favorable attitudes and behavior for those who have the opportunity to use the system.

Our data speak directly to the latter process. It seems clear that Phase III and Phase IV systems succeeded in creating behavior change. That is, impressive numbers of people apparently used seat belts to a greater degree. In addition, the systems they used were by all accounts far safer and more effective. Despite all this, however, drivers were less favorable and more critical toward Phase III and Phase IV systems. This suggests that the supportive feedback loop from (rewarding) behavior to acceptance, with its self-sustaining features, has not yet been forged. At present, therefore, the applicable model appears to be one of structured compliance wherein effective seat belt systems are combined with non-voluntary installation and control devices (e.g., buzzer, interlock).

APPENDICES

APPENDIX A

Figures

<u>Figures</u>	<u>Corresponding Tables</u>
1	2 and 3
2	4 and 5
3	7
4	8 and 9
5	10 and 11
6	13
7	14
8	16
9	18
10	19
11	20
12	22
13	25

FIGURE 1  
 While driving your personal car how often do you wear the lap belt?

Trips less than 25 miles

Almost Always   
 Almost Never 

Trips more than 25 miles

Almost Always   
 Almost Never 

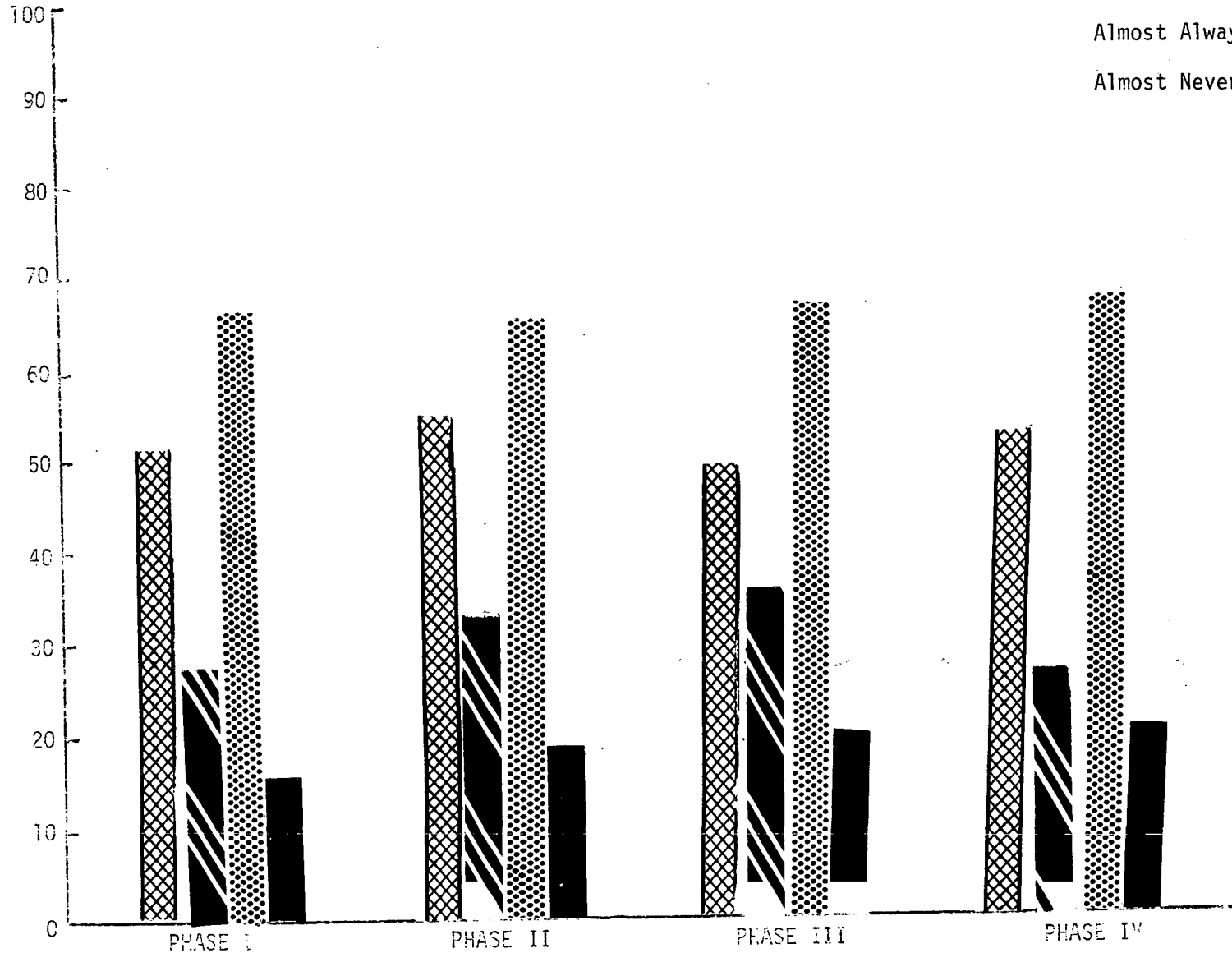




FIGURE 2


While driving your personal car how often do you wear the shoulder belt?

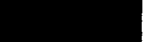
Trips less than 25 miles

Almost Always 

Almost Never 

Trips more than 25 miles

Almost Always 

Almost Never 

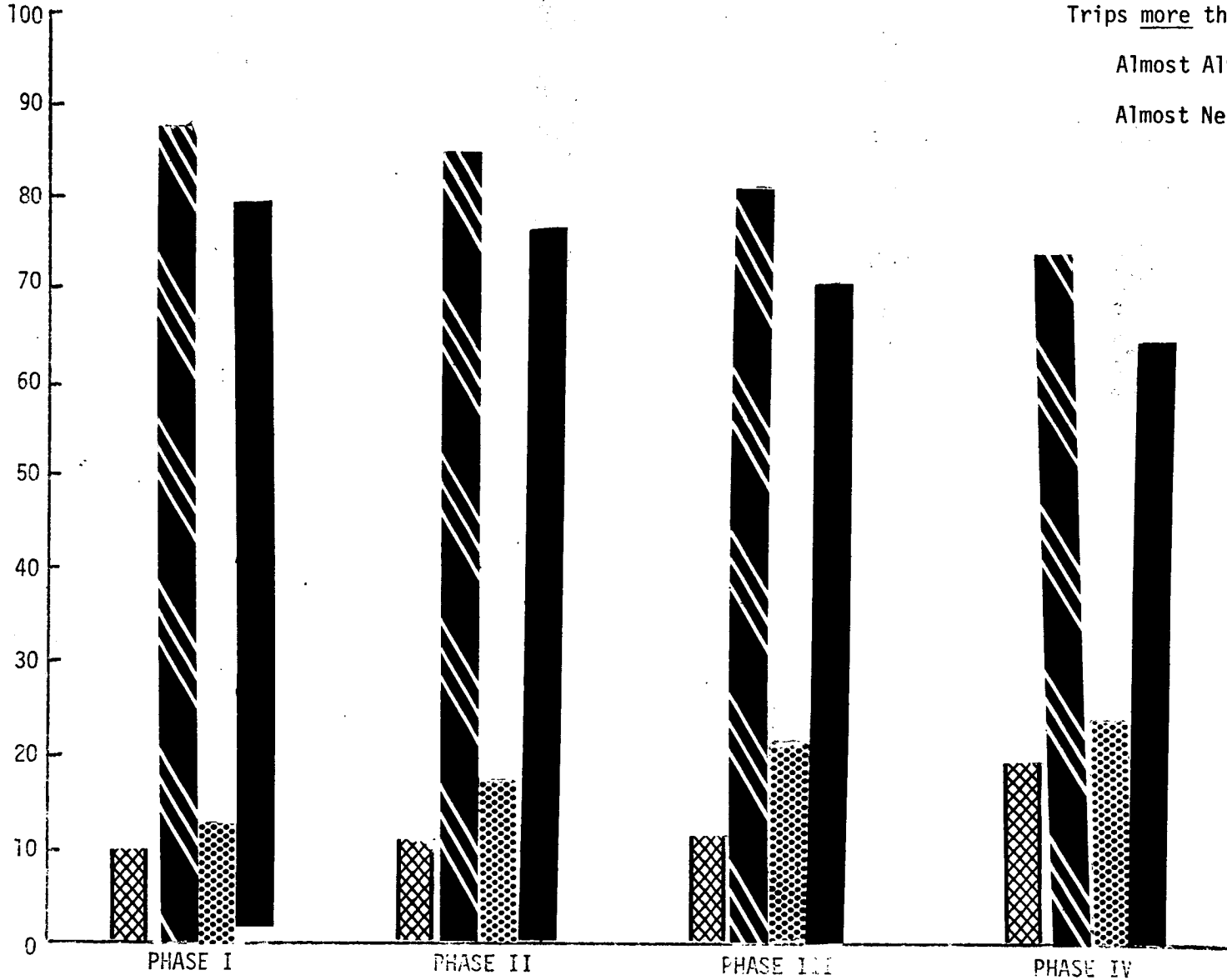




FIGURE 3

Percent of Trips Using Seat Belt

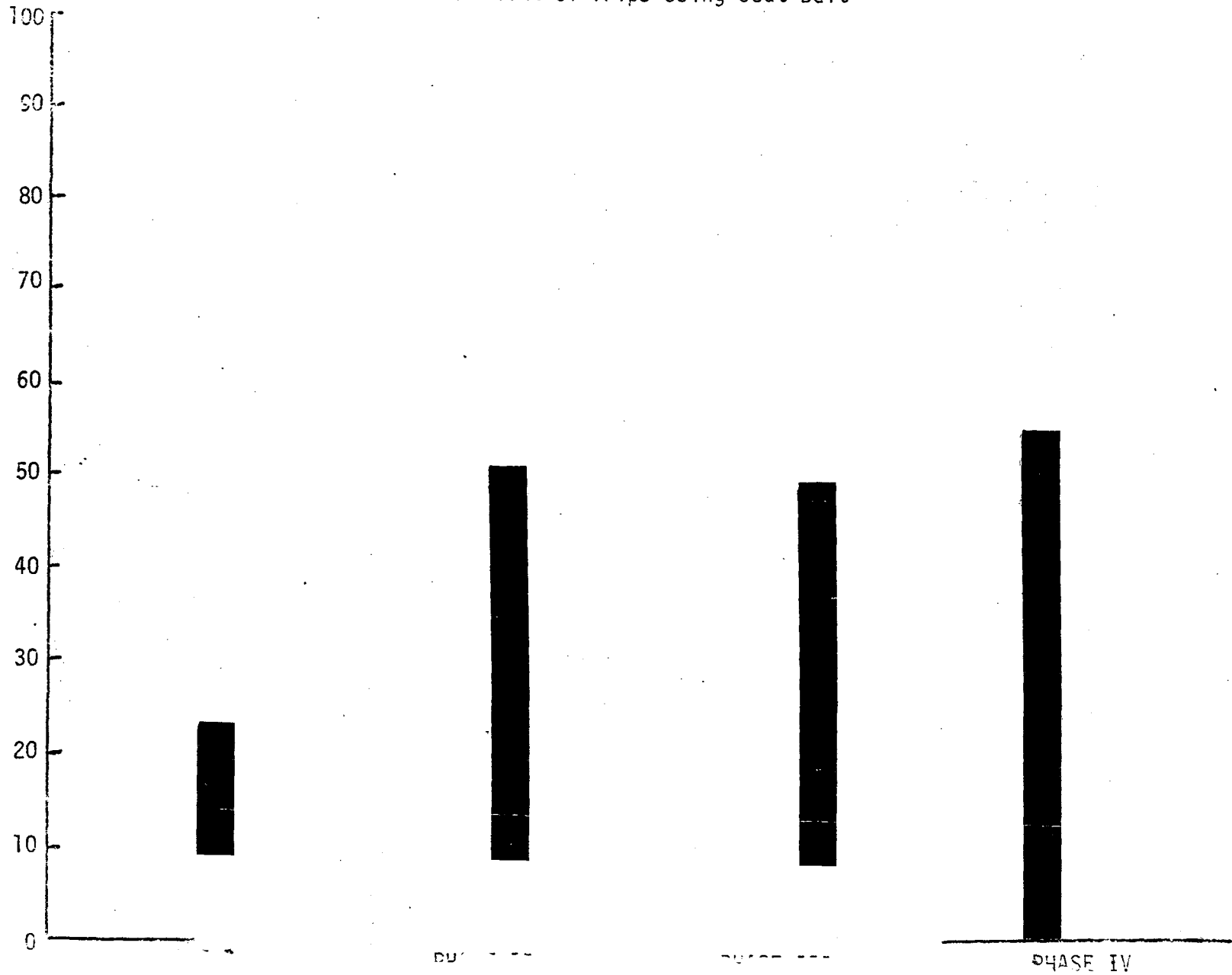


FIGURE 4  
While driving, how often did you wear the lap belt?

Trips less than 25 miles  
Almost Always [cross-hatched pattern]  
Almost Never [diagonal lines pattern]

Trips more than 25 miles  
Almost Always [diagonal lines pattern]  
Almost never [solid black]

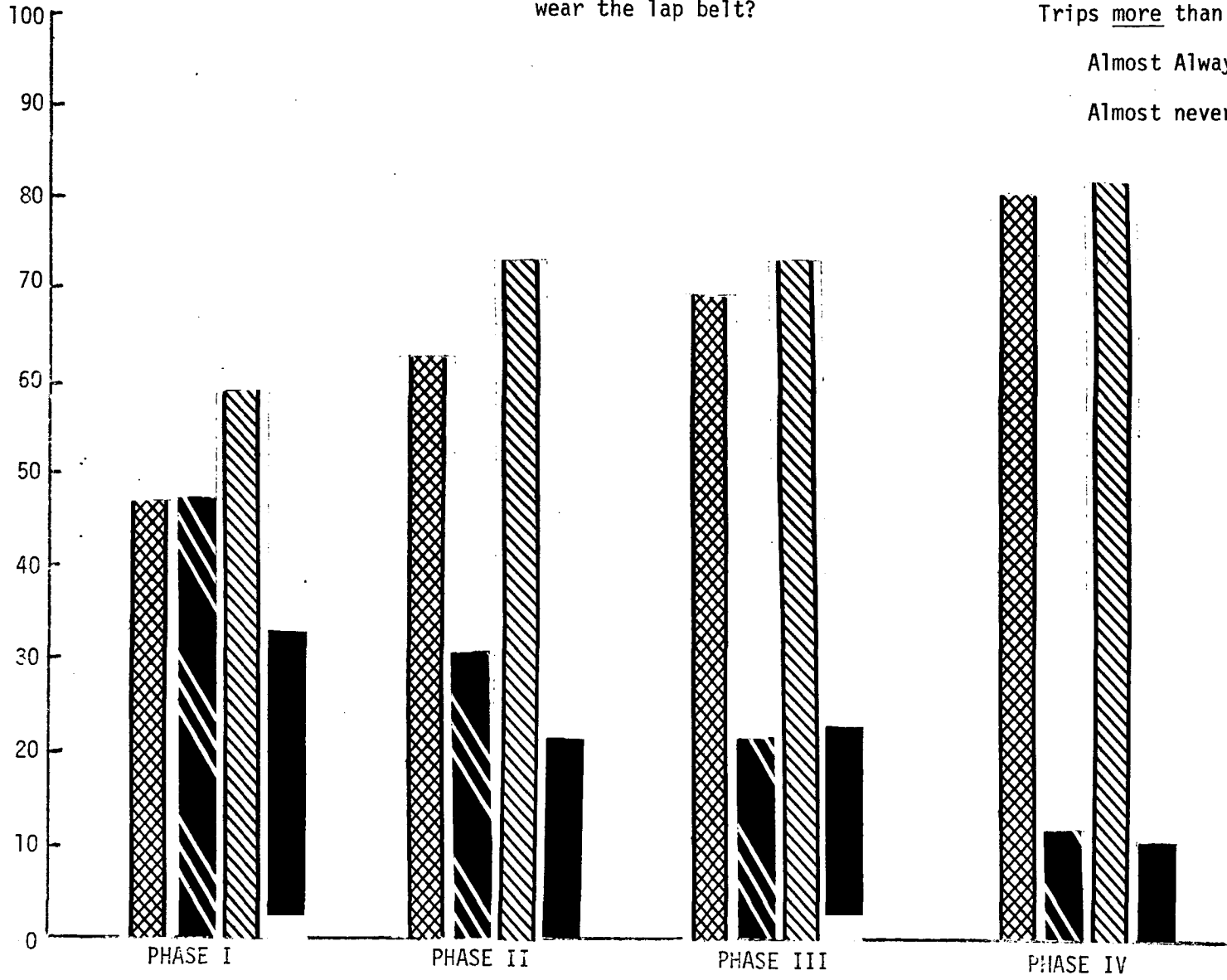


FIGURE 5

While driving, how often did you wear the shoulder belt?

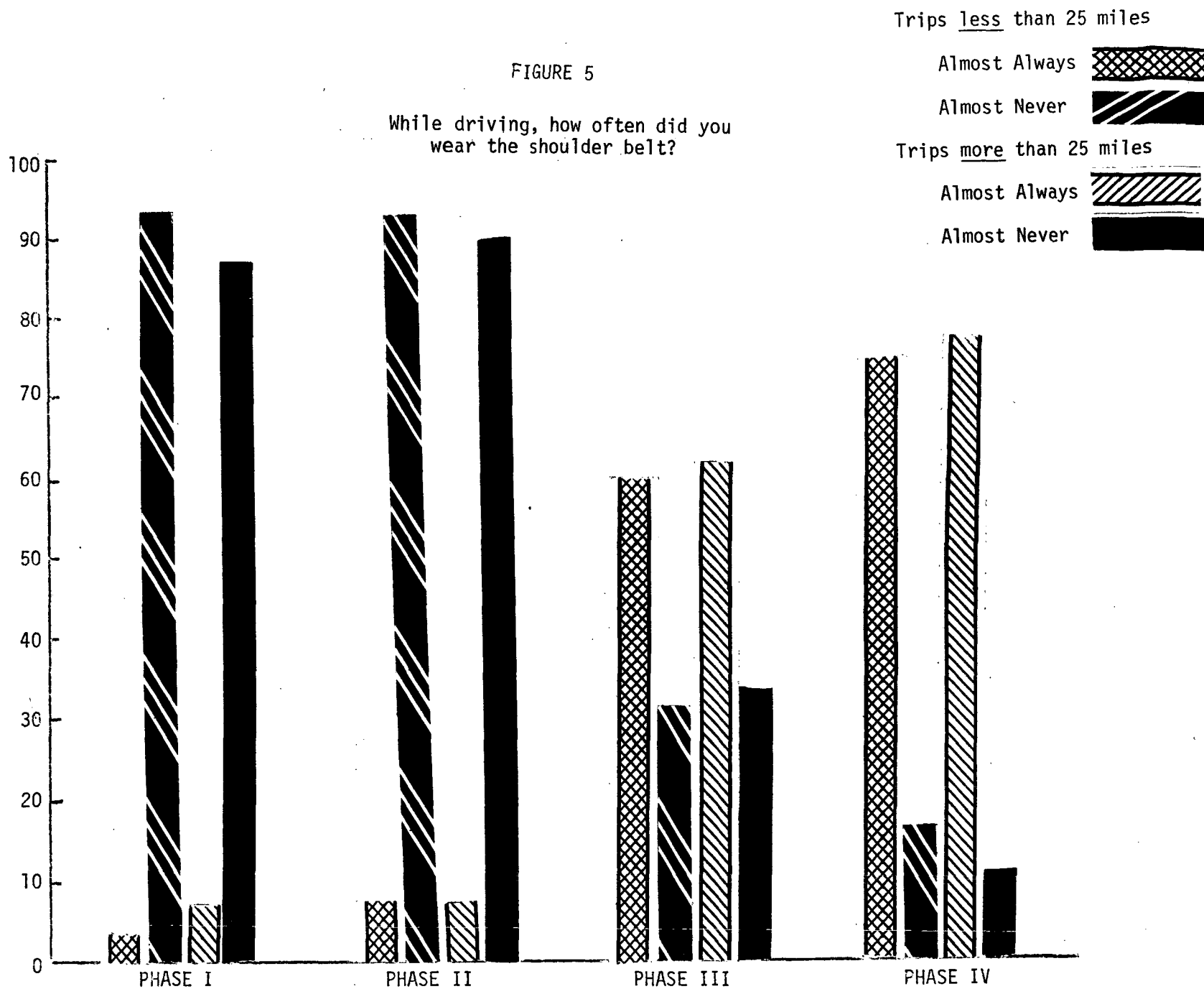



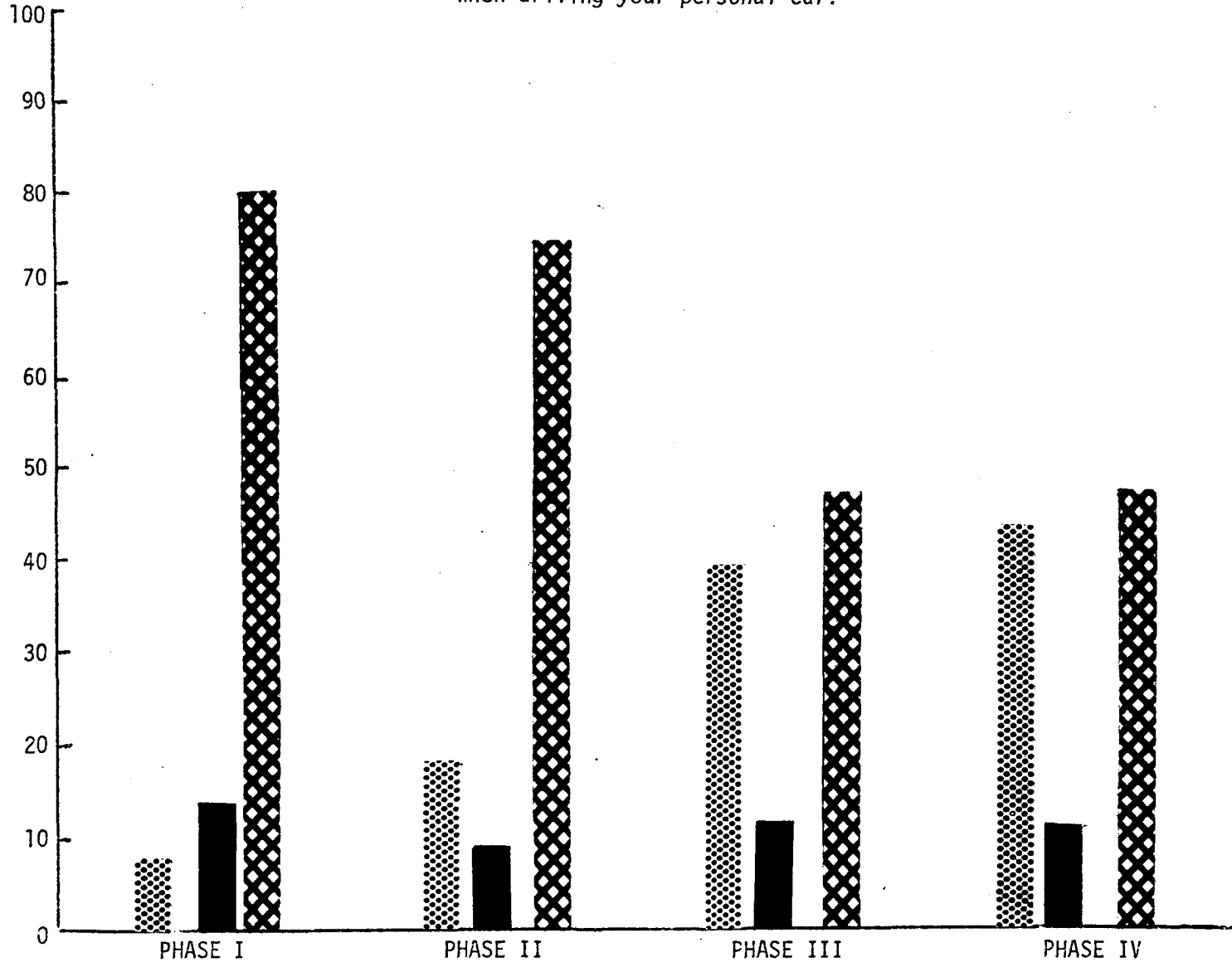


FIGURE 6

When driving this rental car, do you think your use of seat belts increased, decreased or remained about the same as your normal usage of seat belts when driving your personal car?

Increased   
Decreased   
Remained the same 





Agree  
(Completely/Somewhat)   
Disagree  
(Completely/Somewhat) 

FIGURE 7

"The seat belt system in this rented car is a useful and effective safety device."  
Do you agree completely, agree somewhat, disagree somewhat, or disagree completely with that statement?

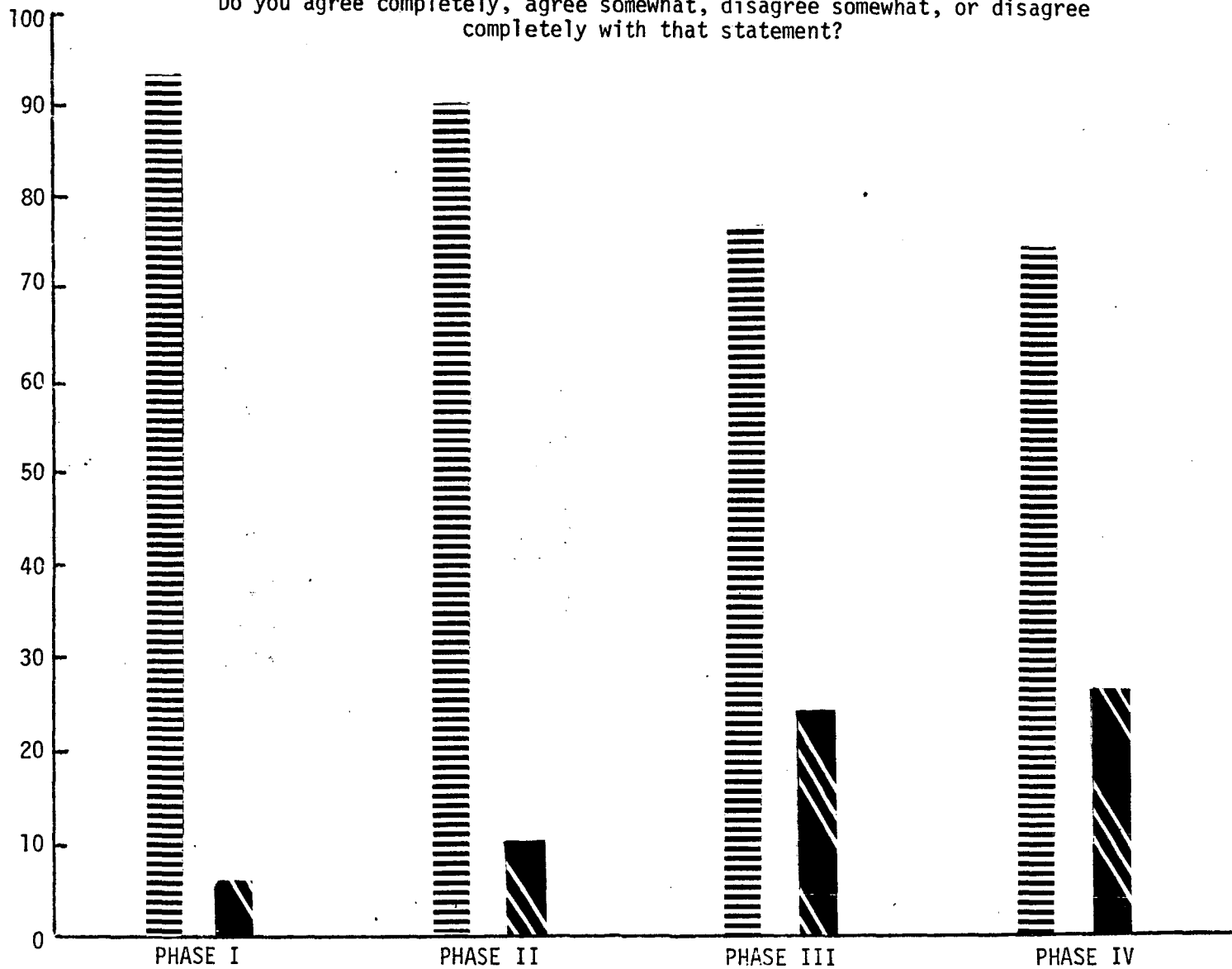





FIGURE 8

If the warning (or interlock) system were factory installed on your personal car, would you use the system, modify the system, or remove the system?

Use   
Modify   
Remove 

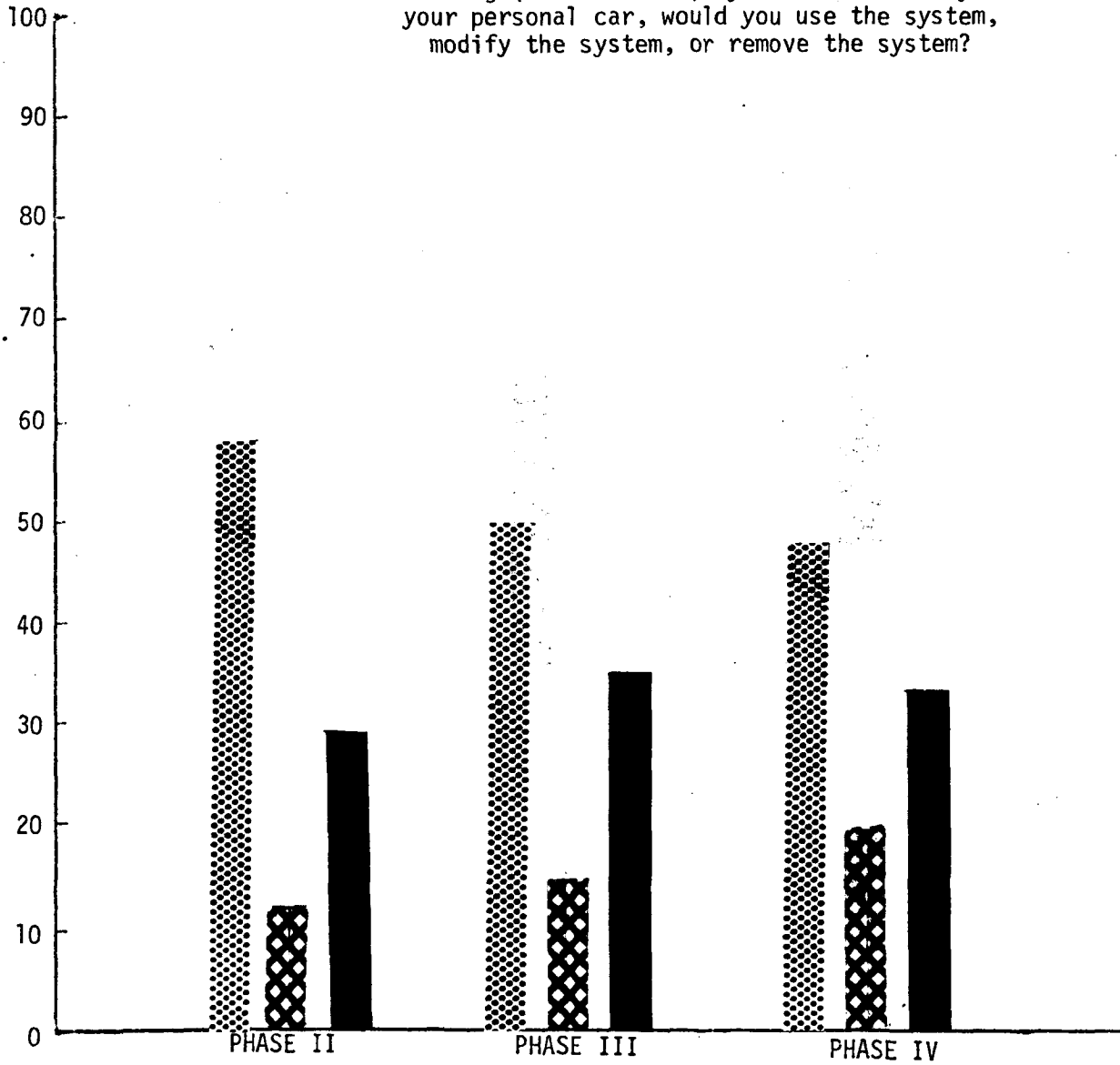


FIGURE 9

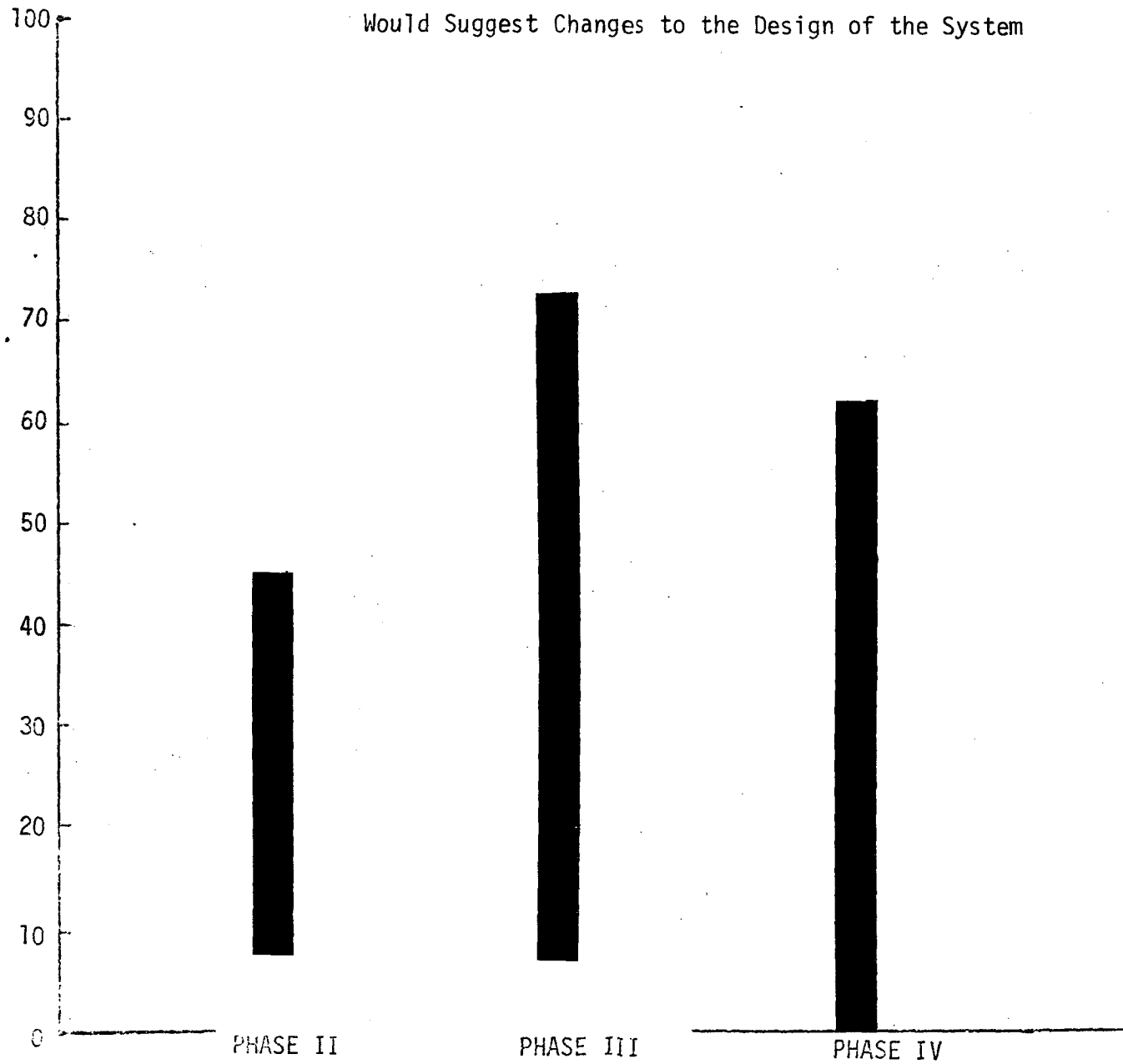


FIGURE 10  
Types of Changes Suggested

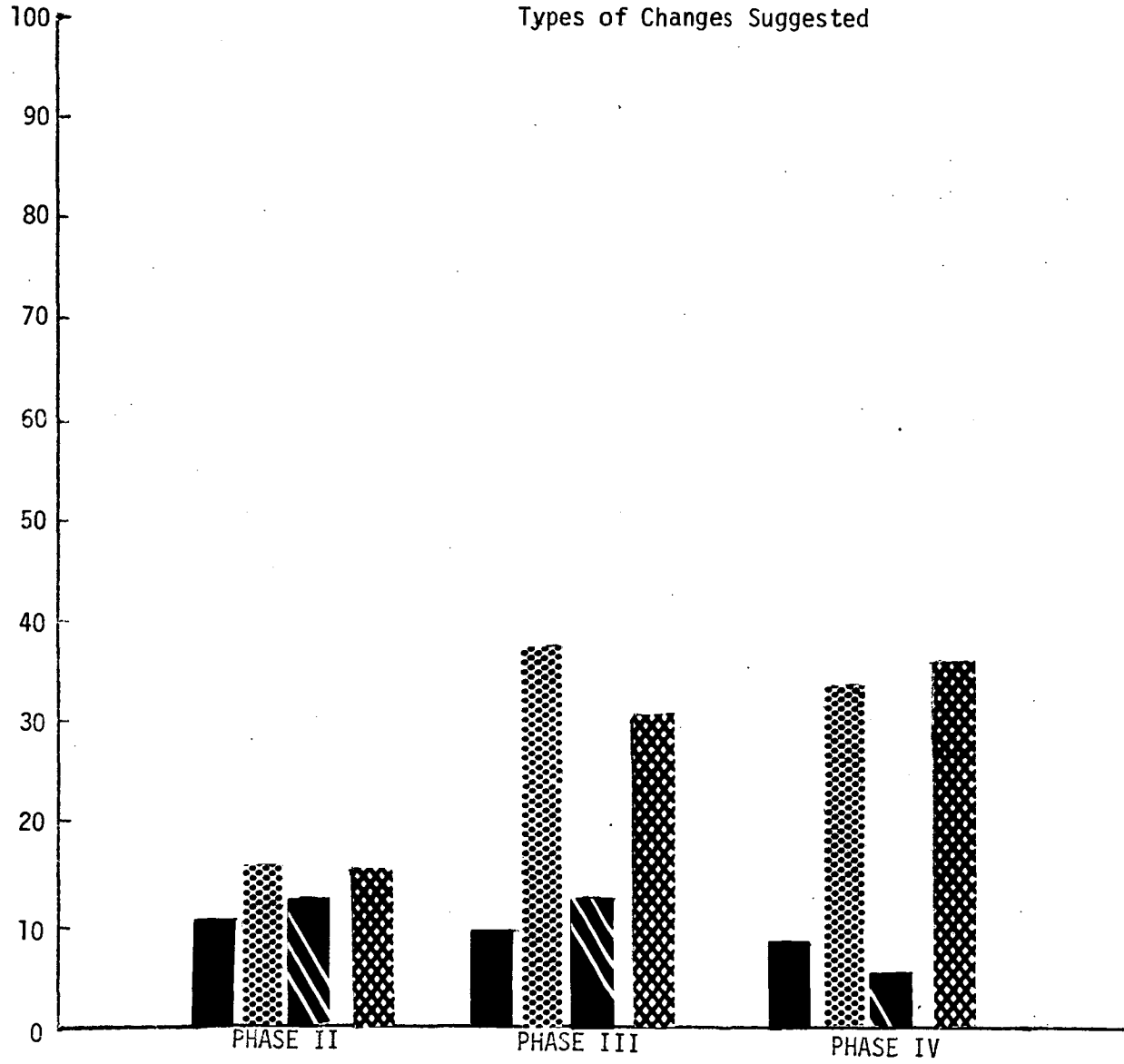
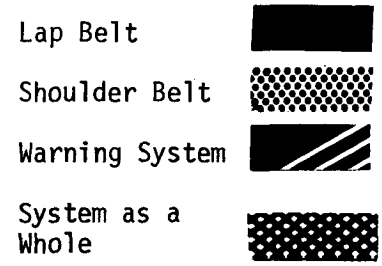




FIGURE 11

Do you have any personal objections to the seat belts that were in this rental car?

54

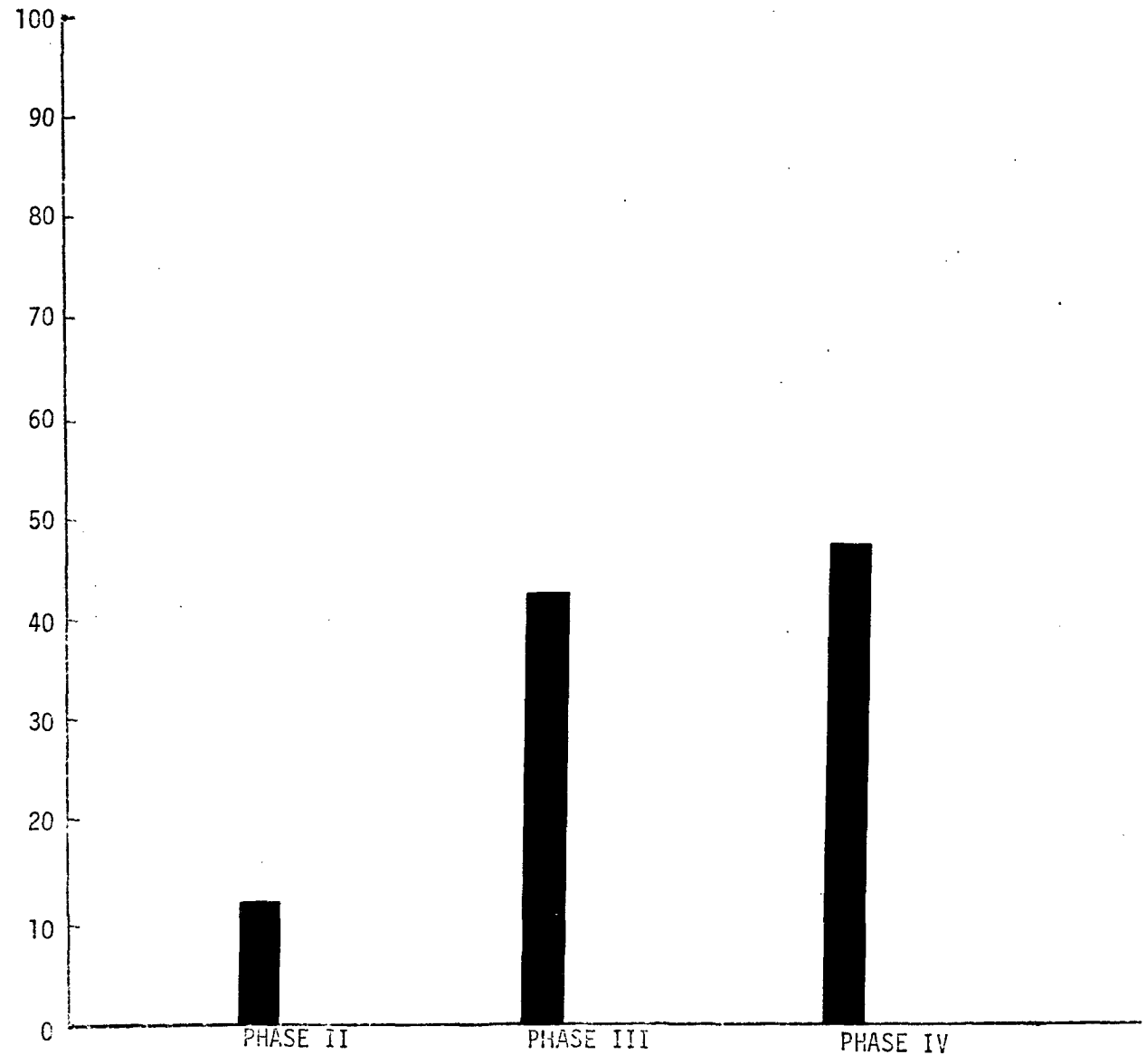


FIGURE 12

Had Objections to the Warning (or Interlock System)  
in the Rental Car

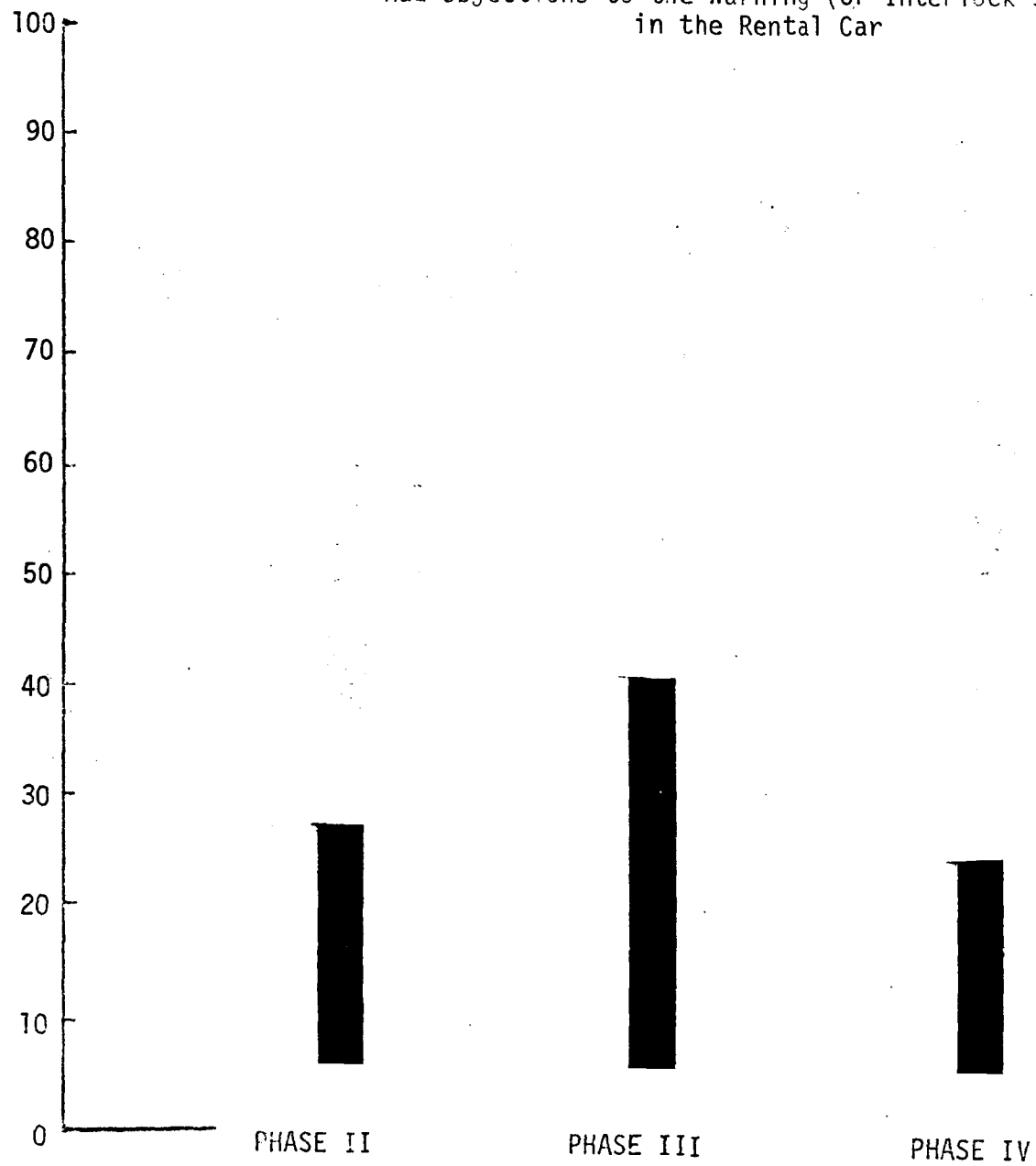
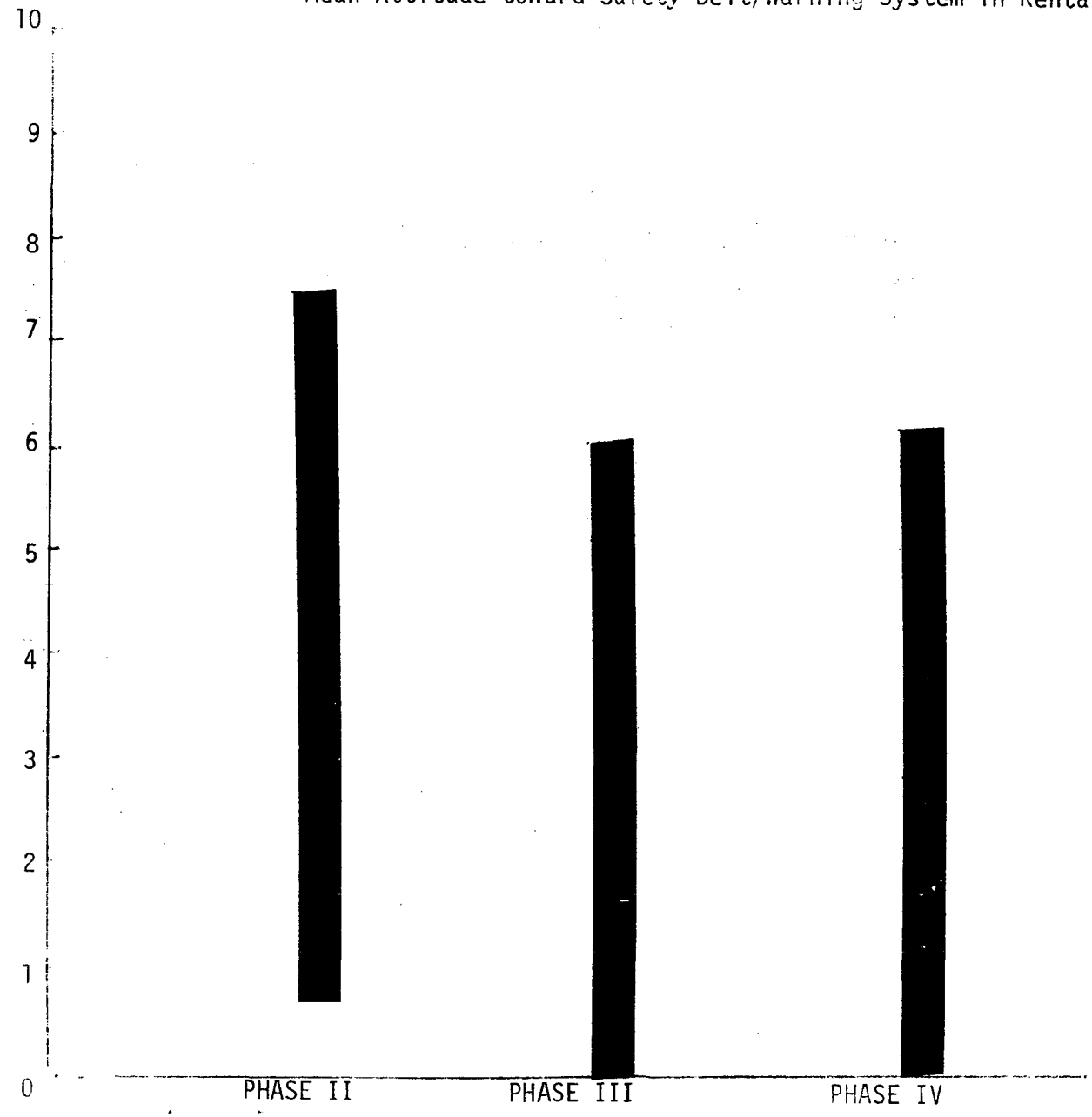


FIGURE 13

Mean Attitude toward Safety Belt/Warning System in Rental Car



## APPENDIX B

### Counter System

The counters in each car were connected to the starter and to the lap belt retractor and recorded the number of times each was used during the car's rental period.

Before a car was rented, the interviewer recorded the numbers on the dials of the counter, and these were again recorded on the car's return. The difference between the numbers on the dials from rental to return indicated the total engine starts and seat belt pulls during the rental. The percent of trips when the seat belt was used was determined by dividing engine starts into seat belt pulls.

At both rental and return the counter dials were checked by the interviewer to make certain they were functioning. This was done by starting the car and pulling the belt and noting if the dials increased appropriately. If they did not, the data from the car was not included.

Programmed into the counter was a three-minute delay control which required the engine to be turned off and/or the belt to be in the retractor for three minutes before another start or pull could be registered. This eliminated the possibility of dual counts from engine stalls or when a seat belt was not pulled far enough to be buckled the first time.

The counter system was not entirely reliable, however. Some of the situations which may have created either under or over counts include:

- 1) Upon being unbuckled not all belts return fully into the retractor. Before being used the next time, the belt would have to be "wiggled" back into the retractor and then pulled. Since the belt would not be in the retractor three minutes, a count would not be recorded.
- 2) A count would be recorded if the belt was pulled and hooked on the armrest, etc. rather than actually being worn by the respondents.
- 3) If the respondent stopped for less than three minutes, a count on either or both dials (depending on the use of the belt) would not be recorded.

It is impossible for us to determine if the counter totals represent an underestimate or an overestimate of actual seat belt use since we cannot know the frequency distribution of each of the above events.

APPENDIX C

National Analysts, Inc.  
Philadelphia, Pa. 19106

Study #1-501  
Fall, 1972  
OMB #04S-72028

Restraint System Evaluation

Respondent # \_\_\_\_\_

Name \_\_\_\_\_ Phase #: \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Date \_\_\_\_\_ Time started: \_\_\_\_\_ A.M. \_\_\_\_\_ P.M.  
ended: \_\_\_\_\_ A.M. \_\_\_\_\_ P.M.

National Analysts, in cooperation with the Department of Transportation, is conducting a research project among people who rent cars. We would like to ask you a few questions about your reaction to the restraint system, that is the lap belt and shoulder belt system, in the car you just rented.

1. Was the primary use of this car for business or for pleasure?

Business	1
Pleasure	2
Both	3

2. A. The first few questions refer to the trips on which you used this rental car. While you were driving this rented car, were any of the trips less than 25 miles in length?

	Yes	1
SKIP TO Q.3	No	2

B. (HAND RESPONDENT CARD) While you were driving on trips of less than 25 miles, how often did you wear the lap belt? (RECORD BELOW)

C. While you were driving on trips of less than 25 miles, how often did you wear the shoulder belt? (RECORD BELOW)

3. A. Now, while you were driving this rented car, were any of the trips 25 miles or longer?

	Yes	1
SKIP TO Q.4	No	2

B. While you were driving on trips of 25 miles or more, how often did you wear the lap belt? (RECORD BELOW)

C. And, while driving on trips of 25 miles or more, how often did you wear the shoulder belt? (RECORD BELOW)

	Trips Less Than 25 Miles		Trips 25 Miles or More	
	2B	2C	3B	3C
	Lap Belt	Shoulder Belt	Lap Belt	Shoulder Belt
Almost always	1	1	1	1
On more than half the trips	2	2	2	2
On less than half the trips	3	3	3	3
Or, almost never?	4	4	4	4

The next several questions concern your use of safety belts in cars other than this rental car.

4. A. Do you have a personal car?

	Yes	1
SKIP TO Q.5	No	2

B. Does that car have:

	Yes	No
Lap belts?	1	2
Shoulder belts?	1	2

C. (HAVE LAP BELTS IN Q.4B) While driving your personal car on trips of less than 25 miles, how often do you wear a lap belt? (RECORD BELOW)

D. (HAVE SHOULDER BELTS IN Q.4B) While driving your personal car on trips of less than 25 miles, how often do you wear the shoulder belt? (RECORD BELOW)

E. (HAVE LAP BELTS IN Q.4B) Now, thinking just of trips 25 miles or more, while driving in your personal car, how often do you wear the lap belt? (RECORD BELOW)

F. (HAVE SHOULDER BELTS IN Q.4B) On trips of 25 miles or more while driving your personal car, how often do you wear the shoulder belt? (RECORD BELOW)

	Trips Less Than 25 Miles		Trips 25 Miles or More	
	4C	4D	4E	4F
	Lap Belt	Shoulder Belt	Lap Belt	Shoulder Belt
Almost always	1	1	1	1
On more than half the trips	2	2	2	2
On less than half the trips	3	3	3	3
Or, almost never?	4	4	4	4

5. What is your attitude toward safety belts in general, that is toward just the lap and shoulder belts and not toward warning devices or lights or buzzers? (PROBE)

6. (IF NO PERSONAL CAR, Q.4A, SKIP TO Q.7) When driving this rental car, do you think your use of seat belts increased, decreased or remained about the same as your normal usage of seat belts when driving your personal car?

Increased	1
Decreased	2
Same	3

7. A. I am going to read a statement to you; please tell me how much you agree with it. The seat belt system in this rented car is a useful and effective safety device. Do you agree completely, agree somewhat, disagree somewhat, or disagree completely with that statement?

Agree completely	1
Agree somewhat	2
Disagree somewhat	3
Disagree completely	4

- B. Why do you say that? (PROBE)

--

8. A. (FOR PHASE I, SKIP TO Q.10) If the warning (or interlock) system were factory installed on your personal car, would you:

	Yes	No
Use it?	1	2
Modify it?	1	2
Or remove it or disconnect it?	1	2

- B. (IF "YES" TO MODIFY) What would you do? (PROBE)

--

- C. Using the card, how often would you modify the system as you just described?

Almost always	1
On more than half of the trips	2
On less than half of the trips	3
Or, almost never?	4



9. The next few questions are just about the safety belt system in the car you just rented.

A. Did the safety system function as it was described to you when you rented the car, or did it have any malfunctions? (IF MALFUNCTIONED, PLEASE DESCRIBE)

B. What changes in the design of the system would you suggest? (PROBE)

C. Do you have any personal objections to the seat belts that were in this rental car? (IF SO, WHAT ARE THE OBJECTIONS)

D. Do you have any personal objections to the warning system (or interlock system) that was in this rental car? (IF SO, WHAT ARE THE OBJECTIONS)

The last few questions are used to divide the interviews into groups.

10. A. Have you ever rented a car here in Fayetteville before?

	Yes	1
SKIP TO Q.11	No	2

B. When was the last time? (IF IN THE LAST 4 MONTHS, DETERMINE EXACT DATE)

Month \_\_\_\_\_

Year \_\_\_\_\_

11. What was the last year of school you completed?

Did not finish high school	1
Completed high school	2
Some college	3
Completed college	4
Post graduate	5
Trade school	6

12. What is your age? Are you:

Under 25?	1
25-34?	2
35-49?	3
50-64?	4
65 or older?	5

Thank you.

BY OBSERVATION:

Male	1
Female	2

CAR DATA

Car License # \_\_\_\_\_

Respondent # \_\_\_\_\_

Respondent Name \_\_\_\_\_

From Car:

Engine counter: At Rental - # \_\_\_\_\_

At Return - # \_\_\_\_\_

Seatbelt counter: At Rental - # \_\_\_\_\_

At Return - # \_\_\_\_\_

From Rental Contract:

Total miles \_\_\_\_\_

Total days \_\_\_\_\_

## APPENDIX D

### Explanation Attached to the Rental Contract

Car rental companies in Fayetteville, North Carolina are participating in a program to evaluate a safety belt system for automobiles. This system includes a new shoulder and lap belt and a "logic system" for the warning lights and buzzers and has been installed into the rental cars here.

The shoulder and lap belts are united into a single unit so that both are fastened simultaneously. These belts are also on an inertia reel which permits the driver to move forward, or to the side, at a slow or even rate, but will lock if there is a sudden impact.

The logic system requires a sequential procedure to follow before starting the car. If the pattern is not followed, the warning light and buzzer will go off alerting the driver that his seat belt is not fastened. The order for the logic system is that the driver sit down in the seat, attach the seat belt and then start the car. After turning off the car, he should then remove the seat belt.

The belt must be fully returned into the retractor in order to complete the cycle for the logic system. Anytime this pattern is not followed the warning light and buzzer will be activated.

APPENDIX E

Sticker Attached to the Dashboard During Phase IV

FASTEN SEAT BELT BEFORE  
STARTING CAR

THIS CAR EQUIPPED WITH  
ENGINE INTERLOCK SYSTEM

## APPENDIX F

### Acceptance Score

The "Acceptance Score" was determined by the respondents' answers to four questions. A numerical weight was assigned to each answer, and the total of the weighted answers determined the Acceptance Score.

The four questions and the weights for each answer are:

	<u>Question</u>	<u>Answer</u>	<u>Weight</u>
7A.	"...the seat belt system in this rented car is a useful and effective safety devise..."	Agree completely	3
		Agree somewhat	2
		Disagree somewhat	1
		Disagree completely	0
8A.	If the warning (or interlock) system were factory installed on your personal car, would you use it, modify it, remove it or disconnect it?	Use	3
		Modify	1
		Remove/Disconnect	0
9C.	Do you have any personal objections to the seat belts that were in this rental car?	No objections	2
		Had objections	0
9D.	Do you have any personal objections to the warning system (or interlock system) that was in this rental car?	No objections	2
		Had objections	0