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EFFECTIVENESS OF SPEED CONTROL SIGNS IN RURAL SCHOOL ZONES AND SMALL COMMUNITIES

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Federal Highway Administration
Office of Research
Washington DC 20590

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Abstract

sults are described of experiments conducted in Mississippi, California, and Oregon sting the effectiveness of speed control signs in rural school zones and small mmunities on high-speed, two-lane highways. Signs tested included existing signing, reduced speed ahead sign, speed limit and reduced speed ahead signs coupled with ard identification beacons, and a speed violation sign activated when a driver eeded the speed limit in effect. Also, roadside interviews were conducted at the es and a questionnaire booklet was administered to groups to assist in determining ability of each of the signs to increase safety and improve driver awareness of ential hazards. The questionnaire booklet provided information on public reaction understanding of the signs. Results indicated that the combination of signs and ard identification beacons and the speed violation sign provided the most stantial improvement in reducing speeds and increasing awareness of roadside ditions for both small communities and school zones. A wide variability in sponse to the new signs persisted from site to site. The improvement ranged from o 10 mph. The combination of signs was not always more effective compared to the lividual signs with hazard identification beacons. The speed violation sign, n added to the signs with hazard identification beacons, resulted in no additional rovement at some sites. Signs without hazard identification beacons were in-equate for informing drivers of existing speed limits. Driver opinion indicated t, in order to obtain a high degree of safety in rural school zones and small mmunities, effective speed control signs must be used in addition to the establish-t of reasonable speed limits and strict enforcement.

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PREFACE

Several experiments were conducted in three states to test the effectiveness of various types of speed control signs in rural school zones and small communities. The experiments were planned and designed after research problem statements were submitted to the Federal Highway Administration (FHWA) by the Mississippi State Highway Department recommending a study of small community speed control, and by the San Diego County, California, Department of Transportation; and the Washington County, Oregon, Department of Public Works recommending studies of speed control in school zones. These experiments were carried out by the respective local authorities. The experiments were an extension of previous studies conducted at the FHWA Maine Facility located on U.S. Route 2. The questionnaire and interview study was designed jointly by the FHWA and the Urban Behavioral Research Associates, Inc. (UBRA) of St. Louis, Missouri. The complete study was sponsored by the Federal Highway Administration.

The authors express gratitude to the following individuals who worked diligently in the field: Paul Teng and Sidney Kidd of the Mississippi State Highway Department; Frank Julian and Jack Murrell of the San Diego County, California, Department of Transportation; and David Herb and Lyle Wohl of the Washington County, Oregon, Department of Public Works. Also, significant contributions were made by the following: Maurice Lanman and Merton Rosenbaum of the Federal Highway Administration; and Patricia Brown, Vera Dolansky, Gordon Boehner, and Ernst Meyer of the Transportation Systems Center.

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1. INTRODUCTION

It has been observed that a high degree of non-compliance to existing speed regulations and a disproportionate number of accidents occur on our nation's two-lane rural highways.[1][2] Excessive speed for the prevailing driving conditions has often been cited as a contributing factor to the number of fatalities involved.[3] Speed control therefore has an important role in attempting to counteract excessive fast driving and to reduce accidents.[4]

Recent studies[5][6] conducted at the Federal Highway Administration (FHWA) rural highway research facility in Maine have examined driver and traffic responses to various speed control devices in small towns and school zones. These studies showed that certain devices were effective in achieving a significant reduction in speed in the regulated zones and a relatively large improvement in compliance to the speed limit in effect, compared to the base sign. Although speed data findings were statistically significant, they do not appear to be substantial enough to warrant widespread application. But coupled with strong favorable driver opinion on the effectiveness of the new signs, justification for their use may be provided.

Driver perception of school traffic control devices has been addressed by Reiss[7] in terms of roadside interviews designed to assess driver perception, attitudes, and behavioral changes related to driving through school zones. Less than half of the drivers correctly identified the signs that were present. The sign most frequently identified was the school speed limit sign with hazard identification beacons. The only school signs understood were signs with flashing lights. However, these did not necessarily modify driver behavior or reduce speed to the level indicated on the sign.

The aims of the present study are (1) respond to the needs expressed by several states in their submitted research problem statements, (2) determine if the major findings of the past research in Maine are transferable to other sites, and (3) extend the past research by examining additional driver awareness and safety measures. These latter measures were obtained through the use of roadside interviews and questionnaire booklets that were administered away from the test sites. Specifically, data were gathered on driver characteristics, driver opinions and beliefs involving speed control, driver awareness of the speed limits and sign changes, driver familiarity with the test sites, driver awareness, understanding, and reaction to roadside signs.

Local traffic officials collected the roadside interview data and administered the written questionnaire booklets for these

2. SCHOOL ZONE EXPERIMENTS

The school zone experiments were conducted at three sites in Oregon, two sites in California, and two sites in Mississippi. The electronic data (vehicle speeds) for one site in California were abandoned due to equipment malfunctions and weather problems. A total of six new sign configurations were tested. Three phases of sign testing were planned for each site. However, in Oregon only two phases were completed before the regular school year ended. It was decided to abandon the last phase in Oregon rather than wait for a new school year to begin. The school sites are referred to by their school names in this report.

2.1 TEST SITE DESCRIPTION

The test sites are shown in plan and profile view in Figures 2-1 through 2-7. (Speed sensor locations and sign configurations by test phase are also shown. These are discussed below and in Section 3, respectively.) The sites were chosen because of their similarity in road type (two lane rural highway), average daily traffic (between 2,000 and 3,000), approach speeds (between 35 and 55 mph), and existing sign condition (in conformance with the 1971 MUTCD).[8] In order to make comparisons between sites, the selected sites had to be free of features that would tend to bias the drivers response to the speed control signs. The sites had to have features that compelled the signing in the first place (i.e., children present during certain periods of the day).

One of the test sites in Mississippi was located at the Anguilla Elementary School on U.S. Route 61 in Anguilla and is shown in Figure 2-1. This test site was straight and level and was located within a small town speed zone (speed limit 35 mph). A four-way intersection was located 540 feet south of the school speed zone. Traffic crossing Route 61 at this intersection was required to stop. Right turning traffic was channelized onto Route 61 with yield sign control. The speed limit north of the school, and small community zones for southbound traffic, was 55 mph. In the northbound direction, traffic exited the school zone directly into a 55 mph speed zone. The school speed limit was 25 mph.

The other test site in Mississippi was located on U.S. Route 16 near Canton and is shown in Figure 2-2. The name of the school at this site was the Luther Branson School. This site was situated on top of a small hill. The road passing the school was straight with a slight grade (between 1% and 2%) on both sides of the school. A fenced-in playground was located just east of the school adjacent to Route 16. The school speed limit was rather

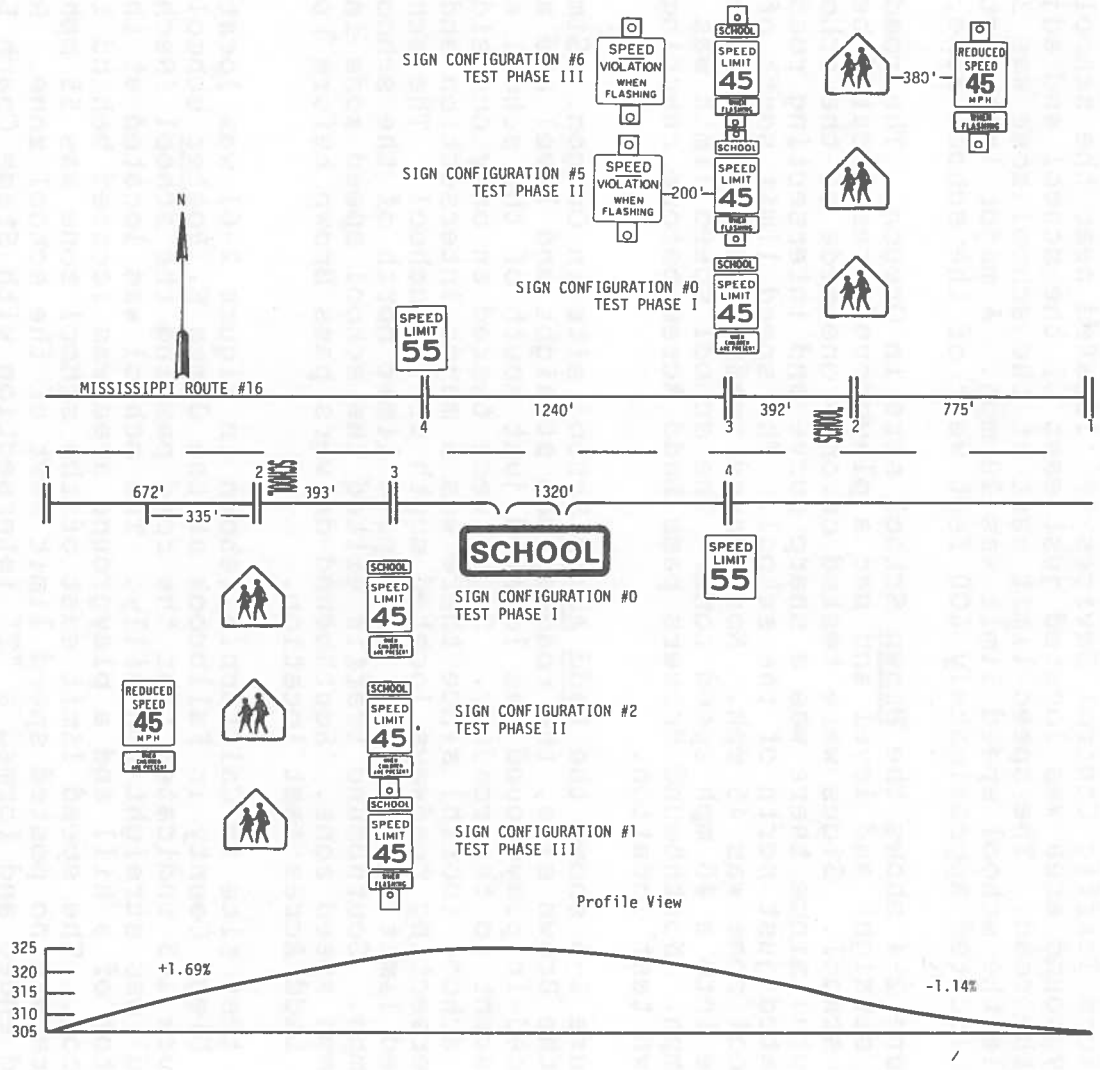


FIGURE 2-2.[+] BRANSON SCHOOL, MISSISSIPPI

[+]Figure not to scale

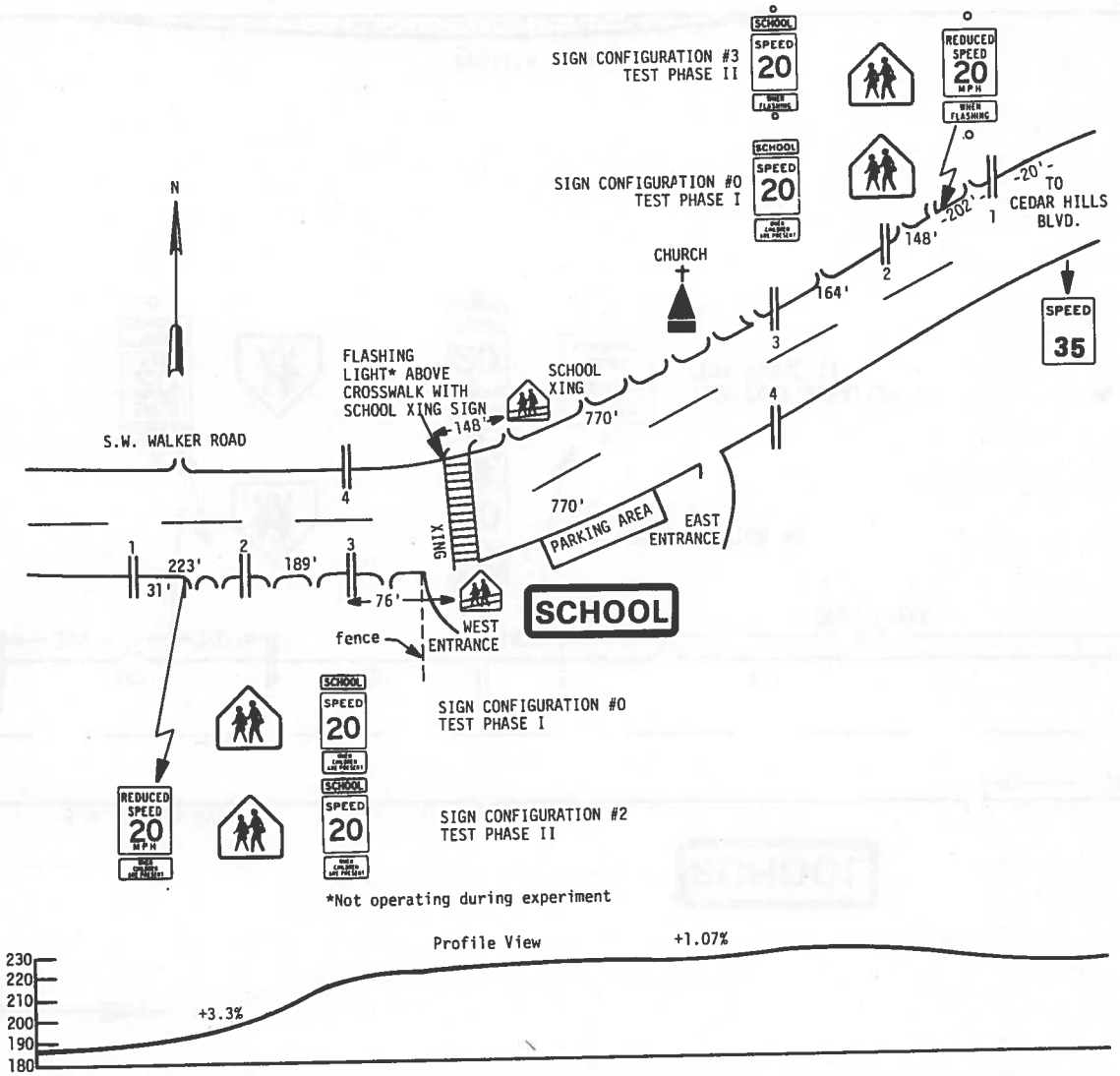


FIGURE 2-3.[+] BARNES SCHOOL, OREGON

[+]Figure not to scale

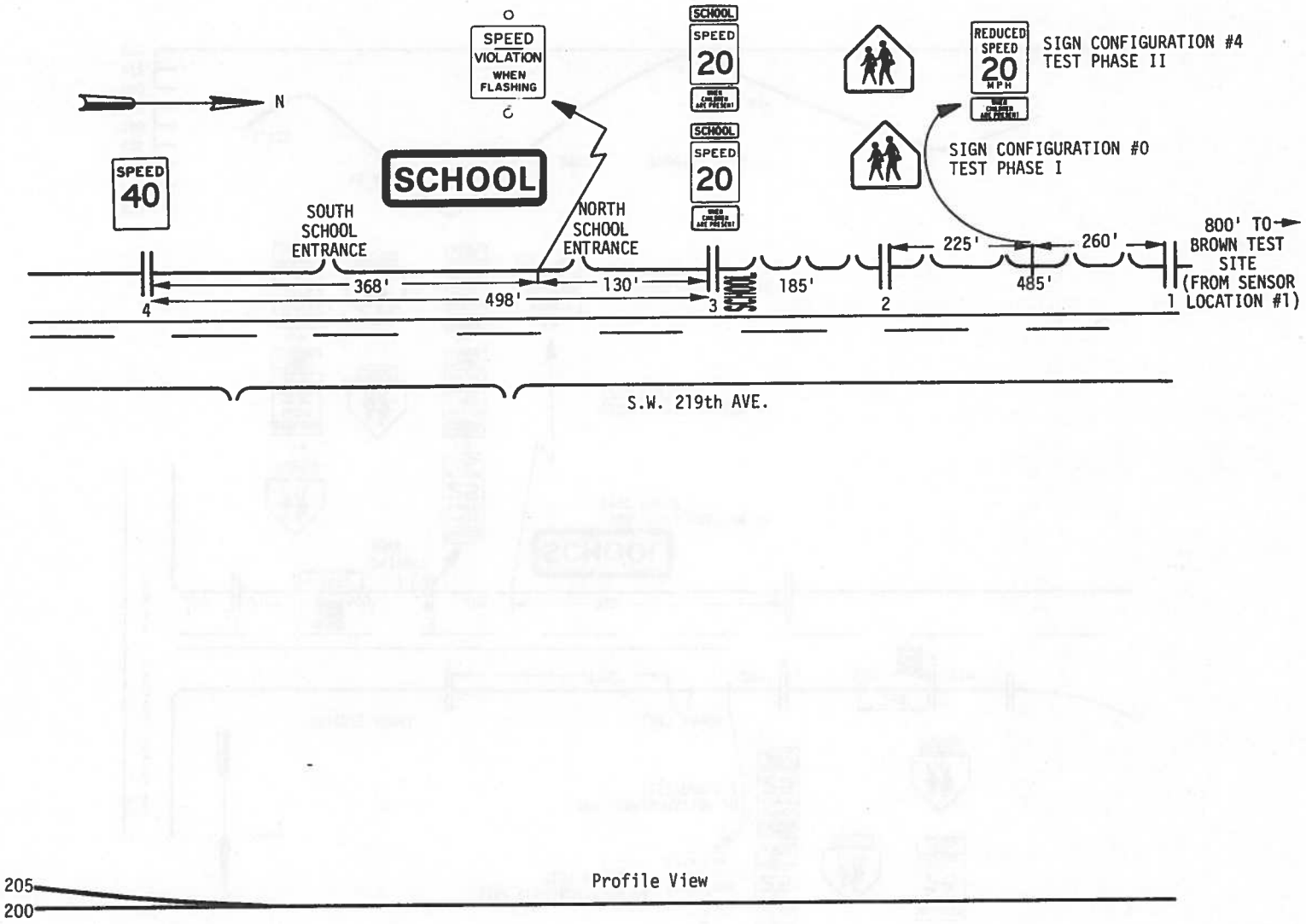


FIGURE 2-5.[+] LADD ACRES SCHOOL, OREGON

[+]Figure not to scale

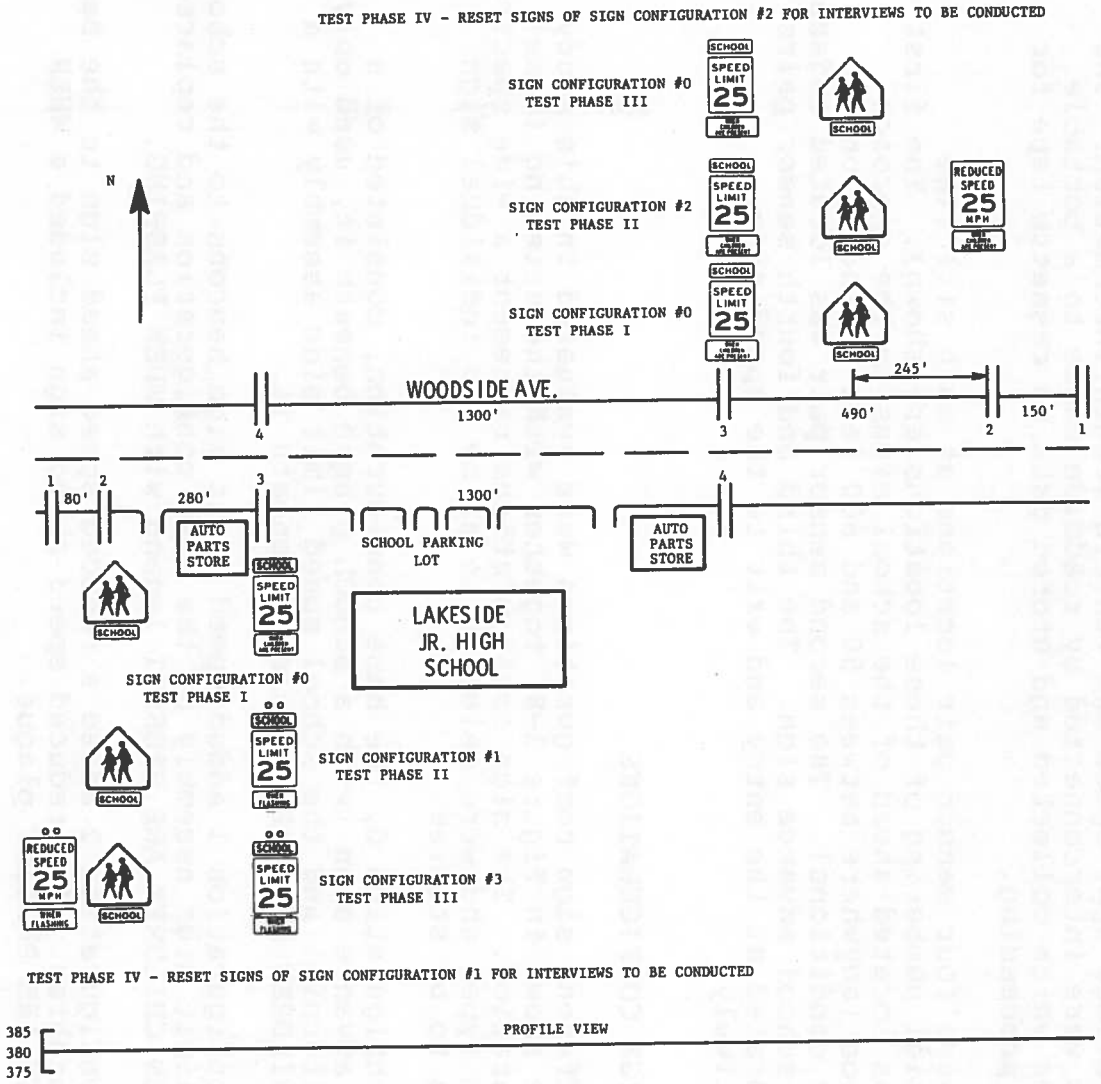
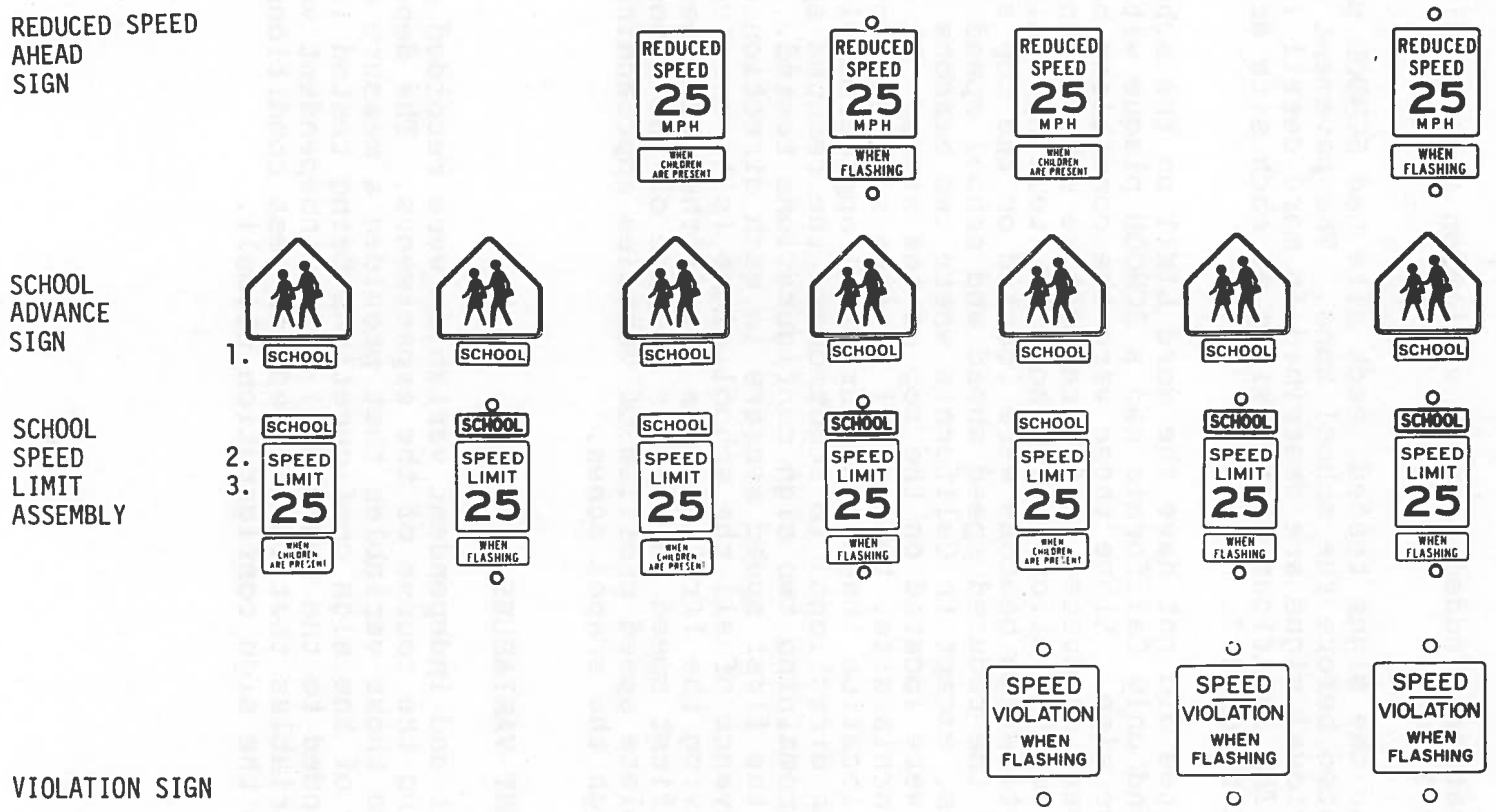


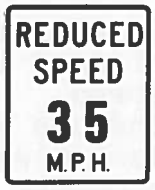
FIGURE 2-7.+ LAKESIDE SCHOOL, CALIFORNIA

+Figure not to scale



1. The legend SCHOOL attached to the school advance sign applies only to the California test sites.
2. The speed limits vary from site to site. They are as follows: Potter, Lakeside, and Anguilla, 25 mph; Branson, 45 mph; Brown, Ladd Acres, and Barnes, 20 mph.
3. At the Oregon test sites, the word "limit" does not appear on the speed limit sign.

FIGURE 2-8. SCHOOL SIGN CONFIGURATIONS



24" x 30"

MUTCD* R2-5b (REDUCED SPEED AHEAD SIGN)
BLACK LETTERS ON WHITE BACKGROUND
BEACONS MAY BE ATTACHED AS DESIRED
ADVANCE SIGN FOR SPEED LIMIT POSTED AHEAD

24" x 30"

MUTCD R2-1 (SPEED LIMIT SIGN)
BLACK LETTERS ON WHITE BACKGROUND
BEACONS MAY BE ATTACHED AS DESIRED
(IN OREGON, LEGEND "LIMIT" IS OMITTED)
SPEED LIMIT ESTABLISHED BY LAW

O

36" x 36"

BLACK LETTERS ON WHITE BACKGROUND
BEACONS FLASH WHEN VEHICLE EXCEEDS POSTED
SPEED LIMIT BY MORE THAN 5 MPH

O

36" x 36"

MUTCD S1-1 (SCHOOL ADVANCE SIGN)
BLACK FIGURES ON YELLOW BACKGROUND
USED IN ADVANCE OF LOCATIONS WHERE SCHOOL BUILDINGS
OR GROUNDS ARE ADJACENT TO HIGHWAY

24" x 8"

MUTCD S4-3
BLACK LETTERS ON YELLOW BACKGROUND
ATTACHED TO SCHOOL ADVANCE SIGN IN CALIFORNIA
USED WITH "SPEED LIMIT" SIGN IN SCHOOL ZONES

24" x 10"

MUTCD S4-4
BLACK LETTERS ON WHITE BACKGROUND
USED WITH BEACONS IN CONJUNCTION WITH REDUCED SPEED AHEAD SIGN OR
"SPEED LIMIT" SIGN ASSEMBLY WHEN ZONE SPEED LIMIT IS IN EFFECT

24" x 10"

MUTCD S4-2
BLACK LETTERS ON WHITE BACKGROUND
USED WITH REDUCED SPEED AHEAD OR
"SPEED LIMIT" SIGN ASSEMBLY IN SCHOOL ZONES

9'8" x 8'0"

MUTCD FIGURE 7-3
PAVEMENT MARKING - WHITE LETTERS

*Manual on Uniform Traffic Control Devices (1971)

FIGURE 2-9. SCHOOL SIGN DESCRIPTIONS

2.3.2 Independent Variables

The independent variables in these experiments were:

- Site - Two in Mississippi, two in California, and three in Oregon.
- Direction of travel - Two directions at each site except Brown and Ladd Acres in Oregon where signs were tested in one direction only.
- Sign configuration - Six plus the existing (base) configuration (see Figure 2-8).
- Speed limit condition - In-effect or not-in-effect. The school zone speed limit-in-effect times are shown in Table 2-1.

The independent variables essentially provided a description of or reference to a particular test condition (e.g., sign configuration 3, southbound direction, Anguilla, Mississippi, school speed limit-in-effect). All tests were conducted during daylight hours and good weather conditions (i.e., no rain, snow, fog, or wet roadway conditions). Only vehicles less than 20 feet in length (mostly automobiles), and vehicles whose time headway with respect to the previous vehicle was more than six seconds (to avoid vehicle/vehicle interaction effects), were included in the analysis.

2.4 TEST SCHEDULE AND PROCEDURES

The site/sign configuration arrangement, data collection schedule, and sample sizes used in the analysis of the school zone experiments are shown in Table 2-2. A separate sign configuration was tested during each of the three test phases. The arrangement was designed such that (1) both the signs with hazards identification beacons (i.e., sign configurations 3) and the violation signs (i.e., sign configuration 6) would be tested in each state, (2) the existing (base) configuration would be tested first at each site and for each direction, and (3) as many combinations of sign configurations as possible would be tested together (i.e., same site and direction) so that the relative effectiveness of the individual signs could be assessed. During the implementation of experimental data collections plans, there were uncontrollable limitations which precluded collection of both vehicle speeds and interview data for all approaches and all sign conditions. The first phase of data collection involved only vehicle speeds with electronic equipment since the base sign configuration was being tested during this phase and interview data were not deemed to be necessary (the roadside interview

TABLE 2-2. DATA COLLECTION SCHEDULE AND SAMPLE SIZES

		SCHOOL ZONE EXPERIMENTS							
		PHASE I		PHASE II		PHASE III			
Site/Direction Sign Configuration	Data Type	Data Collection Dates	Sample Size	Data Collection Dates	Sample Size	Data Collection Dates	Sample Size		
Anguilla South 0-3-0	Speed	2/22/77-3/7/77	517	3/9/77-3/30/77	330	4/12/77-5/4/77	679		
	Interview			4/11/77	67				
Anguilla North 0-1-5	Speed	2/22/77-3/8/77	748	3/9/77-3/30/77	839	4/20/77-5/11/77	884		
	Interview			4/7/77	69	5/10/77	88		
Branson East 0-2-1	Speed	2/22/77-3/30/77	1039	4/5/77-4/27/77	492	5/19/77-5/25/77	133		
	Interview								
Branson West 0-5-6	Speed	3/23/77-3/30/77	550	4/5/77-4/27/77	1173	5/2/77-5/25/77	243		
	Interview								
Barnes East 0-2-3	Speed	4/19/77-5/2/77	219	5/24/77-6/14/77	464				
	Interview			6/15/77	71				
Barnes West 0-3-2	Speed	4/26/77-5/2/77	417	5/24/77-6/14/77	935				
	Interview			6/16/77	100				
Ladd Acres South 0-4-2	Speed	4/19/77-5/11/77	1223	5/16/77-5/26/77	440				
	Interview			6/6/77-6/7/77	100				
Brown North 0-6-0	Speed	4/18/77-5/11/77	658	5/16/77-6/8/77	662				
	Interview			6/6/77-6/7/77	100				
Potter East 0-3-6	Speed	5/5/76-5/13/76	1351	10/29/76-11/19/76	1881	11/22/76-12/1/76 2/22/77-3/21/77	2692		
	Interview								
Potter West 0-4-6	Speed	5/5/76-5/13/76	690	10/29/76-11/22/76	1700	11/22/76-12/8/76 2/22/77-3/21/77	3675		
	Interview								
Lakeside East 0-1-3-1	Speed*								
	Interview					5/25/77-5/26/77	176	6/6/77-6/7/77	113 †
Lakeside West 0-2-0-2	Speed*								
	Interview					5/27/77-5/31/77	117	6/8/77-6/9/77	112 †

*Data collection equipment was installed in roadway, but data were not utilized due to repeated equipment malfunctions.

†TEST PHASE IV - SIGN CONFIGURATIONS RESET TO CONDUCT INTERVIEW

2.5 RESULTS

The results of the school experiments are discussed in the following sections. Section 2.5.1 presents the results in terms of the primary measure, namely, average speed profile and discusses the relative effectiveness of the sign configurations with respect to location along the roadway. Section 2.5.2 presents the results in terms of mean transit speed through the school zones. In addition to discriminating sign configuration differences, this measure was configured to provide information on the "novelty" effect of the new sign configurations. Section 2.5.3 discusses the results in terms of the 85th percentile transit speed and percent compliance. Section 2.5.4 compares driver behavior when the school speed limit was in effect to that when the school speed limit was not in effect. The comparison is made for each sign configuration in terms of mean transit speed. The speed limit-not-in-effect condition was used also as a control variable providing information on how external factors such as seasonal effects might have influenced driver behavior during the course of the experiments. Section 2.5.5 discusses the roadside interview and questionnaire booklet results. Section 2.5.6 summarizes the results of the school zone experiments.

2.5.1 Average Speed Profiles

The speed profile results are shown in Figures 2-10 through 2-19 for each site, direction of travel, and sign configuration, and for school speed limit-in-effect conditions only. The sign configuration sequence of testing is shown above each figure.

The profiles, in general, reflect the characteristics of each site. For example, vehicles tended to accelerate on the approach to and through the school zones at Anguilla-Northbound. This was due to the major intersection preceding the school zone. Vehicles tended to increase their speed once past the school but within the school zone at Potter-Eastbound, Barnes-Eastbound, and Brown-Northbound. This was probably due to the openness of the road and the lack of open roadside playgrounds beyond the schools at these sites. The changing slope profiles at Potter-Eastbound and Barnes-Eastbound were due to the hilly characteristics at these sites.

The sign configurations (SC) that had the greatest impact on the speed profiles were SC's 5 and 6, as shown in Figure 2-13. These SC's resulted in lower speeds by 2-7 mph compared to the base SC. These SC's included combinations of hazard identification beacons and the speed violation sign. However, results at other locations (Anguilla-Northbound in Figure 2-10 and Potter-Eastbound in Figure 2-14) indicated that the speed violation sign

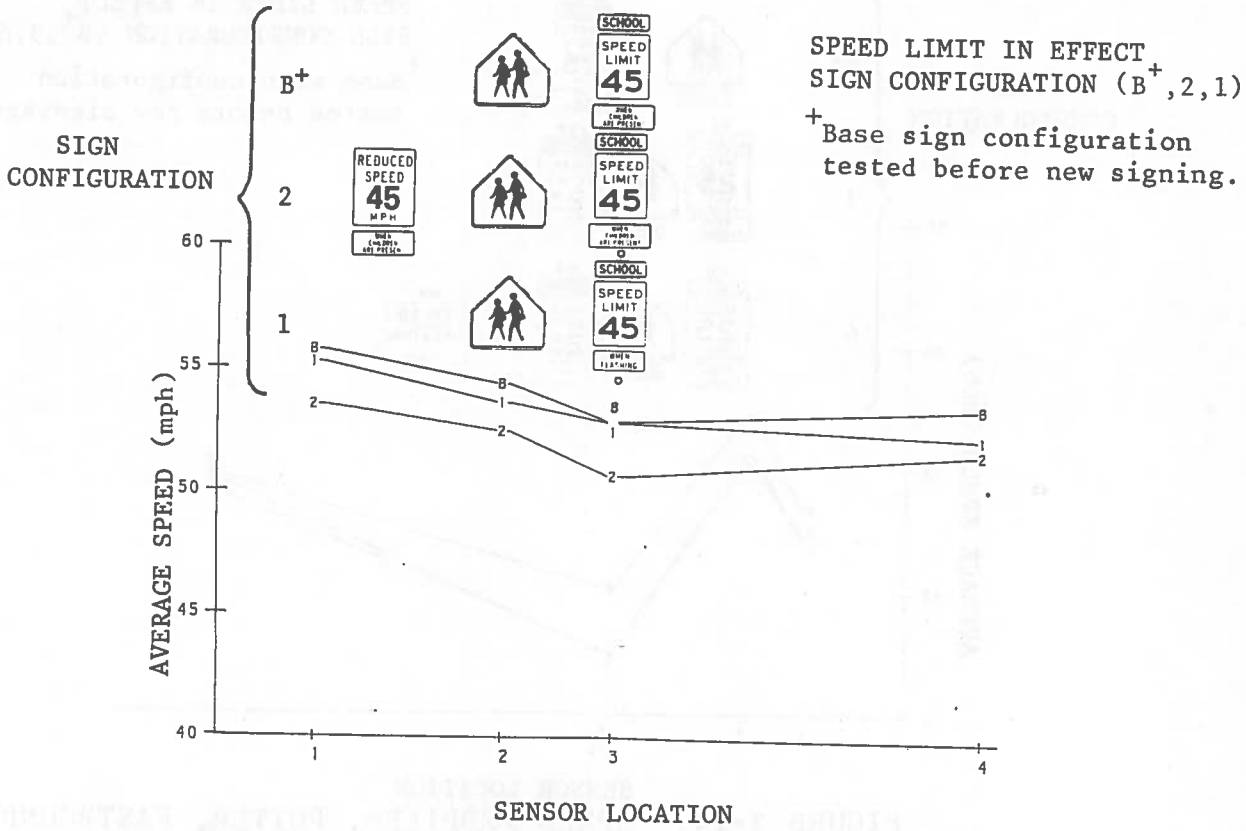


FIGURE 2-12. SPEED PROFILES, BRANSON, EASTBOUND

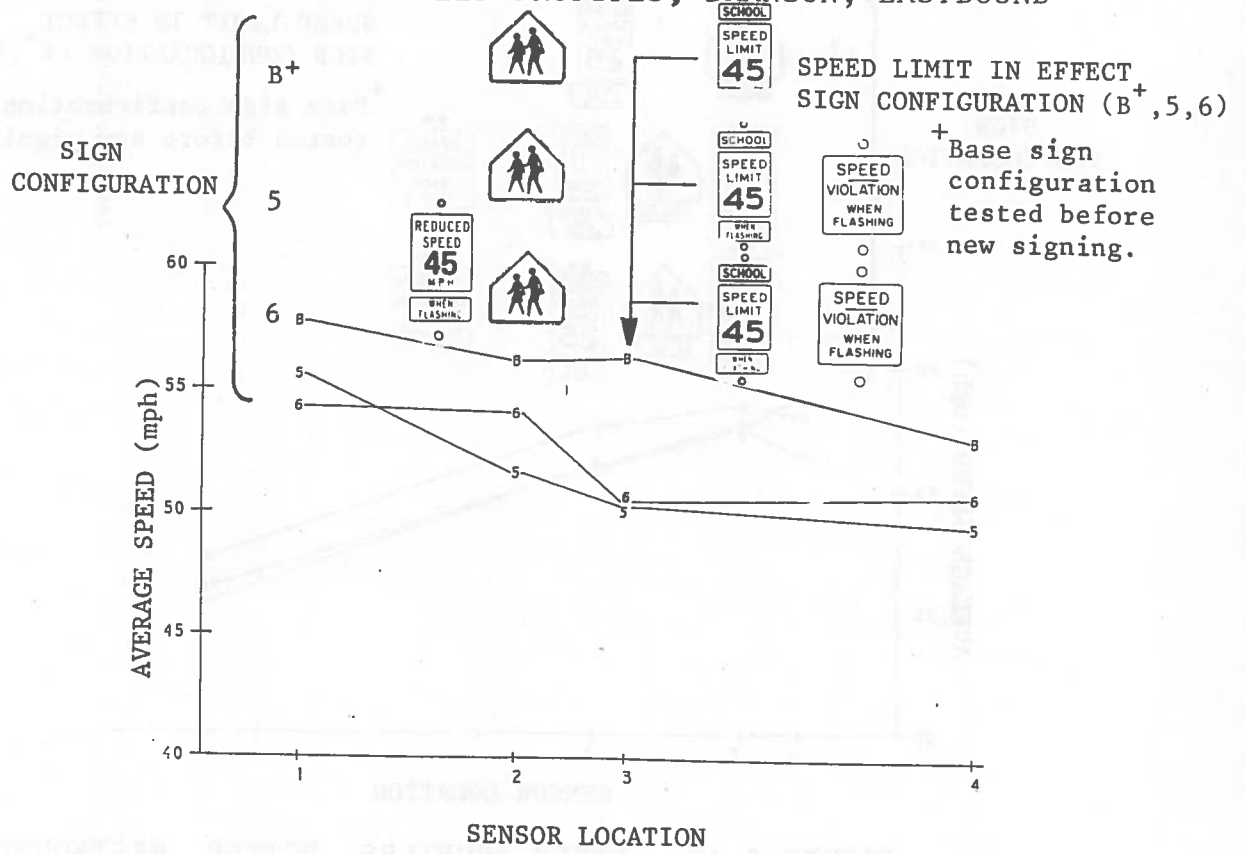


FIGURE 2-13. SPEED PROFILES, BRANSON, WESTBOUND

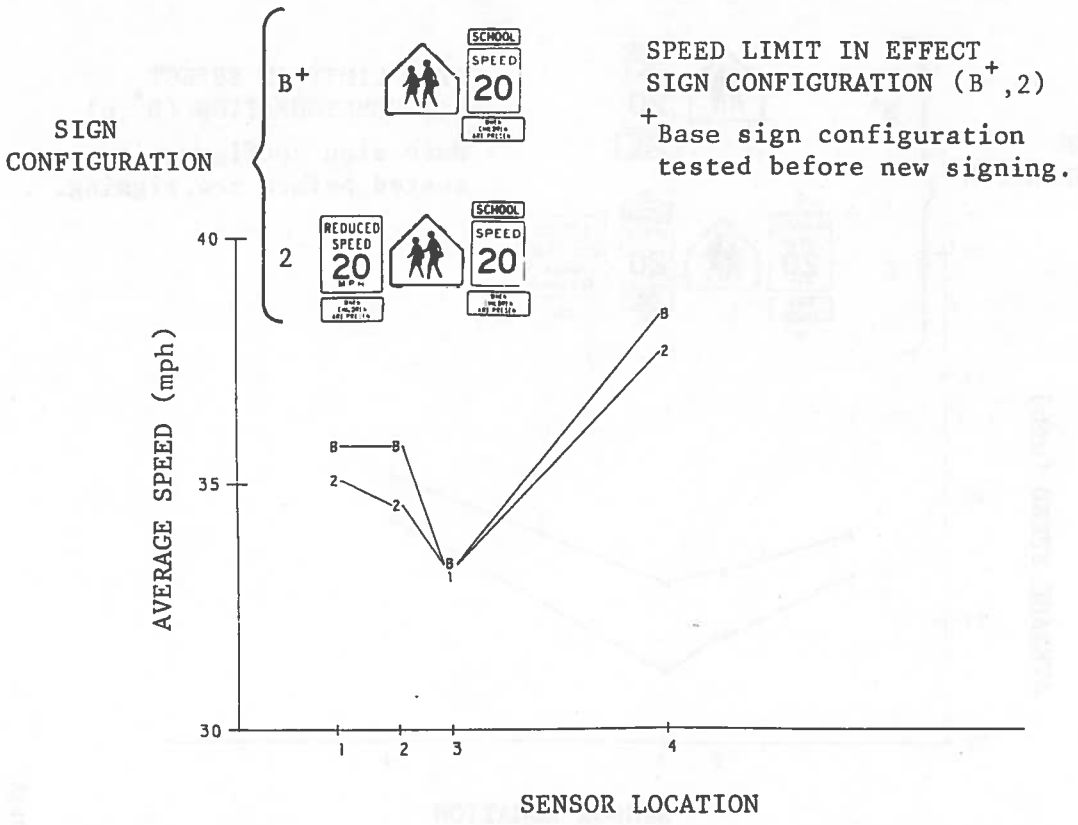


FIGURE 2-16. SPEED PROFILES, BARNES, EASTBOUND

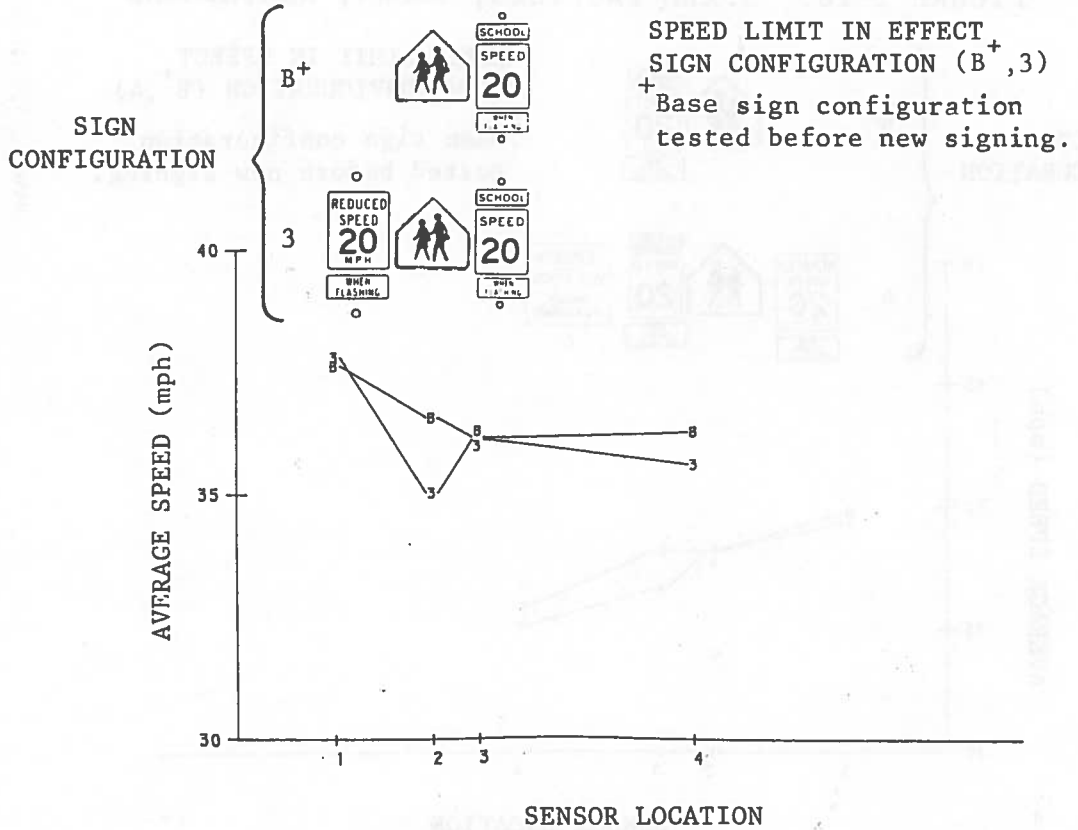


FIGURE 2-17. SPEED PROFILES, BARNES, WESTBOUND

had little added benefit over the signs with hazard identification beacons.

Sign configuration 3 (hazard identification beacons on both the reduced speed ahead sign and the school speed limit sign assembly) seemed to have the next strongest impact in terms of speed profile reductions compared to the base SC. At Anguilla-Southbound (Figure 2-11) the speeds were lowered between 2 and 5 mph over most of the profile. In addition, these results were retained when the base SC was retested (base-after). At Potter-Eastbound (Figure 2-14) the speeds were lowered between 2 and 4 mph over most of the profile. And at Barnes-Westbound (Figure 2-17) speeds were again lowered, although not substantially, over most of the profile.

The speed violation sign used without signs having hazard identification beacons (i.e., SC 4) also showed consistent improvement. At Potter-Westbound, the speed reductions over most of the profile was 2 mph compared to the base SC. It should be noted that the beacons on the speed violation signs could not be activated until after the driver crossed sensor location 3. Thus, any direct responses to the speed violation beacons could only be reflected at sensor location 4. However, if a driver were familiar with the site and aware of the presence of the speed violation sign, he could have been responding at the first three sensor locations as well. It is also interesting to note that the major speed differences between SC 4 and SC 6 at this site occurred at sensor location 1, indicating that the hazard identification beacons were probably having more of an effect on drivers as they approached the school zone compared to the passive reduced speed ahead sign. At Ladd Acres-Southbound, SC 4 lowered the speeds in the school zone by 1 to 2 mph compared to the base SC. There were no substantial speed changes ahead of the school zone. At both sites the speed violation beacons were activated by most drivers (compliance at both sites was less than 5% - see below) so that comparisons between the two sites could be made on the same basis (i.e., most drivers at each site were "violators" seeing and reacting to an activated rather than unactivated speed violation sign).

The only direct comparison between hazard identification beacons on both the reduced speed ahead sign and the school speed limit sign assembly, and beacons on only the school speed limit sign assembly was at Branson-Westbound (Figure 2-13). The reduced speed ahead sign with hazard identification beacons provided a marginal improvement (compared to SC 5) at sensor location 1 and no additional improvements at the remaining sensor locations.

The school speed limit sign assembly with beacons (i.e., SC 1) showed relatively small improvements (i.e., 1 to 2 mph) over the

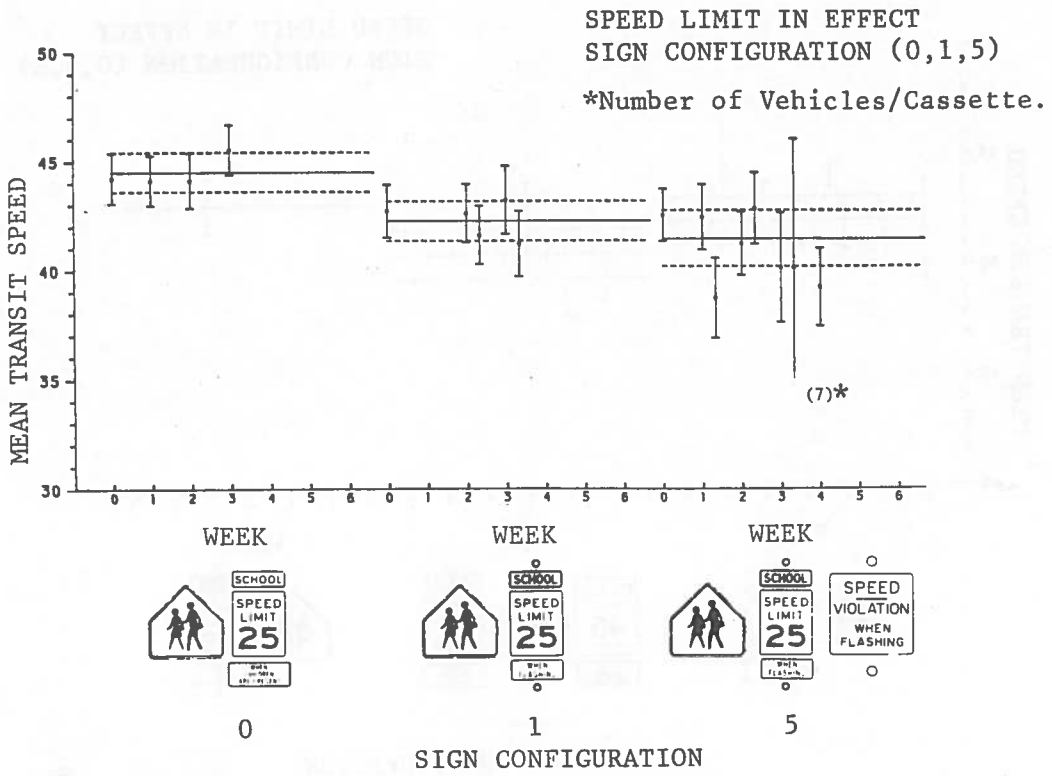


FIGURE 2-20. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION ANGUILLA, NORTHBOUND

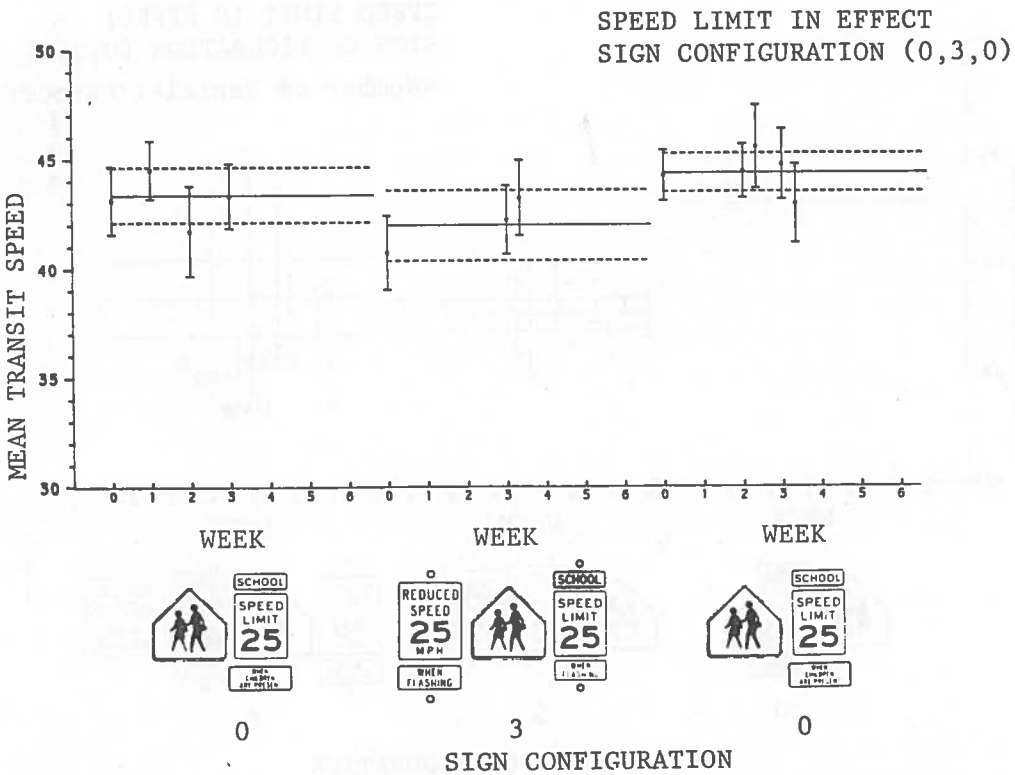


FIGURE 2-21. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION ANGUILLA, SOUTHBOUND

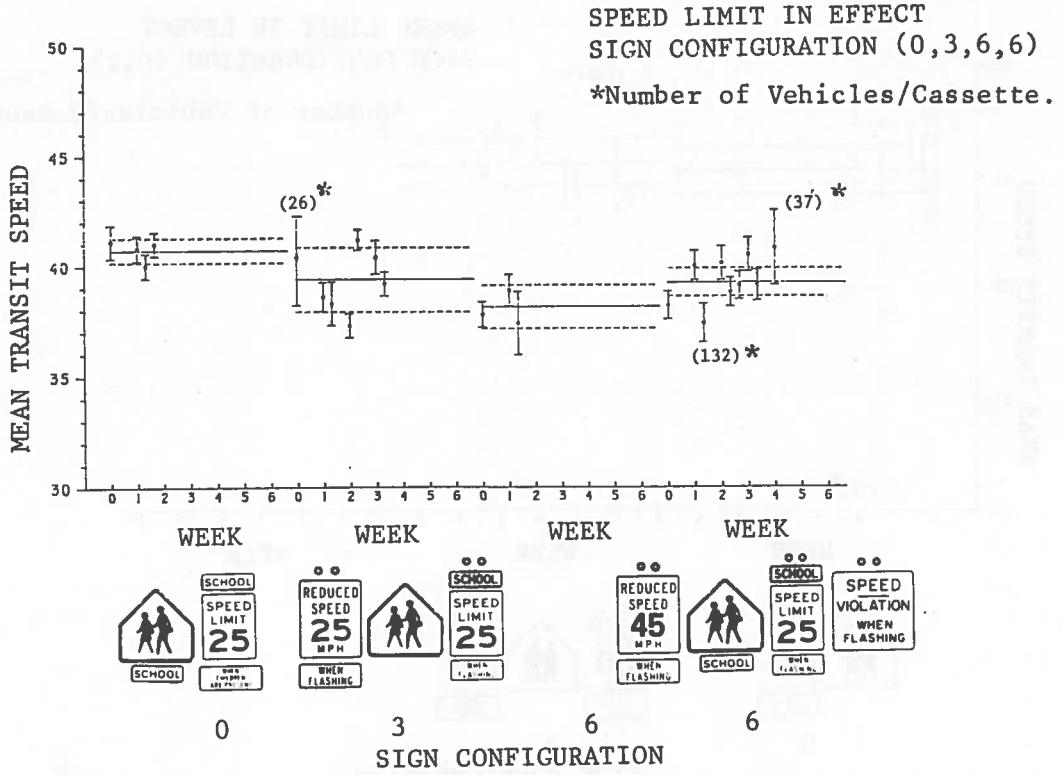


FIGURE 2-24. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION POTTER, EASTBOUND

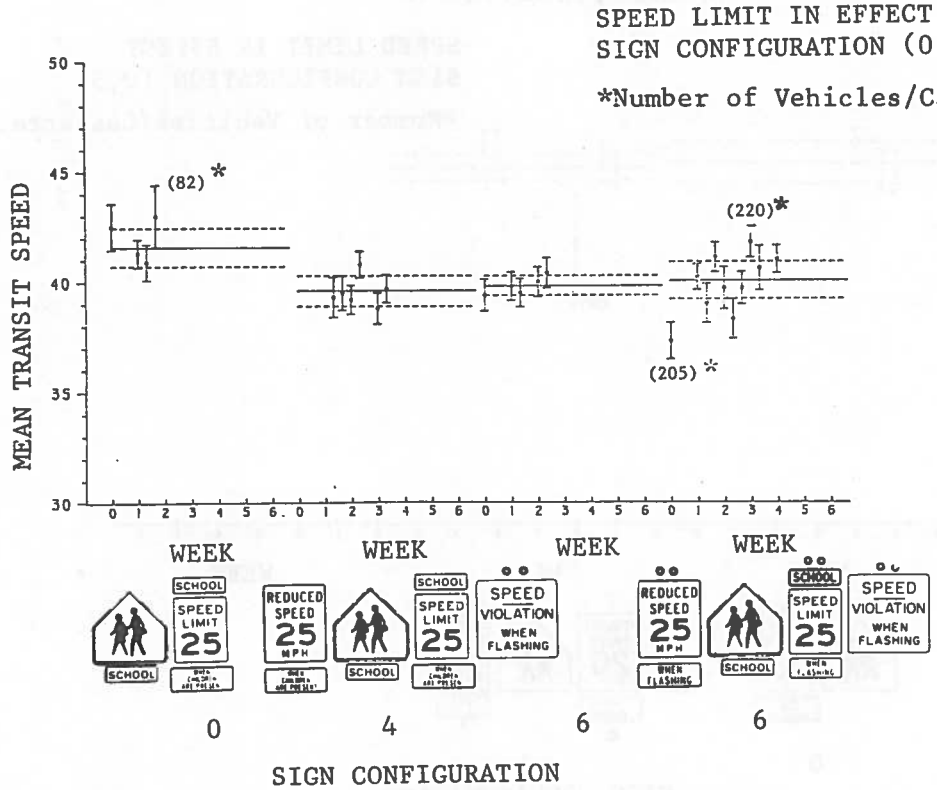


FIGURE 2-25. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION POTTER, WESTBOUND

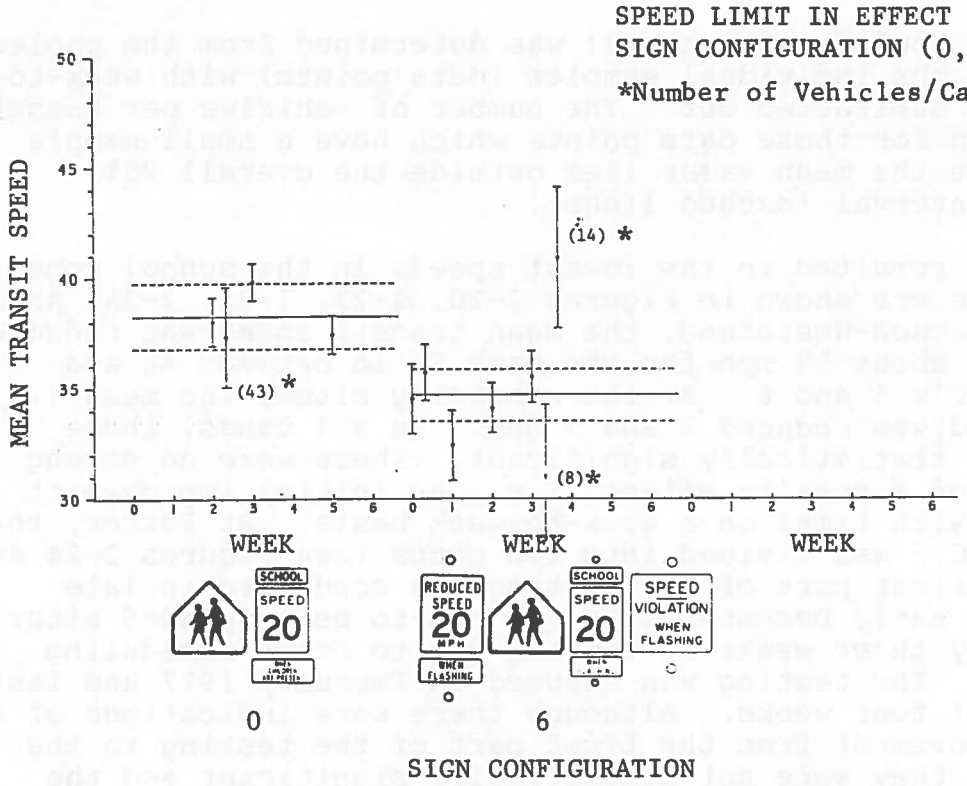


FIGURE 2-28. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION BROWN, NORTHBOUND

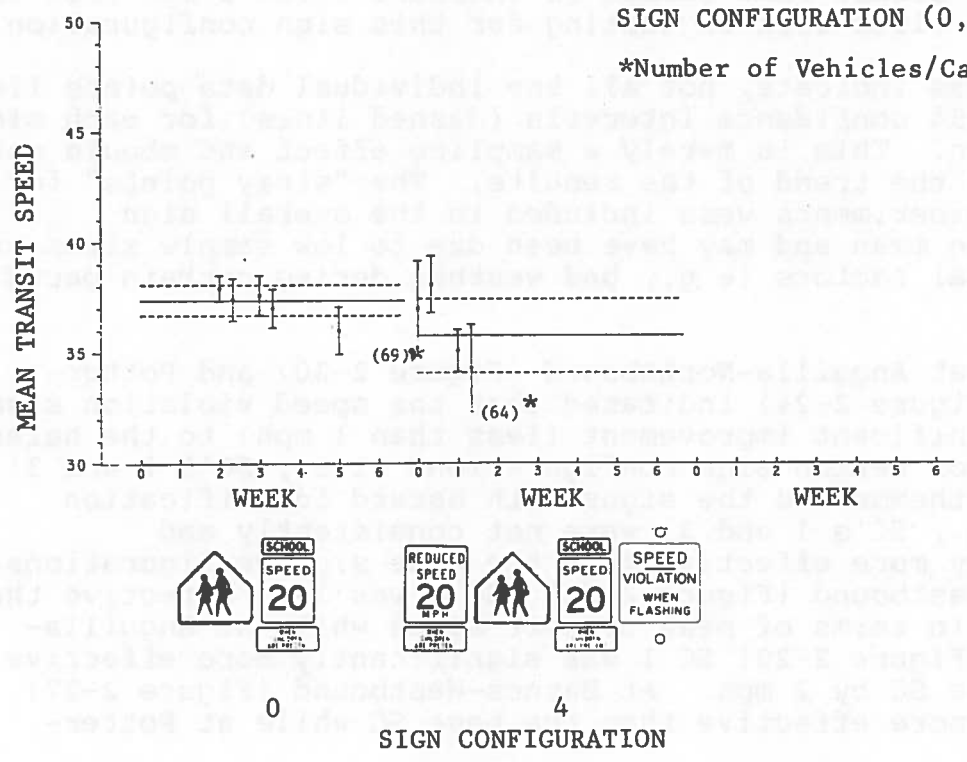


FIGURE 2-29. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION LADD ACRES, SOUTHBOUND

Eastbound (Figure 2-24) and Anguilla-Southbound (Figure 2-21), SC 3 was more effective by 1 mph.

The speed violation sign without hazard identification beacon sign(s) (i.e., SC 4) seemed to be the next best SC (after SC's 5 and 6) in terms of mean transit speed. At Potter-Westbound (Figure 2-25) and Ladd Acres-Southbound (Figure 2-29), the mean transit speed for SC 4 was reduced by about 2 mph compared to the base SC. There were no indications of week-to-week novelty effects at either of these sites for SC 4.

The reduced speed ahead sign (i.e., SC 2) showed inconsistent results in terms of mean transit speed. At Barnes-Eastbound (Figure 2-26), there were essentially no differences between the base SC (i.e, SC 0) and SC 2. At Branson-Eastbound (Figure 2-22), SC 2 showed a 1 mph improvement over the base SC but part of this improvement seemed to be a "novelty" effect; on a week-to-week basis the initial improvement was reduced to no improvement by the end of the fourth week.

In summary, the preceding results indicate that the combination of hazard identification beacon sign(s) and the speed violation sign (i.e., SC's 5 and 6) resulted in the greatest effectiveness (2-5 mph reduction of mean transit speed in the school zone compared to the base SC) while, individually, they provided little improvement over the base SC. Part of the explanation for these results may have been due to site-to-site differences and some overlap of the 95% confidence intervals, but the major element seems to have been a reinforcement characteristic of the two types of signs in achieving a significantly lower mean transit speed.

2.5.3 85th Percentile Transit Speed and Percent Compliance

The 85th percentile transit speed and percent compliance results are given in Tables 2-3 and 2-4, respectively. As mentioned previously, the 85th percentile transit speed provides information on the behavior of high speed drivers (i.e., the high end of the speed distribution), while percent compliance provides information on the behavior of low speed drivers (i.e., the low end of the speed distribution, relatively speaking). Percent compliance is essentially the transit speed percentile for each respective speed limit.

The 85th percentile transit speed ranged from about 35-50 mph at Brown, Ladd Acres, and Barnes; 44-55 mph at Potter and Anguilla; and 51-62 mph at Branson. The speed limits and percent compliances at these sites were as follows:

TABLE 2-4. PERCENT COMPLIANCE SCHOOL EXPERIMENTS, SPEED LIMIT IN EFFECT.

SITE	SIGN CONFIGURATION	PHASE I	PHASE II	PHASE III
ANGUILLA (N)	(0-1-5)	1%	1.5%	3.5%
ANGUILLA (S)	(0-3-0)	3%	1%	1%
BRANSON (E)	(0-2-1)	17%	22%	15%
BRANSON (W)	(0-5-6)	14%	37%	27%
POTTER (E)	(0-3-6)	0%	0%	0%
POTTER (W)	(0-4-6)	0%	0%	0%
BARNES (E)	(0-2)	0%	0%	
BARNES (W)	(0-3)	0%	0%	
BROWN (N)	(0-6)	0%	0%	
LADD ACRES (S)	(0-4)	0%	0%	

N - Northbound
S - Southbound
E - Eastbound
W - Westbound

2.5.4 Speed Limit-In-Effect vs. Speed Limit-Not-In-Effect

This section discusses the differences in driver behavior between speed limit-in-effect conditions and speed limit-not-in-effect conditions in terms of mean transit speed. The data are provided in Table 2-5. The speed limit-not-in-effect conditions were also used as a control variable for determining the potential influence of external factors, such as seasonal effects, on the multi-week experiments. (The new sign configurations may have influenced driver behavior indirectly during periods when the speed limit was not in effect, but this report assumed that the major influence during these periods would be external factors and hence the relative sign configuration effects should be interpreted accordingly.)

Except for the base sign configuration and SC 3 at Barnes-Westbound, the mean transit speeds were lowered between 1 and 5 mph when the school speed limit was in effect compared to when the school speed limit was not in effect. For the base sign configuration, the mean transit speeds were reduced by about 1 mph at most sites when the school speed limit was in effect. The exceptions were Anguilla-Northbound and Brown-Northbound where there were no speed reductions for the base sign configurations.

The combination of hazard identification beacon sign(s) and the speed violation sign (i.e., SC's 5 and 6) resulted in the greatest speed reductions (2-5 mph), and the speed violation sign without hazard identification beacon sign(s) (i.e., SC 4) provided a consistent 2 mph speed reduction at the two sites where it was tested (Potter-Westbound and Ladd Acres-Southbound).

The school speed limit-not-in-effect results indicated that there were no strong external factors such as seasonal effects that were influencing drivers' behavior over the course of the multi-week experiments at each site. At Anguilla and Barnes-Eastbound, the mean transit speeds did not change significantly over the course of the experiments when the speed limit was not in effect. At the remaining sites, except Branson-Eastbound, the mean transit speed decreased by 1-2 mph when the first new sign configuration was tested and remained at the new level for the rest of the testing. (Note that all the sign configurations tested at these sites included either hazard identification beacon sign(s) or the speed violation sign.) The new sign configurations apparently had a residual effect on drivers when the school speed limit was not in effect. This does not reduce the effectiveness of the new sign configurations, but rather indicates that they were causing more cautious driving when the school speed limit was not in effect.

At Branson-Eastbound, the mean transit speed decreased by about 1 mph when the first new sign configuration was tested (SC 2) but reverted back to the level of the base sign configuration when the next new sign configuration (SC 1) was tested. Considering the results that were reported in previous sections, this apparently was related to the novelty effect associated with SC 2. The novelty of the new sign configuration had residual effect when the school speed limit was not in effect. Other than the novelty effect, the mean transit speeds did not change significantly over the course of the experiment at Branson-Eastbound.

In summary, examination of the school speed limit-in-effect and school speed limit-not-in-effect results indicate that the sign configuration results discussed in previous sections were not biased by seasonal or other long-range effects (some of the experiments lasted more than four months). The mean transit speed was generally lowered when the school speed limit was in effect. The new sign configurations that included hazard identification beacon sign(s) and/or the speed violation sign had a residual carry-over effect of about 1-2 mph when the school speed limit was not in effect.

2.5.5 Rural School Zone Interview and Questionnaire Booklet Results

2.5.5.1 Roadside Interview Results - Roadside interviews were conducted at school sites according to the data collection schedule shown in Table 2-2. A summary of the data collected by type, site, and phase of experiment is shown in Table 2-6. Approximately 100 interviews were conducted for each new sign configuration. The interviews, which spanned 1-2 days for each new sign configuration, were conducted at roadside after the speed data collection was completed for each sign configuration. At Lakeside, an additional phase (Phase IV) was implemented in order to get roadside interview data for the indicated sign configurations. These sign configurations were displayed during Phase II, however, interview data were not obtained.

Roadside interviews provided information on variables such as driver characteristics, familiarity with the sites, awareness of speed limits and speed control signs, and reactions and attitudes toward speed control. The roadside interview form and visual displays of signs shown to the driver are given in Figures 2-30 and 2-31, respectively.

The terminology which is used in this report to describe the signs presented on the various sections of the visual display card is given in Table 2-7. Table 2-7 also shows the

relationships of the sign descriptions used for question 7 to the sections of the display card.

Driver Characteristics

The characteristics of drivers who were interviewed are illustrated in Figure 2-32. Driver characteristics were determined from Part II of the interview form. In general, this information is used to ensure that interpretations of results are applicable to the general driving public. For example, about half (54%) of the drivers interviewed did not have school-age children. About half (46%) of the drivers had driver training. Comparisons of responses for various categories such as these were performed to determine if differences were large enough to require separate analyses and separate interpretations for different classes of drivers. In general, responses for separate classes of drivers did not differ to the extent that warranted separate analysis and interpretations. Trends which were noticed were only slight and sample sizes were generally too small to support major conclusions based on driver characteristics.

Driver Awareness of School Zone Speed Limits

Awareness of school zone speed limits was determined from interview question 1. School zone speed limits where interviews were conducted in Mississippi and California were 25 mph and the school speed limit in Oregon was 20 mph. Table 2-8 shows the percent of drivers stating speeds in the various response categories. The stated speeds in Table 2-8 refer to the driver's awareness or recollection of the speed limit in the school zone through which he has just passed.

The Oregon and California drivers were highly aware of the posted school speed limits with 82% of Oregon drivers aware of the 20 mph limit and 83% of the California drivers aware of the 25 mph limit. Mississippi drivers were less certain of the 25 mph school zone speed limit since only 54% gave this speed. Twenty-eight percent of the drivers at the Mississippi site chose speed limits above 25 mph. These responses may be attributed to the fact that 35 mph small community speed control signs were in locations near the school zone. Also, previous experimentation with speed control signs for small communities had been performed at this site (see Section 3).

Awareness of school zone speed limits were highest for Westbound traffic at the Lakeside, California site and for both directions at the Barnes site in Oregon. It may be important to note that the Barnes site included school crosswalk signs near the school. This factor may contribute to a greater awareness of a school

8. (SHOW CARD) LOOK AT THIS CARD AND TELL ME THE NUMBERS ON THE CARD WHICH CORRESPOND TO THE SIGNS WHICH YOU REMEMBER SEEING IN THE LAST 300 YARDS OR SO.

8a. In what order did you see these signs on the roadway?

(use boxes in the right hand column)

1. ☐
2. ☐
3. ☐
4. ☐
5. ☐
6. ☐
7. ☐
8. ☐ ← none (go to Q 9)

9. (SHOW CARD) OF ALL THE SIGNS ON THIS CARD WHICH ONE WOULD CAUSE YOU TO BE MORE CAUTIOUS? WHAT FEATURE OF THE SIGN CAUSES YOU TO SAY THIS?

1.	☐	1.	☐ color
2.	☐	2.	☐ shape
3.	☐	3.	☐ word message
4.	☐	4.	☐ the word SCHOOL
5.	☐	5.	☐ symbols of children
6.	☐	6.	☐ the speed limit
7.	☐	7.	☐ the flashing lights
8.	☐ none	8.	☐ other_____ specify

10. (SHOW CARD) OF ALL THE SIGNS ON THIS CARD WHICH ONE WOULD HAVE THE GREATEST EFFECT IN CAUSING YOU TO SLOW DOWN? WHAT FEATURE OF THE SIGN CAUSES YOU TO SAY THIS?

1.	☐	1.	☐ color
2.	☐	2.	☐ shape
3.	☐	3.	☐ word message
4.	☐	4.	☐ the word SCHOOL
5.	☐	5.	☐ symbols of children
6.	☐	6.	☐ the speed limit
7.	☐	7.	☐ the flashing lights
8.	☐ none	8.	☐ other_____ specify

PART II DEMOGRAPHIC

1. HOW MANY CHILDREN WITH AGES BETWEEN 4 AND 18 DO YOU HAVE?

1. ☐ none (go to Q 3)
2. ☐ one
3. ☐ two
4. ☐ three
5. ☐ four or more

2. HOW DO YOUR CHILDREN GET TO AND FROM SCHOOL?

1. ☐ walk
2. ☐ ride the bus
3. ☐ ride in car
4. ☐ ride bike

3. ABOUT HOW MANY YEARS HAVE YOU BEEN DRIVING?

1. ☐ 1-3 years
2. ☐ 4-7 years
3. ☐ 8-12 years
4. ☐ 13-19 years
5. ☐ over 20 years

4. HAVE YOU EVER HAD A DRIVERS TRAINING COURSE?

1. ☐ yes
2. ☐ no

DO NOT ASK THESE:

5. YOUR AGE:

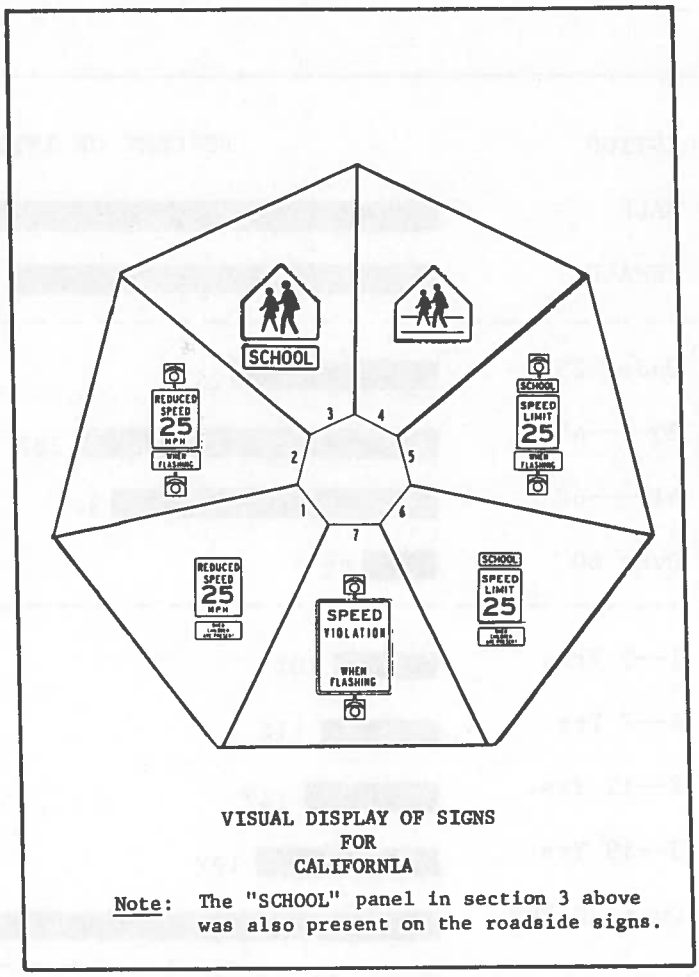
1. ☐ under 25 years
2. ☐ 25-40
3. ☐ 41-60
4. ☐ over 60

6. SEX OF DRIVER:

1. ☐ male
2. ☐ female

THANK YOU VERY MUCH FOR YOUR HELP AND COOPERATION!

FIGURE 2-30. SCHOOL ZONE ROADSIDE INTERVIEW FORM



VISUAL DISPLAY OF SIGNS FOR CALIFORNIA

Note: The "SCHOOL" panel in section 3 above was also present on the roadside signs.

FIGURE 2-31. VISUAL DISPLAYS OF SCHOOL ZONE SIGNS

TABLE 2-7. TERMINOLOGY APPLIED TO VISUAL DISPLAYS OF SIGNS

Display Section	Terminology	Corresponding Question 7 Response Category
1	Reduced Speed Ahead Sign (No Hazard Identification Beacons)	2--Reduced Speed Sign (No Flashing)
2	Reduced Speed Ahead Sign (Hazard Identification Beacons)	1--Flashing Reduced Speed Sign
3	School Advance Sign	6--Children on Sign
4	School Crosswalk Sign	6--Children on Sign
5	School Speed Limit Sign (Hazard Identification Beacons)	3--Flashing Speed Limit Sign
6	School Speed Limit Sign (No Hazard Identification Beacons)	4--Speed Limit Sign (No Flashing)
7	Speed Violation Sign	5--Flashing Speed Violation Sign

TABLE 2-8. AWARENESS OF SCHOOL ZONE SPEED LIMITS

						RESPONDENTS INFORMATION			
State	Site	Travel Direction	Speed Limit	Sign Conf.	Number Interviews	Below 25 mph	25 mph	30--45 mph	Don't Know
MISSISSIPPI	Anguilla	Northbound	25 mph	1	69	3 (4%)	40 (58%)	19 (28%)	7 (10%)
	Anguilla	Southbound	25 mph	3	67	3 (5%)	39 (58%)	17 (25%)	8 (12%)
	Anguilla	Northbound	25 mph	5	88	12(14%)	42 (48%)	26 (29%)	8 (9%)
	Totals	----------	25 mph	--	224	18 (8%)	121 (54%)	62 (28%)	23 (10%)
State	Site	Travel Direction	Speed Limit	Sign Conf.	Number Interviews	Below 20 mph	20 mph	25--40 mph	Don't Know
OREGON	Barnes	Eastbound	20 mph	2	71	3 (4%)	61 (86%)	6 (8%)	1 (2%)
	Barnes	Westbound	20 mph	3	100	2 (2%)	86 (86%)	11 (11%)	1 (1%)
	Ladd Acres	Southbound	20 mph	4	100	3 (3%)	77 (77%)	18 (18%)	2 (2%)
	Brown	Northbound	20 mph	6	100	1 (1%)	82 (82%)	15 (15%)	2 (2%)
	Totals	----------	20 mph	--	371	9 (3%)	306 (82%)	50 (13%)	6 (2%)
State	Site	Travel Direction	Speed Limit	Sign Conf.	Number Interviews	Below 25 mph	25 mph	30--45 mph	Don't Know
CALIFORNIA	Lakeside	Westbound	25 mph	Base	117	3 (3%)	99 (85%)	11 (9%)	4 (3%)
	Lakeside	Eastbound	25 mph	3	176	8 (5%)	143 (81%)	12 (7%)	13 (7%)
	Lakeside	Westbound	25 mph	2	112	6 (5%)	99 (88%)	4 (4%)	3 (3%)
	Lakeside	Eastbound	25 mph	1	113	8 (7%)	89 (79%)	8 (7%)	8 (7%)
	Totals	---------	25 mph		518	25 (5%)	430 (83%)	35 (7%)	28 (5%)

transit speeds were 42-45 mph. In Oregon, where 82% of the drivers were aware of the speed limit, the speed limit was 20 mph and the mean transit speeds were 35-38 mph.

Driver Familiarity with Test Sites

Driver familiarity with test sites was determined by examining the responses to interview questions 2 and 3. Question 2 provided information about the driver's origin and destination in terms of distances from the test sites. Question 3 provided information about the driver's frequency of travel at the test site. A driver's familiarity with a test site can be indicated by frequency of travel alone, by origin and destination information alone, or by a combination of these two measures of familiarity. It is reasonable to assume that a driver who travels frequently at a site is more familiar with the site than a driver who does not travel there frequently. Also, for drivers who do travel frequently at a site, the degree of familiarity is probably greater for those drivers whose origins and/or destinations are nearer to the site. By choosing appropriate "levels" of travel frequency and nearness of origin and/or destination, a technical definition of "familiarity" can be given. Any driver who traveled at the site at least once a month was classified as "frequency-familiar" with the site and any driver whose origin and/or destination was within 5 miles was classified as "distance-familiar" with the site. "Familiar" drivers are then defined as those drivers who are both "frequency-familiar" and "distance-familiar." Table 2-9 shows the counts and percentages for the "once-a-month" and "5-mile" levels for travel frequency and nearness to sites, respectively.

The results showed that about 70% of the drivers in Oregon and California were "familiar" with the test sites, whereas only 23% of the drivers in Mississippi were "familiar" with the test sites.

In terms of travel frequency alone, Oregon results were the highest with an average of 86% of the drivers saying they traversed the site at least once a month. California results showed that an average of 77% of the drivers traversed the site at least once a month, and Mississippi results showed that 69% of the drivers traveled at the site at least once a month.

In terms of origins and destinations only, the California results showed the highest percentage of drivers (85%) with origins and/or destinations within 5 miles of the site. Results for Oregon showed an average of 80% with origins and/or destinations within 5 miles of the site. Mississippi results were quite different with only 26% of the drivers with origins and/or destinations within 5 miles of the site.

The familiarity data of Table 2-9 seems to correlate with the speed data discussed in Sections 2.5.1, 2.5.2, and 2.5.3. That is, familiarity with test site was associated with lower speed limits and lower speeds through the school zone.

Driver Awareness and Response to Sign Changes

Driver awareness and response to sign changes were determined from interview questions 4, 5, and 6. The results are shown in Figures 2-33, 2-34, and 2-35 for Mississippi, Oregon, and California, respectively. In general, sign changes from base conditions to experimental conditions were noticed by from about 44 to 76% of the Mississippi and Oregon drivers who had driven at the sites within the last month. The California percentages of "within-last-month" drivers who noticed changes were lower at about 32 to 35%. Perhaps this was due to the different types of sign changes (fewer uses of signs with hazard identification beacons) and shorter acclimation periods. Another possible cause for the lower driver awareness of sign changes in California was the greater clutter of roadside signs and other distractions (buildings, driveways, etc.). At Anguilla, Mississippi, the percent of Southbound "within-last-month" drivers who noticed changes was only 44%, whereas that for Northbound drivers was 61-67%. The reason for these differences may have been the fact that in previous months, small community speed control experiments were conducted at approximately the same locations for Southbound drivers. Small community speed control studies were conducted at Anguilla in December 1976 and January 1977. These experiments involved the same types of changes; consequently, Southbound drivers may have been accustomed to the new types of experimental signs and thus less likely to notice the change.

Whereas, between 42 and 65% of the "within-last-month" drivers in Oregon and Mississippi said they had changed their behavior as a result of the sign changes, the percent changes in California were much less - between 16 and 27%. Again, possible reasons for these lower percentages may have been the same as those cited above.

At Anguilla Northbound, the addition of hazard identification beacons to the base sign configuration resulted in more responses percentage-wise for all response categories - noticed change, changed behavior, reduced speed and became cautious - than the further addition of the speed violation sign. In Oregon, the addition of the reduced speed ahead sign without hazard identification beacons to the base sign configuration resulted in the highest responses in changed behavior and reduced speed - 58% and 34%, respectively. However, these latter results should perhaps not be considered important since they involved

Sign Changes	Frequency Counts		Interview Questions 4, 5, and 6	Percent of Within Last Month Drivers (10 20 30 40 50 60 70 80 90)
From Base To SC #2 At Barnes Eastbound Traffic School on Right	71 Interviews	46	Noticed Change	71%
	65 Within Last Month Drivers	38	Changed Behavior	58%
		22	Reduced Speed	34%
		16	Became Cautious	25%
From Base To SC #3 At Barnes Westbound Traffic School on Left	100 Interviews	47	Noticed Change	52%
	90 Within Last Month Drivers	38	Changed Behavior	42%
		16	Reduced Speed	18%
		22	Became Cautious	24%
From Base To SC #4 At Ladd Acres Southbound Traffic School on Right	100 Interviews	68	Noticed Change	76%
	90 Within Last Month Drivers	45	Changed Behavior	50%
		28	Reduced Speed	31%
		17	Became Cautious	19%
From Base To SC #6 At Brown Northbound Traffic School on Left	100 Interviews	68	Noticed Change	74%
	92 Within Last Month Drivers	50	Changed Behavior	54%
		25	Reduced Speed	27%
		25	Became Cautious	27%
Summary of All Interviews	371 Interviews	229	Noticed Change	68%
	337 Within Last Month Drivers	171	Changed Behavior	51%
		91	Reduced Speed	27%
		80	Became Cautious	24%

FIGURE 2-34. AWARENESS AND RESPONSE TO SCHOOL SIGN CHANGES IN OREGON

comparisons between different sites and/or directions. (As mentioned earlier, the interview experiment design allowed very few direct comparisons of effects between sign configurations.)

The Mississippi data of Figure 2-33 seemed to be somewhat consistent with the speed data results discussed in Sections 2.5.1, 2.5.2, and 2.5.3 in the sense that drivers reduced their speeds when the hazard identification beacons were added to the base sign configuration and further reduced their speeds when the speed violation sign was added after the hazard identification beacons. Also, the amount of speed reductions from one sign configuration to another was consistent with the "reduced speed" percentages of Figure 2-33 (i.e., 35% corresponded to about 1 mph and 46% corresponded to about 2 mph).

The Oregon data of Figure 2-34 was not consistent with the actual speed data. But, again, the reason for this may have been the fact that the comparisons were made from one site to another and the fact that the "reduced speed" responses of the interview data were qualitative in nature, while the measured speed reductions were quantitative. (According to the measured speed data, practically all the drivers reduced their speeds, but the amount of speed reductions was, in general, greater with the new signs than with the base signs.)

On a state-by-state basis, there also seemed to be a lack of consistency between the interview data and the measured speed data: although more drivers (on a relative basis) in Oregon, compared to Mississippi drivers, said they noticed the sign changes, changed their behavior, become cautious, and actually drove through the school zone at lower speeds, fewer Oregon drivers said they reduced their speeds.

In summary, driver awareness and response to sign changes seem to be influenced by road characteristics. Where there was clutter of roadside signs and other distractions, drivers tended to be less aware of and responded less to sign changes. Where direct comparisons of signs were available, changes involving hazard identification beacons and the speed violation sign seemed to be quite effective in increasing driver awareness and stated behavioral responses. The changes involving the hazard identification beacons alone induced the most awareness and responses. Also, where direct comparisons of signs were available, consistency was found between the interview data (driver stated awareness and response to sign changes) and the measured speed data.

TABLE 2-10. RESPONSES TO: WHAT WAS THE FIRST SIGN OR MARKING NOTICED WHEN ENTERING THE SCHOOL ZONE?

State	Site	Travel Direction	Sign Conf.	Number Interviews	Flashing Reduced Speed Sign	Reduced Speed Sign (No flashing)	Flashing Speed Limit Sign	Speed Limit Sign (No Flashing)	Flashing Speed Violation Sign	Children on Sign	Pavement Markings	Don't Know
					1	2	3	4	5	6	7	8
MISSISSIPPI	Anguilla	Northbound	1	69	33%	13%	6%	6%	10%	4%	6%	22%
	Anguilla	Southbound	3	67	21%	5%	25%	6%	10%	10%	2%	21%
	Anguilla	Northbound	5	88	34%	7%	14%	3%	9%	3%	3%	26%
	Totals	----------	---	224	30%	8%	15%	5%	10%	6%	4%	23%
OREGON	Barnes	Eastbound	2	71	9%	9%	11%	21%	0%	23%	4%	24%
	Barnes	Westbound	3	100	12%	1%	19%	8%	0%	25%	2%	33%
	Ladd Acres	Southbound	4	100	10%	15%	17%	12%	10%	12%	1%	23%
	Brown	Northbound	6	100	7%	26%	13%	19%	8%	9%	2%	16%
	Totals	----------	---	371	9%	13%	15%	15%	5%	17%	2%	24%
CALIFORNIA	Lakeside	Westbound	Base	117	5%	12%	24%	9%	0%	6%	3%	42%
	Lakeside	Eastbound	3	176	13%	5%	21%	7%	1%	10%	2%	43%
	Lakeside	Westbound	2	112	0%	4%	7%	13%	1%	9%	0%	67%
	Lakeside	Eastbound	1	113	6%	8%	21%	9%	0%	2%	1%	53%
	Totals	---------	---	518	7%	7%	18%	9%	1%	7%	2%	50%

they were set to operate only during specified times as shown in Table 2-1. For the speed violation signs, the driver saw hazard identification beacons in operation on the roadside sign only if the speed of his vehicle or one very near to him was 5 mph above the speed limit.

The results from the question 8 responses have been examined in a variety of ways. One of the most informative ways to view these results is in terms of the percentage of drivers who remembered a sign of a given type. These results are found by considering independently the frequencies of responses for each of the panels on the visual display of signs. These results are shown in Table 2-11 which gives the percentage of drivers who remembered a sign of a given type. In the case of the Barnes site in Oregon, drivers were expected to identify both the school advance sign and the school crosswalk sign since both types of signs appeared on the roadside. For the pairs of signs in panels 1 and 2, and 5 and 6, some drivers said they remembered both of the signs, although only one of the signs appeared on the roadside for a particular site. The Oregon results for drivers who said they saw both signs of a given type are also shown in Table 2-11 as the boxed-in percentages. The Oregon data showed that more drivers were identifying both the signs shown in panels 5 and 6 rather than panels 3 and 4, as expected.

In general, the school speed limit sign assembly is remembered most often. (It is, of course, present at each site and for each test condition.) However, at the Barnes site in Oregon, more drivers also remembered a school symbol type sign with higher frequencies occurring for the school crosswalk sign at these sites. California drivers also remembered the school symbol signs almost as frequently as the school speed limit sign assembly. This may have been due to the fact that both the visual display and the roadside signs had the word "SCHOOL" on a special panel below the school advance sign. There was some evidence that when hazard identification beacons were on signs, more drivers remembered these signs.

Driver Viewpoints on Relationships of Signs to Caution and Speed Reduction

In interview questions 9 and 10, the drivers were asked to identify signs on the visual display which would cause them to become cautious or to slow down. Drivers were also asked to name the feature of the sign which was the best reason for their choice. The best interpretation of results for questions 9 and 10 is accomplished on a state-by-state basis. These questions were more general and not specifically designed to address the particular conditions at a site or to relate to the drivers' experiences at that site. Several schemes of interpretations

have been examined and basic results seem to follow the results obtained on the state-by-state basis. Tables 2-12, 2-13, and 2-14 give the results for the three states, respectively. Outstanding frequencies in the body of these two-way tables have been identified by circles around the appropriate figures. The three highest ranking row and column percentages are also identified.

Responses from drivers in Mississippi and Oregon were similar. The school speed limit sign assembly with hazard identification beacons was chosen most often in these states for both questions 9 and 10 and the feature given most often for these choices was the "flashing lights." For question 9 on "caution," the second most popular choice for both Oregon and Mississippi drivers was the school crosswalk sign (even though the school crosswalk sign was not displayed in Mississippi). For question 10 on "slowing down," the second most popular choice for both Oregon and Mississippi drivers was the "speed violation sign." The reasons for choices of the school crosswalk sign were mostly attributed to the "symbols of children" and the reasons for the speed violation sign choices were the "flashing lights." By comparing the question 9 responses with question 10 responses, it appears that viewpoints on "caution" are more related to choices of symbol signs, while viewpoints on "slowing down" are more related to choices of signs with hazard identification beacons or word messages.

In California, drivers indicated that for question 9 on "caution," the most popular choice was the school advance sign and the most frequent reason for this choice was the word "SCHOOL." (Only California had the word "SCHOOL" below the school advance sign.) For question 10, more of the drivers chose the school speed limit sign assembly; however, the word "SCHOOL" was still given frequently as a reason for this choice. Also on question 10, the school advance sign was chosen almost as frequently as the school speed limit sign assembly.

In general, the viewpoints reflected by the question 9 and 10 responses indicate that signs with hazard identification beacons are the most effective for causing drivers to become cautious and to slow down. The speed violation sign seems to be the next most effective sign for causing drivers in Mississippi and Oregon to slow down. These results were thus in general agreement with the speed data results discussed in Sections 2.5.1, 2.5.2, and 2.5.3. Also, from the interview data, the message and reasoning for becoming cautious seems to be conveyed to many drivers by the word "SCHOOL" and by symbols of children.

2.5.5.2 Questionnaire Booklet Results - A questionnaire booklet containing five parts was completed by 370 drivers in the states

TABLE 2-13. OREGON VIEWPOINTS (ALL SITES) ON CAUTION AND SPEED REDUCTION

Question #9 — What feature of the sign is the reason?

Which sign causes you to be more CAUTIOUS?	Color	Shape	Word Message	Word SCHOOL	Symbol of Children	Speed Limit	Flashing Lights	Other	Total Count	Percent	
Reduced Speed Ahead (No Flashing Beacons)			2			1			3	.8	
Reduced Speed Ahead (Flashing Beacons)			4		2	2	(23)	2	33	(8.9)	→#3
School Advance Sign	10				(20)				30	8.1	
School Crossing Sign	3		1	2	(43)		1	3	53	(14.3)	
School Speed Limit Sign (Flashing Beacons)	7		11	(36)	1	2	(135)	3	195	(52.6)	→#2
School Speed Limit Sign (No Flashing Beacons)	1		2	5	1	5	2	1	17	4.6	
Speed Violation Sign			4				(22)	7	33	(8.9)	→#3
None			1					6	7	1.8	
Totals	21		24	44	67	10	183	22	371		
Percent	5.7		6.5	(11.9)	(18.0)	2.7	(49.3)	5.9			
				↓#3	↓#2		↓#1				

Question #10 — What feature of the sign is the reason?

Which sign causes you to SLOW DOWN?	Color	Shape	Word Message	Word SCHOOL	Symbol of Children	Speed Limit	Flashing Lights	Other	Total Count	Percent	
Reduced Speed Ahead (No Flashing Beacons)			1			2		1	4	1.1	
Reduced Speed Ahead (Flashing Beacons)	1		3		2	3	(22)	1	32	(8.6)	→#3
School Advance Sign	10				(13)			1	24	6.5	
School Crossing Sign	2		1	3	(23)			1	30	8.1	
School Speed Limit Sign (Flashing Beacons)	8		9	(35)	2	3	(143)	3	203	(54.7)	→#1
School Speed Limit Sign (No Flashing Beacons)	1		2	5	1	6	1	1	17	4.6	
Speed Violation Sign			4			1	(35)	6	46	(12.4)	→#2
None								14	15	4.0	
Totals	22		20	43	42	15	201	28	371		
Percent	5.9		5.4	(11.6)	(11.3)	4.0	(54.2)	7.6			
				↓#2	↓#3		↓#1				

of Mississippi, Oregon, and California. The questionnaire booklet is shown in the Appendix. This booklet was self-administered in a sit-down situation not at the roadside. Respondents were obtained through the cooperation of the state motor vehicle departments, social clubs, and state or county highway departments and included volunteers in schools, social clubs, professional organizations, offices, and motor vehicle divisions.

The five parts of the questionnaire booklet are the following:

Part I. Driver Characteristics
Part II. Driver Opinions and Beliefs
Part III. Speed Control for Small Communities
Part IV. Speed Control for Rural School Zones
Part V. Driver Reaction to Roadside Signs

This section of the report discusses the general questionnaire booklet results from Parts I and V and the specific results of Parts II and IV pertaining to the School Zone study. The specific results of Parts II and III pertaining to the Small Community study are discussed in Section 3.5.5.2.

Part I. Driver Characteristics

Driver characteristics were included in the questionnaire booklet in order to examine whether or not the information for the booklets completed was a reasonable representative of the driving public. The frequency counts and percentages which were obtained for Part I are shown in Figure 2-36.

The results on driver characteristics on the questionnaire booklets can be compared with the 1978 National Statistics and also with the results from roadside interviews. For example, the 1978 National Statistics show that, in general, 54% of the drivers are male. The questionnaire booklets represented only 47% males. This result may be due to the fact that the questionnaire booklets were made available to more females in social clubs and to secretaries in public transportation agencies. The roadside interviews at school zones represented (overall) 57% male drivers. This result can be considered in agreement with the National Statistics. On the other hand, the roadside interviews at small communities represented 77% male drivers. The higher percent of males at the small rural communities may be natural due to the higher percentage of pickup trucks and traffic which involves more male drivers who drive as part of their normal work day. With respect to school zones, it seems logical to find a higher percentage of female drivers at the school zone, especially during the beginning or ending school hours since "mothers" often take their children to school or else visit the school for a parent-teacher conference. In general,

roadside interviews and questionnaire booklets were not specifically designed to study differences in responses for the different sexes, but rather to identify the sampling population.

The age characteristics of the questionnaire booklet respondents are not drastically different from the 1978 National Statistics which are also shown in Figure 2-36. The age distribution for the school zone interviews was also similar to the age distribution on the questionnaire booklets. The age distribution for the small community interviews showed fewer drivers in the under 25-year group and more drivers in the over 60-year age group. Some of the investigations of small community roadside interviews did show tendencies for response differences between the younger and older drivers; however, sample sizes were generally too small to draw a sound conclusion. Similarly, conclusions based on differences for age groups on questionnaire booklet responses cannot lead to sound conclusions which will apply to the general driving public.

Results on driver training characteristics showed 54% "yes" responses for the questionnaire booklets, but just the opposite, i.e., 54% "no" responses on the school zone interviews and 70% "no" responses on the small community interviews. One reason for the higher percent of "yes" responses on the driver training question in the questionnaire booklet results may be the fact that some of the booklets were completed at a division of motor vehicles office, although these drivers were not necessarily at the division office in connection with their driver's license or training as a driver. Again, this result may not be an indication of the true national breakdown on what percent of drivers have had driver training courses. The analysis of questionnaire booklet results was not designed specifically to compare the effects of driver training on awareness and response to speed control signs.

The questionnaire booklet responses represented a high percentage (64%) of drivers who indicated that most of their driving was done on city streets. Perhaps these drivers do not accurately reflect the viewpoints which are most important to the critical speed control issues at rural school zones and small communities. There was a wide variety of respondents by type of occupation and highest education completed. About two-thirds of the booklet respondents said they had one or more children. A similar question was asked in the roadside interviews for school zones; however, that question specified that the children had to be school age, whereas the booklet question did not refer to the age of the children. The roadside interviews showed that 46% of the drivers had school age children.

The questionnaire booklet and school zone roadside interview contained a question on how children got to school. Results are

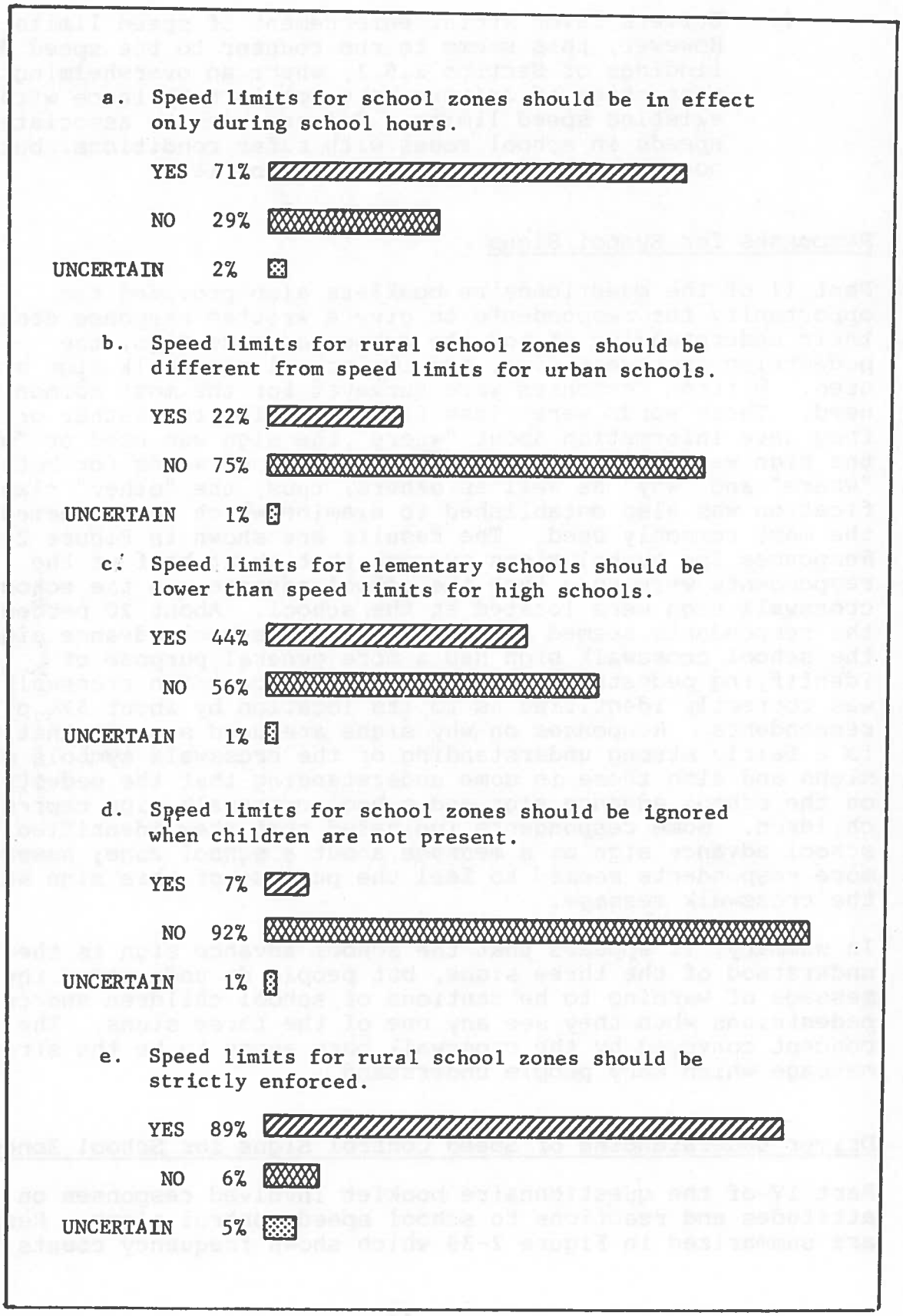


FIGURE 2-37. OPINIONS AND BELIEFS FOR SCHOOL ZONES

Directions: For each of the signs below describe your understanding of how these signs are used; i.e. Tell Where, and Why.

Where?	Percent
School	48.4
Pedestrians	23.2
City	1.1
Parks & Play	.8
Intersection	.3
Business	1.6
Residential	.3
Roadway	.8
No Response	23.5

Why?	Percent
Crosswalk	31.1
Zone	17.6
Warning	4.6
School	3.0
Watch Out	2.4
Children	10.3
Sidewalk	.8
Pedestrians	2.2
No Response	28.1

Other	Percent
Children	14.1
Caution	7.8
Slow	6.2
Safety	1.9
Advance	3.8
Driver	2.2
Adults	1.1
Stop	.3
Warning	.3
No Response	62.4

Where?	Percent
School	4.3
Pedestrians	56.5
City	.5
Parks & Play	.8
Intersection	1.6
Business	.5
Residential	.3
Roadway	.3
No Response	35.1

Why?	Percent
Crosswalk	64.9
Zone	1.4
Warning	1.6
School	.3
Watch Out	.5
Children	1.4
Sidewalk	1.4
Pedestrian	1.4
No Response	27.3

Other	Percent
Children	2.2
Caution	6.5
Slow	4.3
Safety	2.2
Advance	1.4
Driver	2.4
Adults	.8
Stop	1.6
Warning	.3
No Response	78.4

Where?	Percent
School	47.3
Pedestrians	20.8
City	.8
Intersection	1.4
Business	.8
Residential	.3
No Response	28.6

Why?	Percent
Crosswalk	68.1
Zone	2.4
Warning	1.4
School	.5
Children	2.7
Sidewalk	1.1
Pedestrian	.3
No Response	23.5

Other	Percent
Children	12.2
Caution	5.7
Slow	5.1
Safety	1.1
Advance	1.4
Driver	1.1
Adults	.5
Stop	2.7
Warning	.3
No Response	70.0

FIGURE 2-38. RESPONSES FOR SYMBOL SIGNS

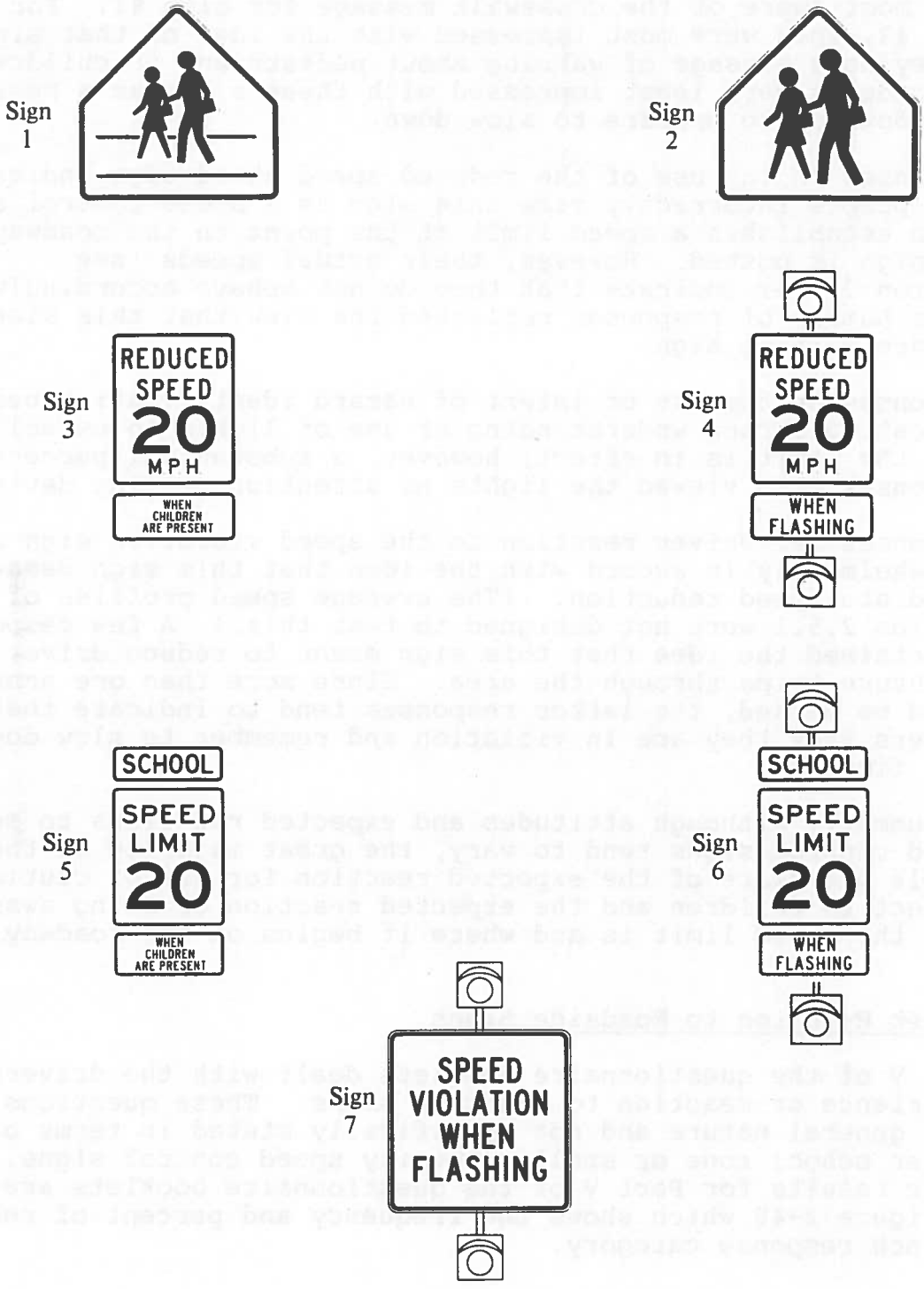
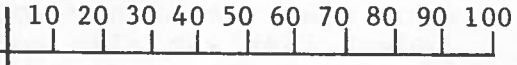


FIGURE 2-39. SCHOOL ZONE QUESTIONNAIRE BOOKLET RESULTS

PART V. DRIVER REACTION TO ROADSIDE SIGNS

Directions: **For each statement place an _X_ beside the answers which best describe your driving experience or reactions to roadside signs.**

Note : More than one answer may be marked. (370)†



1. Which aspects of signs attract your attention the most?

125	Size	33.8
106	Shape	28.6
230	Color	62
143	Wording	38.6
56	Numbers	15.1
10	Other-Explain	2.7

2. Which reasons do you use most for deciding to reduce your speed?

228	To comply with posted speed limits.	61.6
132	To avoid conflicts with other vehicles.	35.7
109	To watch more closely for pedestrians.	29.5
135	To avoid getting a speeding ticket.	36.5
93	To become more aware of roadside conditions.	25.1
7	Other-Explain	1.9

3. Which aspects of signs are best for causing you to slow down?

74	Word messages	20
60	Symbol messages	16.2
158	Posted speed limits	42.7
157	Advance Warnings	42.4
218	Flashing Lights	58
1	Other-Explain	.3

4. Why do you feel drivers sometimes violate speed limits?

145	Speed limits are often unreasonably low.	39.2
109	Drivers do not know what the speed limits are.	29.2
133	Drivers are not concerned with vehicle or pedestrian safety.	35.9
29	Drivers are confused by too many roadside signs.	7.8
71	Drivers cannot see the roadside sign message.	19.2
37	Other-Explain	10

5. What steps do you feel will best help drivers to obey speed limits?

155	Use more police enforcement.	41.9
94	Use larger signs and symbols.	25.4
58	Use pavement markings.	15.7
126	Use more flashing lights.	34.1
103	Use more violation flashing lights.	27.8
30	Other-Explain	8.1

†Number of total respondents.

FIGURE 2-40. PART V. DRIVER REACTION TO ROADSIDE SIGNS

awareness of school advance signs which included the panel with the word "SCHOOL."

3. Drivers view the school speed limit sign assembly with hazard identification beacons as the most effective for causing them to become cautious or to slow down. California drivers seem to also associate caution and slowing down with the school advance sign which included the panel with the word "SCHOOL."

4. Drivers tend to view the reduce speed ahead sign incorrectly as a sign which identifies or establishes the beginning of a speed zone. (However, they do not behave accordingly.)

5. Drivers generally became aware of the speed violation sign when it was used. Most drivers understand that the hazard identification beacons on the speed violation sign directs them to slow down immediately.

6. Drivers favor strict enforcement of speed limits even though they almost completely disobey them. (This may have been an indication that the speed limits were unreasonably low.) Drivers also believe that speed limits should be in effect only during school hours whether children are present or not. Drivers favor uniform speed limits regardless of type or location of school.

7. Most drivers who said they noticed a change in sign conditions also stated that they changed their behavior either by reducing speed or by becoming cautious.

8. School advance signs are not understood as well as school crosswalk or pedestrian crosswalk signs. The use of the word "SCHOOL" on the school advance sign is related to a greater awareness and response to the sign in California.

Conclusions:

The findings from analysis of interview and questionnaire booklet data suggest the following conclusions:

A. Improvements in school zone speed control signs may result from more use of hazard identification beacons to draw attention to signs and to convey the message that the school speed limit is in effect at a particular time.

B. Improved uses of school advance signs can result from use of panels with the word "SCHOOL" or the words "SCHOOL ZONE" to help clarify the intended use of these signs.

enforcement of speed limits. However, the drivers sampled during the electronic (speed) experiments almost completely disobeyed the speed limits. This may have been an indication that the speed limits were unreasonably low at the test sites.

The results of the electronic (speed) experiments are in basic agreement with a previous study which was conducted at the Maine Facility[6] in 1973, namely:

1) The passive signs are inadequate for informing drivers of existing school zone speed limits.

2) The hazard identification beacon sign(s) tended to lower driver speeds when compared to the base sign configurations.

3) The reduced speed ahead sign with hazard identification beacons tended to reduce driver speeds additionally ahead of the speed zone.

4) The combination of the signs with hazard identification beacons and the speed violation sign resulted in the lowest speeds in the school zones.

The major differences between the previous and present studies were:

1) The amount of improvement for the signs with hazard identification beacons was large (10 mph in the previous study compared to the present study where the improvement ranged from 0-5 mph). However, this may have been due to the fact that the speed limit in Maine was 60 mph and the school zone speed limit was 15 mph, so one would expect a large speed change under these conditions.

2) The differences between the signs with hazard identification beacons alone and the combination of signs with hazard identification beacons and the speed violation sign was small in the previous study but substantial in the present study.

The overall results of the school experiments and the small community experiments (discussed in Section 3) are reviewed and summarized together in Section 4.

3. SMALL COMMUNITY EXPERIMENTS

The small community experiments, to test the effectiveness of speed control signs, were conducted at two sites in Mississippi-Anguilla and Cary. Three new sign configurations were tested in addition to the base configuration. Three phases (passes) of sign testing were completed at each site.

3.1 TEST SITE DESCRIPTION

The test sites are shown in plan and profile view in Figures 3-1 and 3-2. Speed sensor locations and sign configurations by test phase are also shown. These sites were chosen because of their similarity in road type (two-lane rural highway) and average daily traffic (between 2,000 and 3,000 vehicles per day). In addition, both serve as the main street for the small rural community and both have substantial roadside activity (variety shops, gas stations, and intersections).

One of the test sites was located at Anguilla, Mississippi, on U.S. Route 61 and is shown in Figure 3-1. This site was straight and level. Within the community zone was the Anguilla Elementary School. The school zone was regulated by a 25 mph speed limit sign and a WHEN CHILDREN ARE PRESENT plaque. (It was intended to conduct the small community experiments during the summer months when school was not in session. However, due to delays some of the experiments were actually conducted during the school session. During these periods data were collected when the school speed limit was in effect but were not used in the analysis.) Southbound traffic entered the speed zone from a 55 mph speed limit. Experiments were not conducted in the opposite direction since a major intersection was located about 1000 feet south of the speed zone and traffic necessarily entered the speed zone at speeds commensurate with the speed limit. Note that the town corporate limit sign appeared above the 35 mph speed limit signs.

The other test site was also located on U.S. Route 61 at Cary, Mississippi, (11 miles south of Anguilla) and is shown in Figure 3-2. This site was level throughout, straight in the southbound direction and had a slight curve in the northbound direction. In the southbound direction, a creek bordered the roadway, while in the northbound direction there were private homes, businesses and intersections. The speed limit was 55 mph outside the zone in both directions and 35 mph in the zone. Note that the town corporate limit sign appeared above the 35 mph speed limit signs.

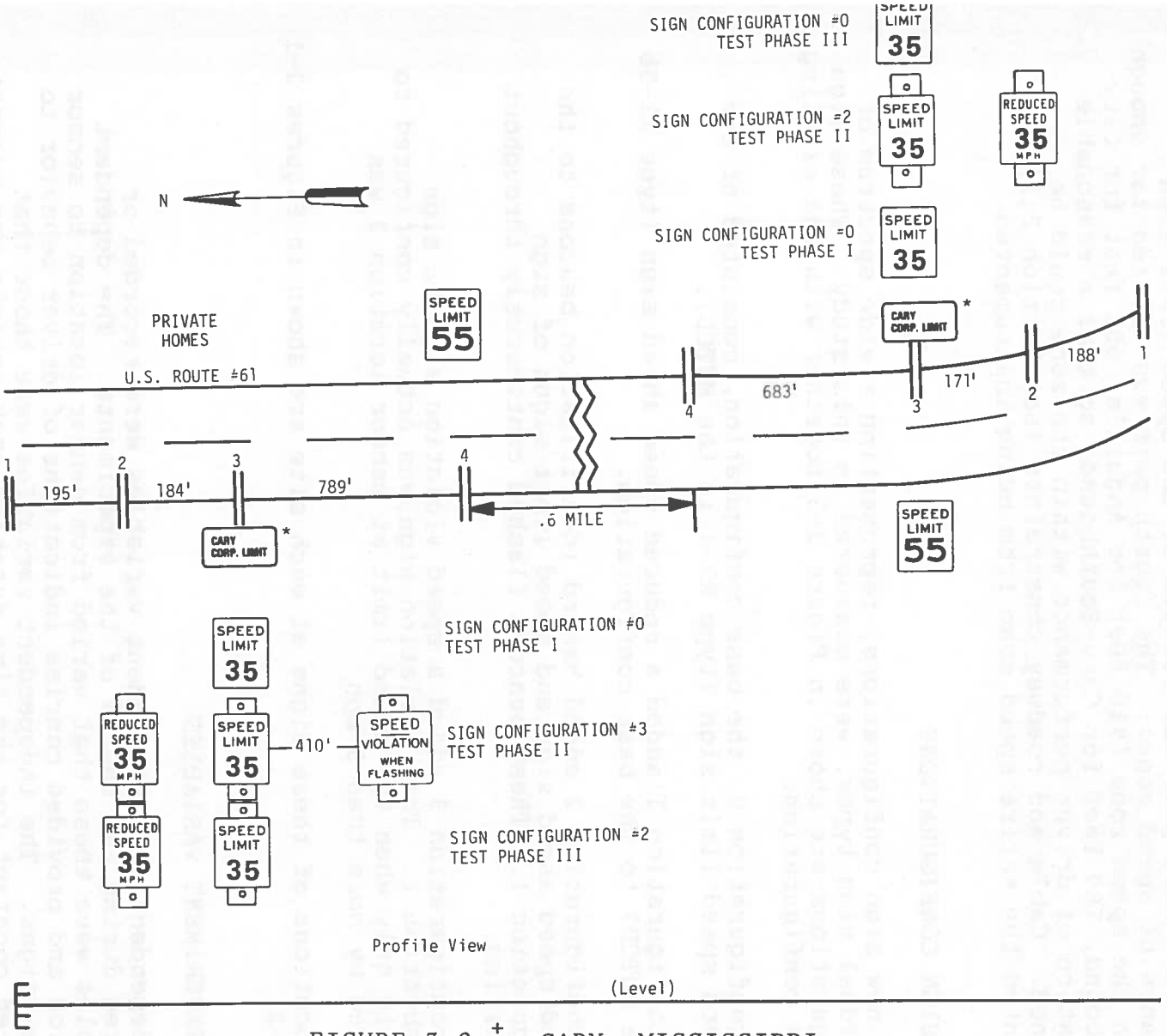


FIGURE 3-2.+ CARY, MISSISSIPPI

+Figure not to scale

*This sign was placed directly above the speed limit sign for each test phase.

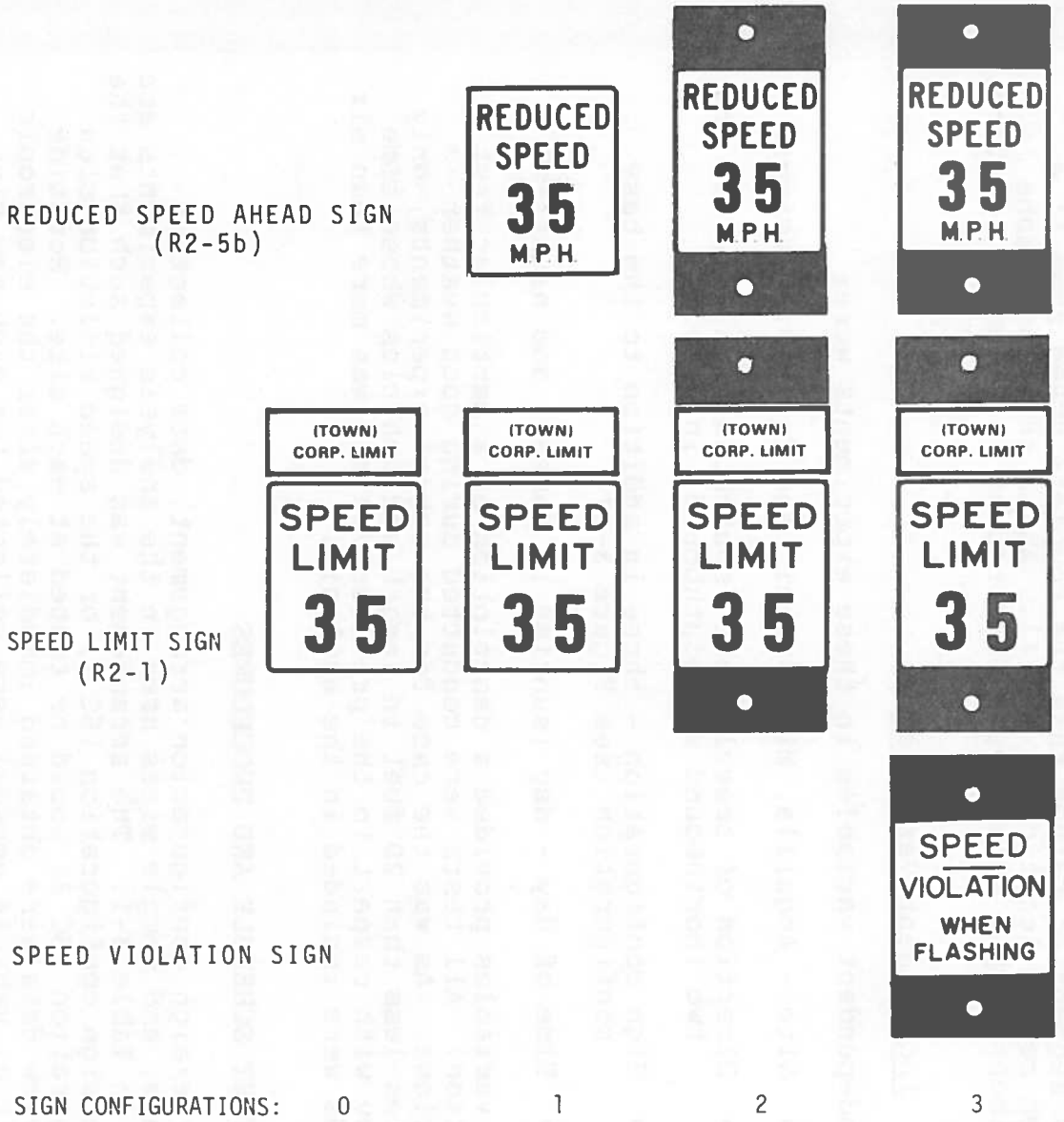


FIGURE 3-3. SMALL COMMUNITY EXPERIMENT: SIGN CONFIGURATIONS

TABLE 3-1. DATA COLLECTION SCHEDULE AND SAMPLE SIZES

SMALL COMMUNITY EXPERIMENTS							
Site/Direction Sign Configuration	Data Type	PHASE I		PHASE II		PHASE III	
		Data Collection Dates	Sample Size	Data Collection Dates	Sample Size	Data Collection Dates	Sample Size
Anguilla South 2-1-0	Speed	10/11/76-11/19/76	3801	12/3/76-1/7/77	5936	1/21/77-2/4/77	4979
	Interview	12/2/76	109	1/12/77	102		
Cary North 0-2-0	Speed	9/15/76-9/29/76	620	10/11/76-11/5/76	1466	12/3/76-1/7/77	1635
	Interview			11/17/76	108		
Cary South 0-3-2	Speed	9/15/76-9/29/76	7580	10/11/76-11/22/76	9018	12/3/76-1/10/77	12554
	Interview			11/18/76	108	3/15/77	100

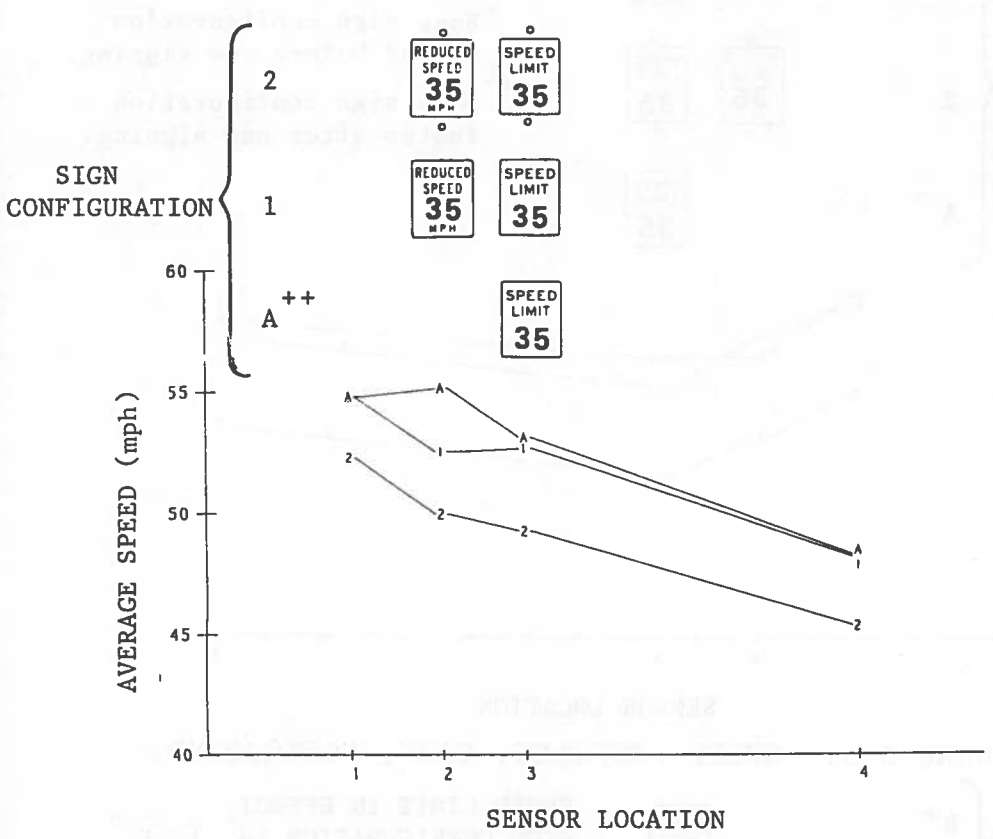


FIGURE 3-4. SPEED PROFILES, ANGUILLA, SOUTHBOUND

++Base sign configuration tested after new signing.

Sign configurations 2 and 3 had the greatest impact on the speed profiles, reducing speeds by 3-7 mph compared to the base SC. This is shown in Figures 3-4, 3-5, and 3-6. Furthermore, the results at Cary-Southbound (Figure 3-6) indicated that the speed violation sign had little added benefit over the hazard identification beacon signs. (The speed differences were between 1 and 2 mph.) However, SC 3 (hazard identification beacon signs with speed violation sign) resulted in a smoother speed profile. This latter point is probably not significant since the speed profiles for SC 2 at both Cary-Northbound and Anguilla-Southbound were each relatively smooth.

At Cary-Northbound, the base sign configuration was tested before and after SC 2. The "after" condition essentially reverted back to the "before" condition in terms of speeds ahead of the regulated zone but showed a residual effect of 1-2 mph in terms of speeds in the zone. This could mean that the drivers were either influenced by the testing itself by this amount or responding to seasonal variations. (The "before" condition was tested in late September while the "after" condition was tested in December and January.) In any event, the sign configuration effect (i.e., SC 2) was substantial and for conservative estimates should be referenced to the lower of the two base speed profiles. Thus at Cary-Northbound, SC 2 was more effective than the base SC by about 5 mph.

The reduced speed ahead sign (i.e., SC 1, see Figure 3-4) was probably no more effective than the base sign configuration even though the speed at sensor location 2 was lower for SC 1 by about 3 mph compared to the base sign configuration. This may have been a follow-on effect from SC 2 (the hazard identification beacon signs) which was tested first at this site. The possibility of a follow-on effect is discussed further in the next section. Note that the base sign configuration was tested after the new sign configurations at this site.

In summary, SC 2 (speed limit sign and reduced speed ahead sign each with hazard identification beacons) was the most effective sign configuration. It resulted in significantly lower speeds by 3-7 mph compared to the base sign configuration at all three sites tested. Adding the speed violation sign did not result in any additional and significant speed reductions. The reduced speed ahead sign did not seem to be effective in reducing driver speeds especially in the speed regulated zone.

3.5.2 Mean Transit Speed

The mean transit speed results during daytime conditions are shown in Figures 3-7 through 3-9 for each site, direction of travel, and sign configuration. The data are also broken down by

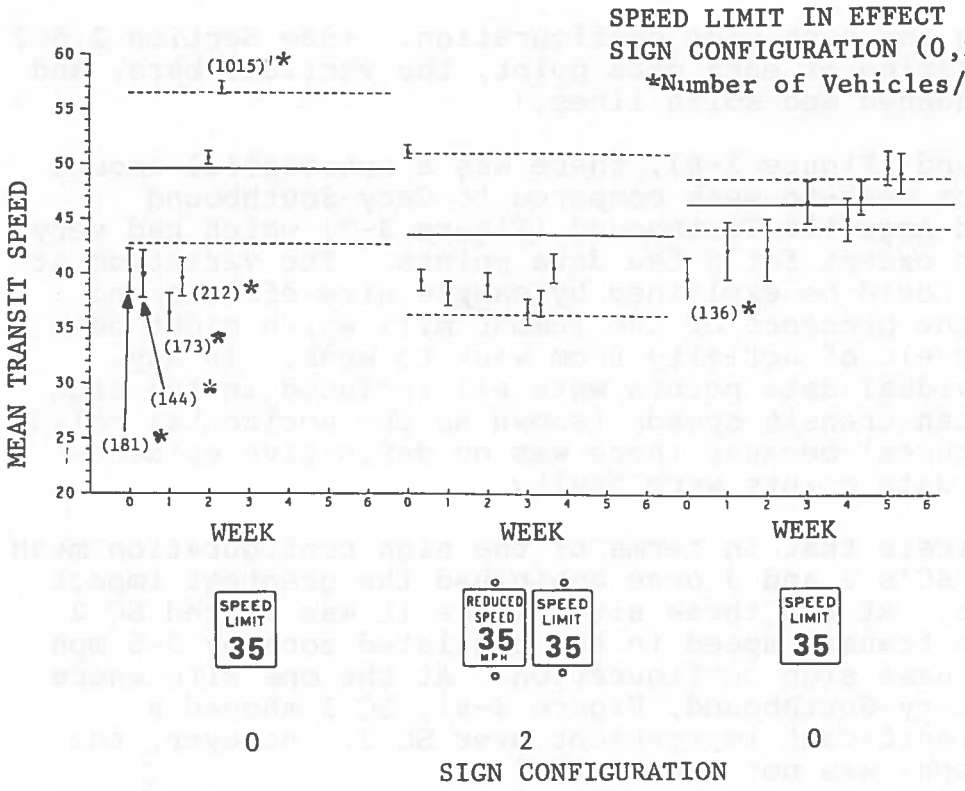


FIGURE 3-8. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION CARY, NORTHBOUND

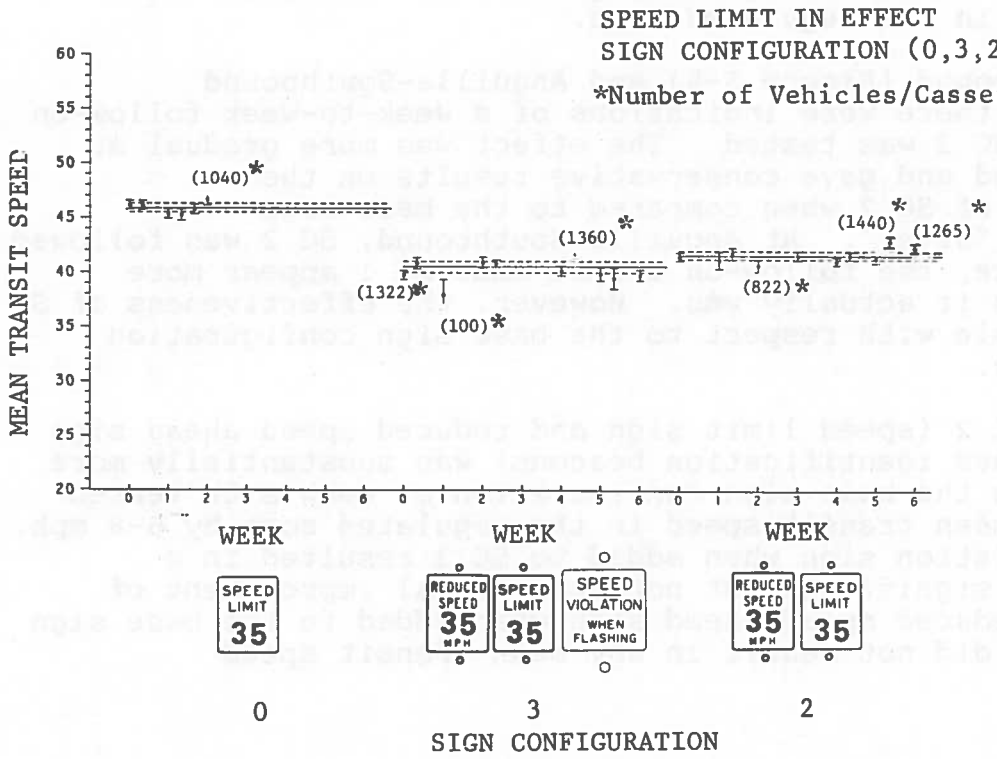


FIGURE 3-9. MEAN TRANSIT SPEED VS. SIGN CONFIGURATION CARY, SOUTHBOUND

3.5.3 85th Percentile Transit Speed and Percent Compliance

The 85th percentile transit speed and percent compliance results are shown in Tables 3-2 and 3-3, respectively. The 85th percentile transit speed ranged from 46-65 mph at Cary-Northbound, from 46-56 mph at Cary-Southbound, and, except for one data point which was 49 mph, from 55-61 mph at Anguilla-Southbound.

The 85th percentile transit speed was consistent with the average speed profile and mean transit speed measures. At Cary-Northbound and Cary-Southbound, the 85th percentile speed was more sensitive than the mean speed while at Anguilla-Southbound it was slightly less. The 85th percentile transit speed for SC 2 was reduced 5 mph compared to the base sign configuration at Cary-Southbound; 2 mph at Anguilla Southbound; and 8 and 14 mph at Cary-Northbound for the "before" and "after" conditions, respectively.

Sign configuration 3 was more effective than sign configuration 2 in terms of the 85th percentile transit speed by 1 mph; the same amount as for the mean transit speed. Sign configuration 1 showed no improvement over the base sign configuration in terms of the 85th percentile mean transit speed.

The percent compliances to the 35 mph speed limit were relatively low for all sign configurations at Anguilla-Southbound (generally less than 20%) and Cary-Southbound (generally less than 30%). The percent compliances at Cary-Northbound ranged from about 5% to over 50%. This variance was consistent with the variance of the mean transit speed measure for Cary-Northbound discussed in the previous section.

The percent compliance increased from 10% for the base sign configuration to 21% for SC 2 at Cary-Southbound. At Anguilla-Southbound, the increase was from 5% to 10%. At Cary-Northound, the increase was from 35% for the base "before" condition and 30% for the base "after" condition to 38%. These percent compliances were averages over the respective sign configurations.

The percent compliance increased from 21% for SC 2 to 25% for SC 3 at Cary-Southbound, a relatively unsubstantial amount. There were no differences in percent compliance between SC 1 and the base sign configuration at Anguilla-Southbound.

In summary, the 85th percentile transit speed and percent compliance measures provided little additional information on

TABLE 3-3. PERCENT COMPLIANCE SMALL COMMUNITY EXPERIMENTS, DAY

SITE	SIGN CONFIGURATION	PHASE I	PHASE II	PHASE III
ANGUILLA (S)	(2-1-0)	10%	5%	5%
CARY (N)	(0-2-0)	35%	38%	30%
CARY (S)	(0-3-2)	10%	25%	21%

N - Northbound
S - Southbound

TABLE 3-4. MEAN TRANSIT SPEEDS, SMALL COMMUNITY EXPERIMENTS

	ANGUILLA S	CARY N	CARY S
Sign Configuration	2-1-0	0-2-0	0-3-2
PHASE I	38.5/40.5* 47/47 46.5/47.5 48/45 45/47 49/44 46/47 46/47 46.5/45.5	40/42.5 40/37 36.5/34.5 39.5/41 50/51 56.5/63.5	46/46 46/46 45.5/47 45.5/47 45.5/46 46.5/48.5
PHASE II	49/49 49.5/49 48/49 51/48 51.5/49.5 50/48 49.5/50 50.5/48	51/52 39.5/39.5 38/43 39/41 36.5/40.5 37/40.5 40/41.5	39.5/41.5 40.5/40 40.5/42.5 40.5/39.5 40/41 41/39.5 40/42 39.5/39 40/42
PHASE III	50/48.5 50.5/50 50/50 50/48 49/50 51/49	39/43.5 42/47 42/45 46/50 45/53 47/48.5 49/52 48.5/51	41.5/41.5 41.5/41 42/43 40.5/41 41.5/42.5 41/42.5 41.5/42 41/43 43/42.5 42.5/44

*DAY/NIGHT

N - Northbound
S - Southbound

the correct speed limit. The incorrect answers from many (29% overall) involved speed limits below 35 mph. Perhaps the reason for these responses is the presence of the school zone with speed limit 25 mph just inside the town corporate limits.

In terms of differences between sign configurations, the results at Cary showed essentially no differences between SC 2 and SC 3: 85% of the drivers interviewed after SC 3 were aware of the 35 mph speed limit versus 88% and 81% of the drivers interviewed after SC 2 (SC 2 was tested twice at Cary). Furthermore, 90% of the drivers interviewed after SC 3 responded that the speed limit was 35 mph or less. This compares to 90% and 89% for drivers interviewed after SC 2.

At Anguilla, there was a substantial difference between SC's 1 and 2: 58% of the drivers interviewed after SC 2 were aware of the speed limit and 91% were aware that the speed limit was 35 mph or less. This compares to 52% and 77%, respectively, for drivers interviewed after SC 1. Furthermore, whereas only 5% of the drivers interviewed after SC 2 didn't know what the speed limit was, 18% interviewed after SC 1 didn't know. In summary, the interview data of Table 3-6 indicate that the addition of hazard identification beacons to the reduced speed ahead sign and speed limit sign (SC 3) was effective in increasing driver awareness of the speed limits and that the speed violation sign had no added benefits over the hazard identification beacon signs (SC 2). These results were thus consistent with the speed data results discussed in Sections 3.5.1, 3.5.2, and 3.5.3. It is interesting to note that although 90% of the drivers at Cary were aware that the speed limit was 35 mph or less, the compliance to the speed limit was less than 38% and the mean transit speed was usually greater than 40 mph. At Anguilla, where 84% of the drivers stated that the speed limit was 35 mph or less, compliance was less than 10% and the mean transit speed was usually greater than 47 mph. Furthermore, at Anguilla, the results obtained for signs without hazard identification beacons (SC 1) were 77% awareness, 5% compliance, and about 50 mph transit speed and for signs with hazard identification beacons (SC 2), 91% awareness, 10% compliance, and 47 mph transit speed. Thus, there was a strong, consistent relationship showing that increased awareness led to increased compliance and reduced speeds.

Safe Speed Feelings

In interview question 4, drivers were asked the question: "What do you feel is a safe driving speed along this area?" Results of responses to this question are shown in Table 3-7.

9. **(SHOW CARD)** LOOK AT THIS CARD AND TELL ME THE NUMBERS ON THE CARD WHICH CORRESPOND TO THE SIGNS WHICH YOU REMEMBER SEEING IN THE LAST 400 YARDS OR SO.

	9a	9b
1.		
2.		
3.		
4.		
5.		
6.		
7.		

9b. In what order did you see these signs on the roadway? (Use boxes in the right hand column)

7. none (skip 9b)

10. **(SHOW CARD)** WHICH ONE OF THESE SIGNS WOULD HAVE THE GREATEST EFFECT IN CAUSING YOU TO SLOW DOWN?

1. ☐
2. ☐
3. ☐
4. ☐
5. ☐
6. ☐ none

11. WHAT FEATURE OF THAT SIGN CAUSES YOU TO SAY THIS?

_____
Specify

12. and 13. POINT TO:
- 12a. REDUCED SPEED (NO FLASHER):
- 12b. REDUCED SPEED (FLASHER) :
- 13a. SPEED LIMIT (NO FLASHER):
- 13b. SPEED LIMIT (FLASHER) :

THEN ASK:
HOW WOULD YOU REACT TO THIS SIGN?

	12a	12b	13a	13b	
1.					slow down immediately
2.					slow down gradually
3.					maintain same speed
4.					don't know
5.					other (specify below)

12a. _____

12b. _____

13a. _____

13b. _____

14. **(SHOW CARD)** IF AFTER SEEING EITHER OF THESE **(POINT TO SPEED LIMIT SIGNS)**, YOU SAW A SIGN LIKE THIS WITH THE LIGHTS FLASHING, **(POINT TO SPEED VIOLATION WHEN FLASHING SIGN)**–

A. What would it mean to you? **(MARK ALL ANSWERS GIVEN BY THE RESPONDENT).**

1. ☐ I was going too fast
2. ☐ I might get a ticket
3. ☐ I should slow down immediately
4. ☐ I was over the posted speed limit
5. ☐ That my speed is being monitored
6. ☐ don't know
7. ☐ other_____
specify

B. How would you react? **(MARK ALL ANSWERS GIVEN) BY THE RESPONDENT).**

1. ☐ slow down immediately
2. ☐ maintain same speed
3. ☐ look for traffic officer
4. ☐ slow down gradually
5. ☐ don't know
6. ☐ other_____
specify

15. ABOUT HOW MANY YEARS HAVE YOU BEEN DRIVING?

1. ☐ 1-3 years
2. ☐ 4-7 years
3. ☐ 8-12 years
4. ☐ 13-19 years
5. ☐ over 20

16. HAVE YOU EVER HAD A DRIVERS TRAINING COURSE?

1. ☐ yes
2. ☐ no

DO NOT ASK THESE:

17. YOUR AGE:
1. ☐ under 25 years
2. ☐ 25-40
3. ☐ 41-60
4. ☐ over 60

18. SEX OF DRIVER:
1. ☐ male
2. ☐ female

THANK YOU VERY MUCH FOR YOUR HELP AND COOPERATION!

FIGURE 3-10. SMALL COMMUNITY ROADSIDE INTERVIEW FORM

TABLE 3-5. CHARACTERISTICS OF DRIVERS INTERVIEWED

Site	Travel Direction	Sign Conf.	Date	Number Interviews	Sex		Estimated Age of Driver				Origin more than 20 miles	Destination more than 20 miles
					Male	Female	Under 25	25--40	41--60	Over 60		
Cary	Northbound	2	11/76	108	76%	24%	13%	40%	28%	19%	48%	44%
Cary	Southbound	3	11/76	108	71%	29%	14%	35%	41%	10%	46%	52%
Anguilla	Southbound	2	12/76	109	77%	23%	5%	44%	45%	6%	64%	51%
Anguilla	Southbound	1	1/77	102	83%	17%	12%	36%	38%	14%	76%	64%
Cary	Southbound	2	3/77	100	75%	25%	25%	30%	36%	9%	55%	58%
			TOTALS	527	77%	23%	13%	37%	38%	12%	58%	53%

	Type of Vehicle			Training Course		Years of Driving Experience				
	Cars	Pickup Trucks	Others	Yes	No	1-3 yrs.	4-7 yrs	8-12yrs	13-19yrs.	Over 20 yrs.
CARY-Northbound	67%	32%	1%	19%	81%	5%	7%	19%	19%	51%
CARY-Southbound	58%	31%	11%	39%	61%	6%	8%	18%	13%	55%
ANGUILLA-Southbound	67%	27%	6%	30%	70%	3%	6%	17%	17%	56%
ANGUILLA-Southbound	51%	28%	21%	25%	75%	3%	10%	10%	23%	54%
CARY-Southbound	70%	28%	2%	34%	66%	7%	14%	13%	17%	49%
			TOTALS	30%	70%	5%	9%	15%	18%	53%

TABLE 3-7. SAFE SPEED FEELINGS

Site	Travel Direction	Sign Conf.	Date	Number Responses	Below 35 mph	35 mph	40-45 mph	Above 45 mph
Cary	Northbound	2	11/76	99	9 (9%)	56 (57%)	24 (24%)	10 (10%)
Cary	Southbound	3	11/76	108	19 (18%)	66 (61%)	20 (18%)	3 (3%)
Cary	Southbound	2	3/77	97	15 (15%)	55 (57%)	23 (24%)	4 (4%)
CARY TOTALS				304	43 (14%)	177 (58%)	67 (22%)	17 (6%)

Site	Travel Direction	Sign Conf.	Date	Number Responses	Below 35 mph	35 mph	40-45 mph	Above 45 mph
Anguilla	Southbound	2	12/76	103	28 (27%)	51 (49%)	18 (18%)	6 (6%)
Anguilla	Southbound	1	1/77	87	19 (22%)	32 (37%)	24 (27%)	12 (14%)
ANGUILLA TOTALS				190	47 (25%)	83 (44%)	42 (22%)	18 (9%)

TABLE 3-8. SPEED LIMIT KNOWLEDGE VERSUS SAFE SPEED FEELINGS

Site	Travel Direction	Sign Conf.	Date	Number who Know Limit	Number Expressing Safe Speed Feelings	Safe Speed Feelings			
						Below 35 mph	35 mph	40-45 mph	Above 45 mph
Cary	Northbound	2	11/76	95	87	8 (9%)	51 (59%)	21 (24%)	7 (8%)
Cary	Southbound	3	11/76	92	92	13 (14%)	58 (63%)	18 (20%)	3 (3%)
Cary	Southbound	2	3/77	81	78	5 (6%)	52 (67%)	18 (23%)	3 (4%)
CARY TOTALS				268	257	26 (10%)	161 (63%)	57 (22%)	13 (5%)

Site	Travel Direction	Sign Conf.	Date	Number who Know Limit	Number Expressing Safe Speed Feelings	Safe Speed Feelings			
						Below 35 mph	35 mph	40-45 mph	Above 45 mph
Anguilla	Southbound	2	12/76	63	60	6 (10%)	40 (67%)	10 (17%)	4 (6%)
Anguilla	Southbound	1	1/77	53	46	3 (6%)	23 (50%)	17 (38%)	3 (6%)
ANGUILLA TOTALS				116	106	9 (8%)	63 (59%)	27 (26%)	7 (7%)

TABLE 3-9. DRIVER RATINGS OF ENFORCEMENT

Site	Travel Direction	Sign Conf.	Date	Number Interviews	Don't Know	Lenient	Average	Strict
Cary	Northbound	2	11/76	102	22 (22%)	30 (29%)	42 (41%)	8 (8%)
Cary	Southbound	3	11/76	108	28 (26%)	33 (30%)	44 (41%)	3 (3%)
Cary	Southbound	2	3/77	98	30 (31%)	14 (14%)	49 (50%)	5 (5%)
CARY TOTALS				308	80 (26%)	77 (25%)	135 (44%)	16 (5%)

Site	Travel Direction	Sign Conf.	Date	Number Interviews	Don't Know	Lenient	Average	Strict
Anguilla	Southbound	2	12/76	104	37 (36%)	17 (17%)	39 (37%)	11 (11%)
Anguilla	Southbound	1	1/77	89	33 (37%)	11 (12%)	34 (39%)	11 (12%)
ANGUILLA TOTALS				193	70 (36%)	28 (15%)	73 (38%)	22 (11%)

stratifying the data into two groups. The frequency information was then studied within each group. The stratification based on the 20-mile distance is used for comparing responses to interview question 9 which measures awareness of roadside sign conditions.

Driver Awareness of and Response to Sign Changes

Driver awareness of and response to changes in sign configurations are measured by interview questions 6, 7, and 8. According to the structure of the interview form, question 6b applied only to those drivers who said they had traveled at the site within the last month. Drivers who answered "yes" to question 6a are termed "within-last-month" drivers. Question 7 was only applied to drivers who answered "yes" to question 6b, and question 8 was only applied to drivers who answered "yes" to question 7. Figure 3-12 shows the frequency counts for the various parts of questions 6 and 7 and also the most frequent response categories for question 8. The number of "within-last-month" drivers is used as the basis for bar charts which show the percentages of "within-last-month" drivers who noticed a change, changed behavior, and reduced speed or looked for pedestrians. The first three sets of interviews represented in Figure 3-12 involved changes from the base configuration to experimental sign configurations which involved signs with hazard identification beacons. The results for these interviews show that the change to sign configuration #3 was noticed most frequently and produced the highest percent (46%) of "within-last-month" drivers who said they changed their behavior by reducing speed. The change to sign configuration #2 was noticed less frequently at Anguilla than at Cary. This result may be related to the higher percentage of drivers with origins and/or destinations of more than 20 miles at the Anguilla site. The last two sets of interviews represented changes which involved the removal of hazard identification beacons at Anguilla and the removal of the speed violation sign at Cary. The percentages of drivers who noticed these changes is much less; i.e., about half as frequent as the original changes. The percentage of "looking for pedestrians" varied between 8 and 11% except at Cary-Northbound where the percentage was 17%.

The most important finding from Figure 3-12 appears to be that changes from the base to experimental signs with hazard identification beacons are noticed by a large percent of the drivers who traveled at the site at least once a month, and most of these drivers said they responded to the change by reducing their speed.

This was consistent with the speed data results discussed in Sections 3.5.1, 3.5.2, and 3.5.3, namely, drivers reduced their speeds a substantial and statistically significant 3-7 mph after

the base sign configuration was changed to signs with hazard identification beacons. There was also consistency in results when the speed violation sign was removed (i.e., from SC 3 to SC 2 at Cary-Southbound). Only 14% of the drivers said they reduced their speeds and there was only about a 1 mph reduction in speed and a few percentage points change in compliance (from 25% to 21%). However, there were some inconsistencies: when the hazard identification beacons were removed (i.e., from SC 2 to SC 1 at Anguilla-Southbound), only 31% of the drivers said they noticed the change and only 25% changed their behavior (10% reduced their speeds), yet speeds increased a substantial and statistically significant 2-4 mph and percent compliance was halved.

In general, there was strong consistency between driver stated responses to sign changes and actual responses when the changes involved the addition of hazard identification beacons, but less consistency when the changes involved the removal of hazard identification beacons or speed violation signs.

Driver Awareness of Roadside Signs

Driver awareness of roadside sign configurations was investigated by examining question 9 responses. These data were obtained by showing the driver the visual display of signs (see Figure 3-11) and then asking which signs the driver remembered seeing on the roadside and in what order while driving through the site. The first investigation of this data was performed to study the effects of driver familiarity with test sites on awareness of roadside sign configurations. Familiarity was defined in terms of whether or not the driver's origin and/or destination was within 20 miles of the site. Those drivers whose origin and/or destination was within 20 miles of the site were considered familiar with the site. The second investigation was performed to study which signs on the display card were remembered. The results from these two investigations are presented below.

Driver Familiarity Versus Awareness of Roadside Signs

The basic results of this investigation of effects of familiarity with test sites on awareness of roadside sign configurations are shown in Table 3-11. The correlation between familiarity and awareness of roadside signs appears to be much stronger at Cary than Anguilla. The data imply that one cannot rely solely on site familiarity (origin and destination within 20 miles) to provide increased awareness of roadside signs. The table also shows that the percent of drivers who did not remember any signs was greater at Anguilla than at Cary (15% versus 5%). This

result may be attributed to the fact that there just was a higher percentage of unfamiliar drivers at the Anguilla site.

At Anguilla, the hazard identification beacons reduced the frequency of "did not remember any signs" responses but not the ratio of unfamiliar to familiar responses.

Awareness of Roadside Sign Configurations

The results of this investigation were summarized by sign configuration rather than on a site-by-site basis. The basic meaningful results are shown in Table 3-12. This table shows the percent of drivers who identified the various types of signs on the interview display card. The results in Table 3-12 show that when sign configuration 1 was tested, the familiar drivers were having more of a tendency to identify signs with hazard identification beacons than expected, although these beacons from the previous month's experimentation had been removed. When sign configuration 2 was tested, almost 60% of the drivers identified the reduced speed ahead sign with hazard identification beacons, whereas 50% of the drivers chose the speed limit sign with hazard identification beacons. Table 3-12 also shows the percent of drivers who chose only signs with hazard identification beacons or only signs without hazard identification beacons. These results suggest that about 50 to 60% of the drivers exposed to a sign configuration which employs hazard identification beacons remember the fact that the signs did involve beacons. When hazard identification beacons were not used, only 22% of the drivers were confused about whether or not the signs used them. When sign configuration 3 was tested, two-thirds of the drivers identified the reduced speed ahead sign with hazard identification beacons. The fact that this was the highest rate of identification for the display may be attributed to the fact that these interviews were conducted under conditions where the signs with hazard identification beacons had been in place for the longest period of time. Also, the influence of the speed violation sign is reflected in this higher rate of identification. Seventy percent of the drivers who were exposed to the speed violation sign (activated or non-activated) remembered seeing it.

In summary, the signs with hazard identification beacons were remembered more often than signs without hazard identification beacons. For the sign configurations which used beacons on both the reduced speed ahead sign and the speed limit sign, there seemed to be some uncertainty as to which sign was which; however, the drivers said they remembered the reduced speed ahead sign slightly more often. The speed violation sign was remembered most often. This occurred for sign configuration 3 (where the speed violation sign was actually used). The

percentages of drivers remembering the reduced speed ahead signs with hazard identification beacons was higher for SC 3 than those for SC 2 where the speed violation sign was not used.

Driver Opinion on Which Sign Has the Greatest Speed Reducing Effect

Driver responses on which sign would have the greatest speed reducing effect were measured by questions 10 and 11. Since these questions were more general and not intended to be in reference to the site or the driver experience at the site, an overall summary of the data was considered most meaningful. The results shown in Figure 3-13 indicate that signs with hazard identification beacons would have the most effect for causing drivers to slow down. This is consistent with the speed data results discussed in Sections 3.5.1, 3.5.2, and 3.5.3. The reasons for these choices were attributed to the hazard identification beacons on the sign. The speed violation sign was the most popular choice but the reduced speed ahead sign was chosen almost as frequently. The speed limit sign with hazard identification beacons was the third most frequent choice. Notice that the reduced speed ahead sign was chosen slightly more than twice as often as the speed limit sign. Apparently, the word "reduced" was having some influence on the driver's choice of signs, although the speed data results of Section 3.5.1 did not show additional speed reductions in the vicinity of the reduced speed ahead sign compared to the speed reduction in the vicinity of the speed limit sign.

Driver Understanding of Sign Messages

Driver understanding of sign messages was determined from interview questions 12, 13, and 14. These questions were also more general and not intended to be in reference to the site or driver experience at the site. An overall summary of the data is shown in Figure 3-14. This figure suggests that drivers generally associate requirements for immediate speed reduction with the presence of hazard identification beacons on signs. For signs without hazard identification beacons, drivers seem more in agreement with a requirement for a gradual speed reduction rather than an immediate speed reduction. The slightly higher percentages for the "slow down gradually" response to signs without hazard identification beacons may be interpreted as a stronger degree of certainty with respect to signs which are currently used in many small community situations. For the reduced speed ahead and speed limit signs with hazard identification beacons, the "slow down gradually" response was, in fact, given by a substantial number (37%) of drivers. Perhaps these drivers would not reduce their vehicle speeds immediately

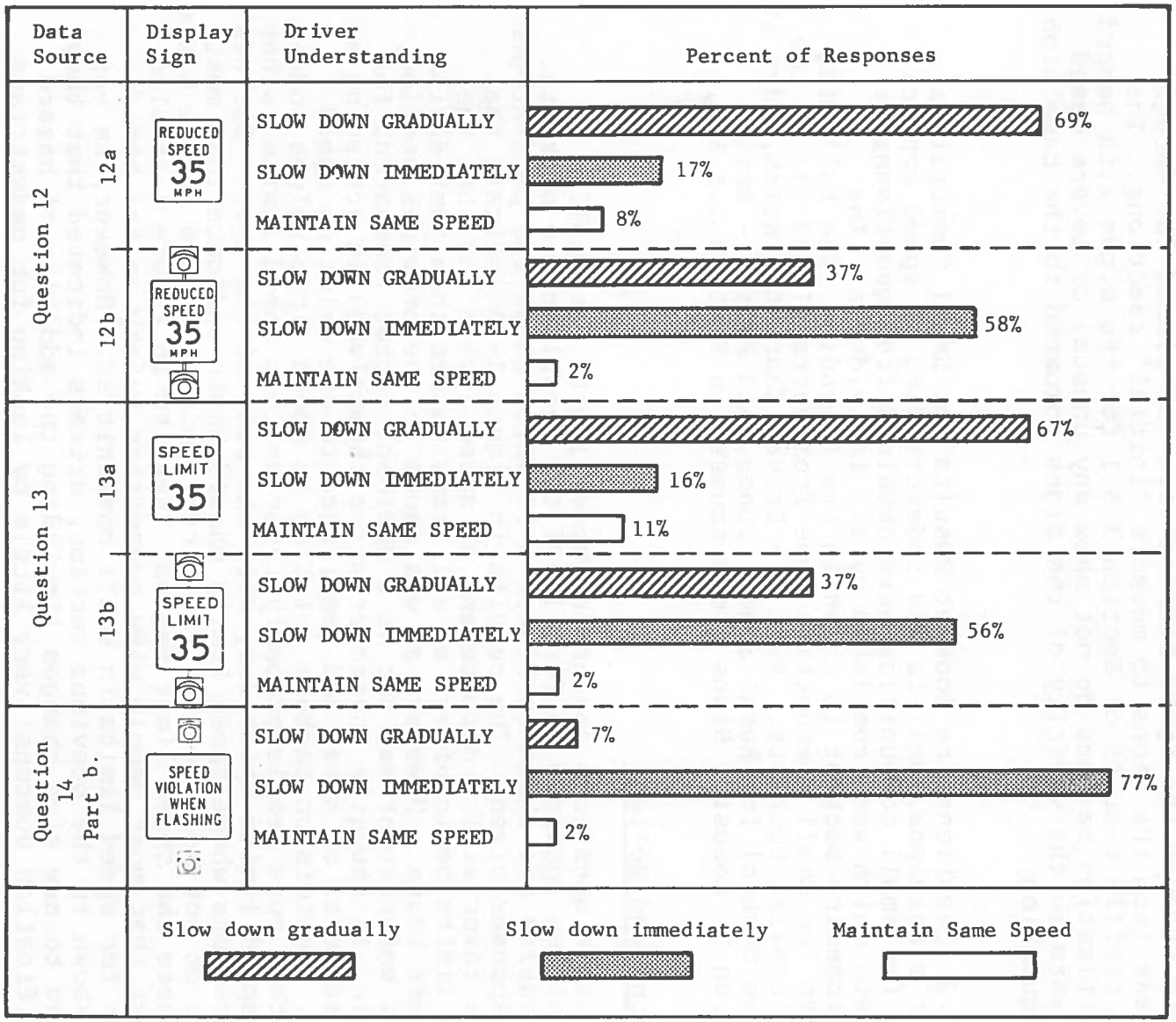


FIGURE 3-14. DRIVER UNDERSTANDING OF SIGN MESSAGES

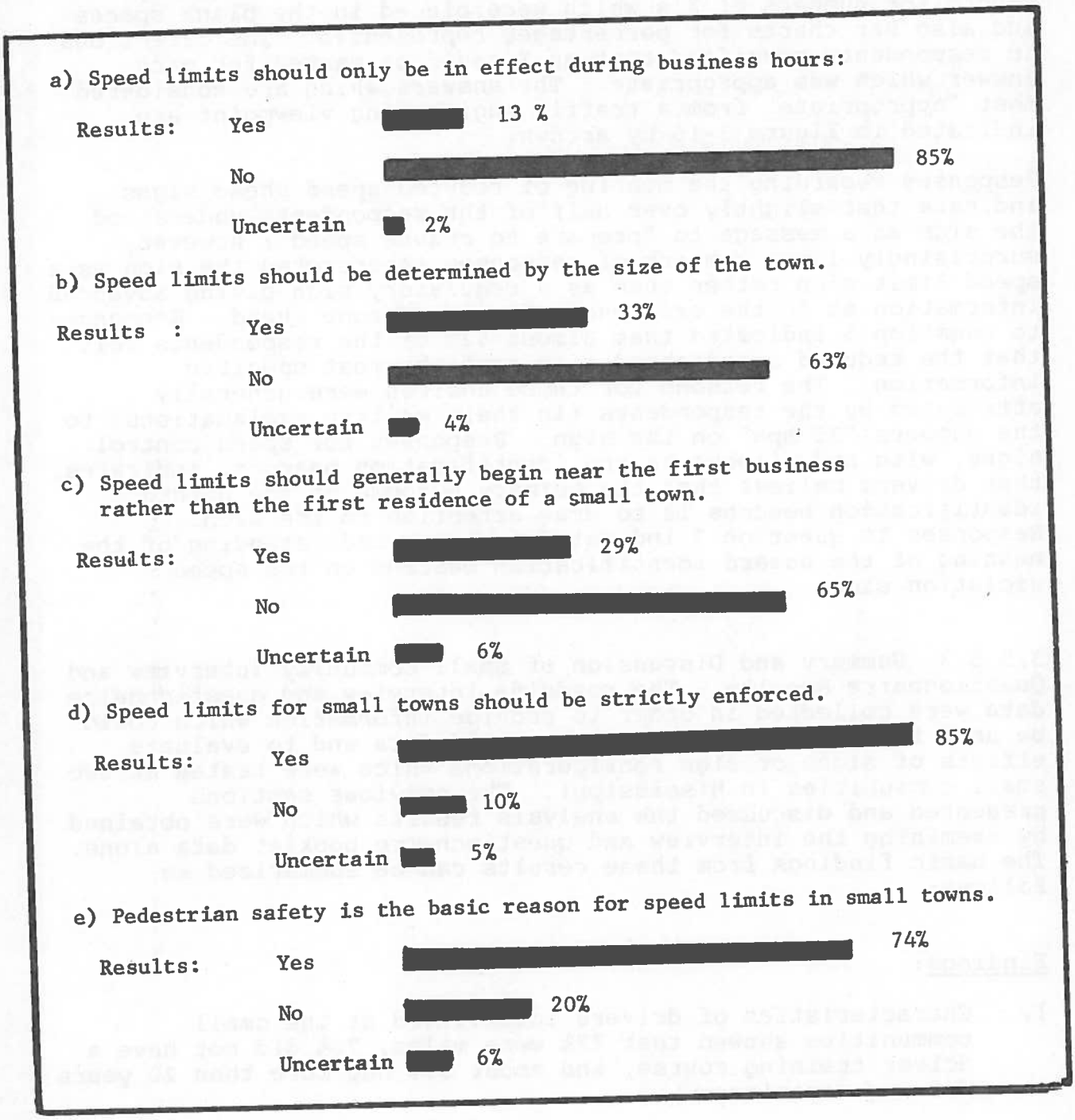


FIGURE 3-15. OPINIONS AND BELIEFS FROM QUESTIONNAIRE BOOKLETS

2. Drivers at the Cary site were generally aware (85%) of the speed limit of 35 mph. Anguilla drivers were less certain of the speed limit with 55% knowing about the 35 mph speed limit but 29% choosing lower speeds.

3. Fifty-eight percent of the Cary drivers felt that 35 mph was a safe speed limit for that site. Only 44% of the Anguilla drivers felt that 35 mph was safe for the site.

4. The addition of the hazard identification beacons to the reduced speed ahead sign and speed limit sign was effective in increasing driver awarness of the speed limits and causing drivers to choose lower speeds as safe driving speeds. However, the speed violation sign provided little or no additional benefits over the hazard identification beacon signs.

5. Drivers rated enforcement of speed limits as more strict in Anguilla compared to Cary. However, the speeds recorded in Anguilla were higher and the percent compliance to the speed limit lower compared to Cary.

6. Overall, the interviews represented about 55% of drivers who were familiar with the sites in the sense that their origin and/or destination was within 20 miles of the site. One set of interviews at Anguilla did represent a higher than average number of drivers from places farther away than 20 miles.

7. Changes from the base configuration to experimental configurations involving hazard identification beacons were noticed by more than 70% of the drivers who had the opportunity to notice the change. Changes which involved removal of a sign or removal of hazard identification beacons were noticed by less than 45% of the drivers who had the opportunity to notice the change.

8. Drivers stated that they responded to sign changes mostly by reducing speed and second by looking for pedestrians. Sign configurations with hazard identification beacons involve higher percentages of these responses than the sign condition without hazard identification beacons.

9. Driver awareness of roadside signs with hazard identification beacons was greater than awareness of signs without hazard identification beacons. The highest level of awareness occurred for the speed violation sign.

10. Speed violation signs and reduced speed ahead signs with hazard identification beacons were chosen as the most effective for causing a speed reduction. The hazard

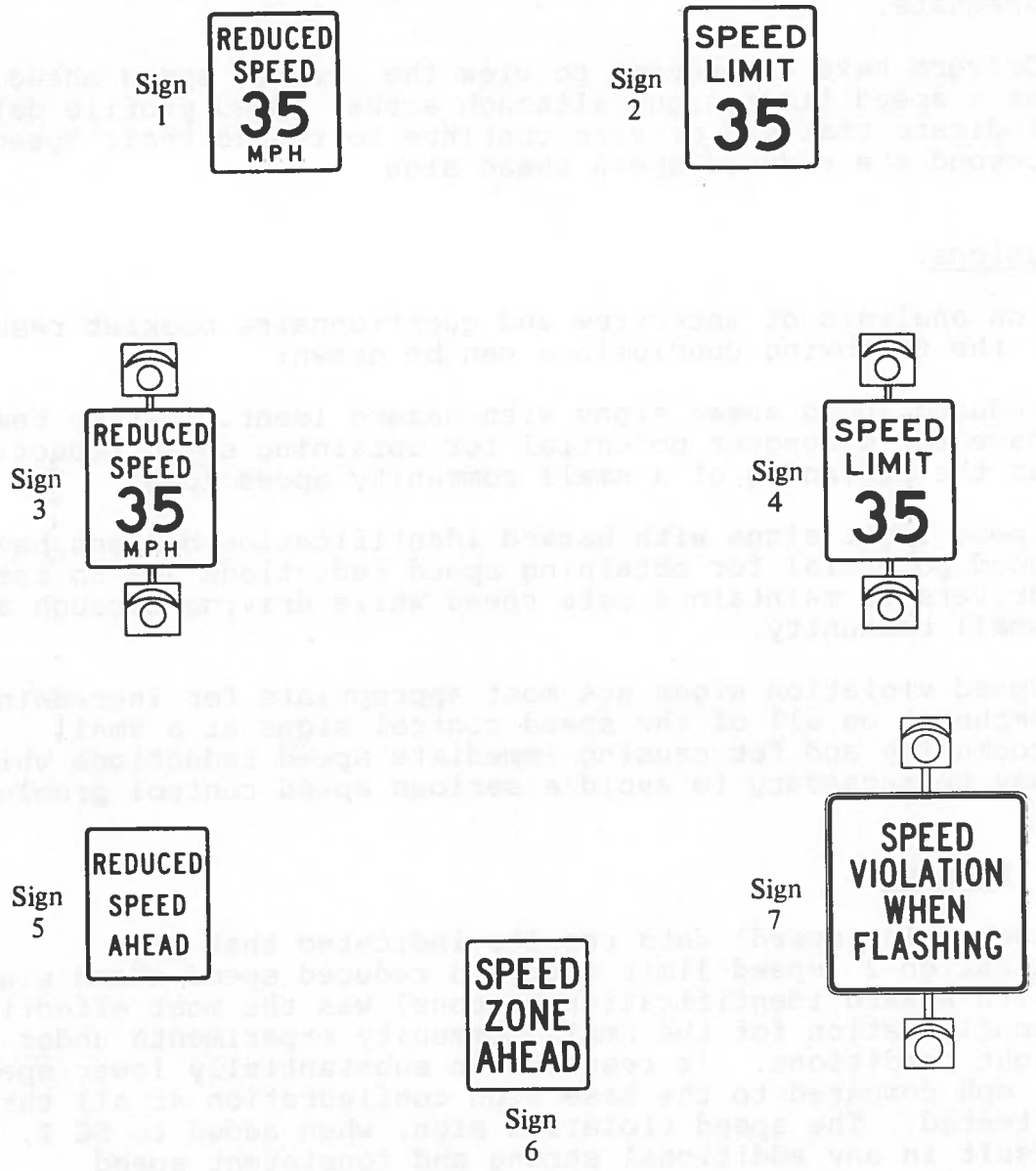


FIGURE 3-16. QUESTIONNAIRE BOOKLET RESULTS FOR SMALL TOWNS

These results were consistent with the roadside interview and questionnaire booklet findings in that the addition of the hazard identification beacons to the reduced speed ahead sign and speed limit sign was effective in increasing driver awareness of the speed limits and causing drivers to choose lower speeds as safe driving speeds. Furthermore, the speed violation sign, when added to SC 2, did not result in any additional strong and consistent improvements in terms of these latter measures. Increased awareness and driver feelings about low, safe speeds (from the interview data) were found to be consistent with increased compliance to the speed limit and reduced speeds (from the electronic data). There was also a strong consistency between driver stated responses to sign changes (qualitatively) and actual responses when the changes involved the addition of hazard identification beacons, but less consistency when the changes involved the removal of hazard identification beacons or speed violation sign. However, drivers indicated that the sign changes did not generally cause them to look for pedestrians. Extra care and caution should therefore be exercised during transition periods when new signs are installed.

The results of the electronic (speed) experiments differed in a number of major respects with a previous study which was conducted at the Maine Facility between November 1973 and May 1974. First of all, in the Maine study, only one type of sign configuration (speed limit sign and reduced speed ahead sign each with hazard identification beacons plus a speed violation sign - equivalent to SC 3 in the present study) was substantially more effective than the base sign configuration. This sign configuration reduced speeds in the regulated zone by only 3-4 mph compared to the base sign configuration.

The signs with hazard identification beacons (equivalent to SC 2 in the present study) were not effective in reducing driver speeds in the Maine study. Hence, the Maine study showed that adding the speed violation sign to the hazard identification beacon signs resulted in additional and substantial speed improvements.

The two studies (present study and the Maine study) were similar in the following respects:

1. There were very few differences in relative sign configuration effectiveness between day and night conditions.

2. The reduced speed ahead sign, when addded to the base sign configuration, did not result in any additional speed improvements.

4. RESULTS AND CONCLUSIONS

Several experiments were conducted in three states to test the effectiveness of various types of speed control signs in rural school zones and small communities on high-speed, two-lane highways. The types of signs included reduced speed ahead signs, speed limit signs, symbol signs, and activated speed violation signs. The experiments involved the collection of vehicle speed data, roadside interview data, and questionnaire booklet data. Although, operationally, the signs for small communities and school zones serve two separate purposes, functionally, they are the same. Thus, these experiments were designed to test the effectiveness of each sign type, whether for the small community or the school, to reduce driver speed to comply with the existing speed limit and to increase driver awareness of the speed limit and the possible presence of pedestrians and/or children.

Although there were some minor differences between the separate results for the school zone and small community experiments, the general conclusion reached from this study and the past study conducted in Maine, is that the use of the hazard identification beacons and the speed violation sign is an effective method for reducing driver speeds and increasing driver awareness of the roadside conditions. Sign configurations with hazard identification beacons, but without the speed violation sign, were found to be most effective but did not always result in substantial and statistically significant improvements. Sign configurations with the speed violation sign but without other signs having hazard identification beacons were effective only in a few instances. The combination of signs with hazard identification beacons and the speed violation sign seemed to offer the highest potential reducing driver speeds (as much as 10 mph reductions over the base sign configuration was recorded at some sites) and increasing driver awareness of the roadside conditions. Passive signs (i.e., signs without hazard identification beacons) were ineffective for informing drivers of existing speed limits. This was expressed by drivers in both the roadside interview and questionnaire booklet data and measured electronically in the field (speed characteristics).

From the interview data, the school advance sign and the word "SCHOOL" on the panel below the school advance sign was effective in increasing driver awareness of the school zone. Also, increased awareness and test site familiarity were associated with sites that had lower speeds and speed limits but driver awareness seemed to be reduced by roadside clutter and other distractions.

In summary, the use of hazard identification beacons with the standard speed control signs provides an improved method for

5. REFERENCES

1. William C. Taylor, "The Effect of Speed Zoning on Traffic Operations," Ohio Department of Highways, Report No. 3-14819, February 1965.

2. Stanley R. Byington and Merton J. Rosenbaum, "The Maine Facility," Public Roads, 37, December 1973, pp. 246-255.

3. David Solomon, "Accidents on Main Rural Highways Related to Speed, Driver and Vehicle," U.S. Dept. of Commerce, Bureau of Public Roads, July 1964.

4. Curt M. Elmberg and Harold R. Michael, "Effect of Speed Limit Signs on Speed on Suburban Arterial Streets," Highway Research Board, No. 303, 1961, page 1.

5. Joseph S. Koziol and Peter Mengert, "Evaluation of Speed Control Signs for Small Rural Towns," U.S. Dept. of Transportation, Federal Highway Administration, Report No. DOT-TSC-FHWA-76-3, Washington, D.C., May 1977.

6. Merton J. Rosenbaum, Phylis Young, Stanley R. Byington and William Basham, "Speed Control in Rural School Zones," Transportation Research Record, No. 541, 1975.

7. M.L. Reiss and D. Robertson, "Driver Perception of School Traffic Control Devices," BioTechnology, Inc., Transportation Research Record, No. 600, 1976.

8. Federal Highway Administration, "Manual on Uniform Traffic Control Devices for Streets and Highways," U.S. Dept. of Transportation, Report No. GPO SN6001-0021, Washington, D.C., 1971.

APPENDIX

QUESTIONNAIRE BOOKLET

QUESTIONNAIRE ON SPEED CONTROL IN SMALL COMMUNITIES AND RURAL SCHOOL ZONES

- INTRODUCTION -

Transportation officials are concerned with establishing appropriate traffic control signs and markings for small towns and rural school zones. The aim of this questionnaire booklet is to obtain your opinions and reactions to both standard as well as experimental speed control signs. Your answers to items presented in this booklet will help officials to make decisions which will improve the safety standards for roadside speed control and advisory signs at rural school zones and small towns. Approximately 15 minutes of your time will be needed to mark your answers in the booklet. Please follow the directions for each part of the questionnaire.

THANK YOU FOR YOUR COOPERATION

AND ASSISTANCE

PART II. DRIVER OPINIONS AND BELIEFS

Directions: For each statement place an X beside the answer which best describes your opinion or belief about the statement. If you absolutely have no opinion or belief, draw a circle around the question mark (?).

1.	Speed limits for school zones should be in effect only during school hours.	Yes___ No___ ?
2.	Speed limits for rural school zones should be different than speed limits for urban schools.	Yes___ No___ ?
3.	Speed limits for elementary schools should be lower than speed limits for high schools.	Yes___ No___ ?
4.	Speed limits for school zones should be ignored when children are not visible.	Yes___ No___ ?
5.	Speed limits for rural school zones should be strictly enforced.	Yes___ No___ ?
6.	Speed limits for small towns should only be in effect during business hours.	Yes___ No___ ?
7.	Speed limits for small towns should be determined by the size of the town.	Yes___ No___ ?
8.	Speed limits should generally begin near the first business rather than the first residence of a small town.	Yes___ No___ ?
9.	Speed limits for small town should be strictly enforced.	Yes___ No___ ?
10.	Pedestrian safety is the basic reason for speed limits in small towns.	Yes___ No___ ?

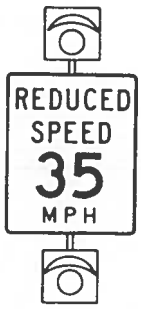
Directions: For each of the signs below describe your understanding of how these signs are used; i.e., Tell Where, and Why.

GO ON TO PAGE 3

Sign 1

Sign 2

Sign 3



Sign 4

Sign 5

Sign 6

Sign 7

Sign 1

Sign 2

Sign 3

Sign 4

Sign 5

Sign 6

Sign 7

GO ON TO PAGE 7