The standard error of each parameter estimate is indicated in parentheses above the estimate. Both the exposure parameter and the seasonal moving average parameter are significant at the $\alpha < 0.01$ level. The estimate for the reduction due to I_t is not significant and so must be eliminated from the model. Residual analysis revealed no model deficiencies,

Interpretation of Findings

After implementing its STEP program, Boise sustained a reduction of 14.1 injury accidents/month. A total of 268 injury accidents were forestalled over the study period. The observed three-month delay in this reduction is entirely reasonable when one considers start-up time for public information and liaison activities. It is interesting to note that there was an immediate sharp increase in the traditional enforcement component (ticketing), but apparently this effort by itself did not achieve immediate reductions in accidents. It was not until the public information and liaison activities were under way that the maximum reductions occurred.

There was no significant reduction in injury accidents for the non-STEP group during the period of intervention in Boise. This was the expectation and is entirely logical because there was no additional effort to reduce accidents in these areas.

CONCLUSIONS

The Boise STEP achieved its objective of reducing injury accidents. It is reasonable to attribute these reductions to implementation of STEP because no such reduction was observed where STEP was not used. Increases in traditional enforcement at HALs and activity in the contextual areas both appear to be important elements of this successful program. In addition, coordination activities with other agencies, specifically the local court and the local engineering jurisdiction, facilitated accident reduction by improving communications. This allowed all agencies concerned to develop and pursue common highway safety objectives.

Cost-Effectiveness

The monthly reduction in Boise injury accidents was 14.1. This represents about a 17 percent reduction from the base period average. The cumulative reduction over the study period was 268 injury accidents. Based on the Boise base period injury severity distribution, this yielded an estimated economic cost savings of $1 600 000, an estimate calculated from National Safety Council estimating procedures. The total cost of implementation for the study period was $788 000. This yields a favorable benefit-cost ratio of 2.0. In other words, for every dollar spent $2 was saved.

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Analysis of Selective Enforcement Strategy Effects on Rural Alabama Traffic Speeds

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A study is described that was undertaken to examine the effects of patrol tactics on vehicle speeds, to identify the best patrol tactics of those studied, to identify general speed trends over time, and to examine the effects of an areawide selective enforcement program implemented by the Alabama State Highway Patrol. Both two- and four-lane roads were examined. Six patrol tactics were investigated—four single-vehicle tactics and two dual-vehicle tactics. All data were gathered from a radar-equipped van operated in a moving mode. Vehicle speed characteristics examined included mean speed, 85th percentile speed, and speed variance. Mean speeds were more affected by patrol tactics than were 0.85 percentiles or variances. Statistically significant reductions in average speeds were obtained with all tactics that used marked patrol vehicles. The largest reductions in average speed occurred with the stationary tactic. Significant reductions in 0.85 percentile speeds were obtained for all tactics on the four-lane road but for none of the tactics on the two-lane road. Variances were generally not affected on the four-lane road, whereas on the two-lane road they increased for five of the six tactics studied. Overall, the most effective tactic was the marked stationary vehicle. The unmarked patrol vehicle, even when issuing citations, had little, if any, effect on the speed parameters. A greater halo effect on speeds occurred on the two-lane than on the four-lane road. The general areawide selective enforcement program may have reduced mean speeds on the four-lane road but did not affect speeds on the two-lane road. No trends or cumulative effects on speeds were found during the three-month selective enforcement period.

An investigation of the short-term effects of a selective enforcement (SE) program on rural highway vehicle speeds in Alabama is described in this paper. A dual-lane highway (US-280) and a four-lane Interstate (I-85) were studied, and for each type of highway one continuous 12-mile segment of experimental highway and a 12-mile segment of matching control highway were examined. The speed limit throughout all segments studied was 55 mph. Control segments were selected based on topographic, proximity, and speed profile characteristics. Average daily traffic (ADT) on the selected roadways was as follows:

Roadway	ADT (no. of vehicles)
Two-lane experimental	6300
Two-lane control	3540
Four-lane experimental	9430
Four-lane control	9500

The formal SE program operated from October 1 to December 31, 1979, and was implemented through the Opelika Post of the Alabama State Highway Patrol. The program involved the use of $35 354 of federal funds for overtime employment of 28 officers for a total of 3721 hr. Funding was provided by NHTSA through the Alabama Office of Highway and Traffic Safety. Overtime functions during the SE period consisted of saturation enforcement along particular roadway segments, establishing roadway check stations, spot announcements on broadcasting media, and so on. The study was designed to provide information for decision making about patrol tactics to use for traffic law enforcement (1-19).

Data were collected from July through December in the following time phases: a baseline (B) phase from July 26 to September 9, a phase preceding selective enforcement (PSE) from September 10 to 30, and the SE phase. These phases were chosen as an integral part of the overall study design, which is discussed later in more detail. The B period was used to establish vehicle speed characteristics before implementation of the formal SE program and use of patrol tactics. The succeeding PSE period was used to examine the effects of the patrol tactics used before (and hence independent of) the later SE program and also to establish any trends in vehicle speed before the SE program that were unaffected by patrol tactics. Finally, the SE period was used to examine the general effect of the SE program both with and without patrol tactics.

The objectives of the investigation were

1. To determine whether the SE program had any overall effect on vehicle speeds,
2. To determine the effect on vehicle speed of each patrol tactic used in the PSE period,
3. To determine the effect on vehicle speed of each patrol tactic used in the SE period,
4. To determine the halo effect for the "single stationary marked patrol vehicle" tactic in the PSE and SE periods,
5. To compare the effects of patrol tactics used in the PSE period, and
6. To compare the effects of patrol tactics used in the SE period.

Six patrol tactics were examined for objectives 2-6; these represented combinations of single, dual, stationary, and moving patrol vehicles. The tactics used on the experimental roadway segments are discussed in detail later.

PATROL TACTICS STUDIED

The six patrol tactics used were standard tactics commonly used by police agencies:

1. Single stationary marked patrol vehicle (SSM),
2. Single moving marked patrol vehicle (SMM),
3. Single stationary-moving marked patrol vehicle (SSMM),
4. Single moving unmarked patrol vehicle (SMU),
5. Dual moving marked/moving unmarked patrol vehicles (DMM/MU), and
6. Dual stationary-moving marked/moving unmarked patrol vehicles (DSMM/MU).

Any marked patrol vehicle used in a tactic was operated in the interior 6-mile portion of each 12-mile experimental segment used in the study. When unmarked cars were used, they were operated over the entire segment length. These were standard units operated by uniformed troopers. Some marked cars were equipped with mobile radar units. The unmarked car always operated in its standard manner. During all work with marked cars, citizens band Channel 19 was monitored and occasionally used for communication by both the patrol vehicle and a continuously moving data collection van. For each free-flowing vehicle observed from the van, 14 variables were recorded. Traffic citations were issued when necessary, and, when a car was called on an emergency, data collection was suspended. The tactics used are described below.

Single Stationary Marked Patrol Vehicle

In the SSM tactic, the marked patrol vehicle was parked for a 30-min time interval at a randomly selected milepost and was faced in a randomly selected direction (north, south, east, or west). At the end of 30 min it was moved to another location. During a typical data collection session, three stationary locations were observed. Radar was occasionally used.

Single Moving Marked Patrol Vehicle

A standard moving mode was used--i.e., a 40- to 45-mph patrol speed. On the four-lane experimental roadway (4E), the SMM operated on both the inside and outside lanes. Radar was occasionally used, but the distinction between use or no use was not made. The officer was free to issue traffic citations.

Single Stationary-Moving Marked Patrol Vehicle

The SSMM was a combination of the SSM and SMM. The vehicle was stationary for 5-min intervals at randomly selected mileposts facing randomly selected directions. Radar was occasionally used.

Single Moving Unmarked Patrol Vehicle

In the SMU tactic, an unmarked car was used in its standard operating mode. It would cruise as traffic dictated until a suspected speeding vehicle was observed traveling in the same direction. It would then verify the pace of the suspected speeding vehicle, which would then be apprehended.

Dual Moving Marked/Moving Unmarked Patrol Vehicles

One marked car using the SMM mode and one unmarked car using the SMU mode constituted the DMM/MU tactic. Both vehicles were used simultaneously.

Dual Stationary-Moving Marked/Moving Unmarked Patrol Vehicles

One marked car using the SSMM mode and one unmarked car using the SMU mode constituted the DSMM/MU tactic. Both vehicles were used simultaneously.

TYPES OF VEHICLES OBSERVED

Table 1 gives a breakdown of the number of vehicles

Table 1. Number of vehicles observed during study by road and vehicle type.

Roadway	Automobile No.	Automobile Percent	General Truck No.	General Truck Percent	18-Wheeler No.	18-Wheeler Percent	Van No.	Van Percent	Other No.	Other Percent	Total
Four-lane control	2 733	59.9	566	12.4	1053	23.1	177	3.9	30	0.7	4 559
Four-lane experimental	7 305	64.1	1732	15.2	1878	16.5	416	3.7	65	0.5	11 396
Two-lane control	1 622	71.5	429	18.9	110	4.9	73	3.2	34	1.5	2 268
Two-lane experimental	4 267	69.5	1246	20.3	312	5.1	234	3.8	77	1.3	6 136
Total	15 927		3973		3353		900		206		24 359

Table 2. Study design.

Patrol Tactic	Baseline Two-Lane	Baseline Four-Lane	PSE Period Two-Lane	PSE Period Four-Lane	SE Period Two-Lane	SE Period Four-Lane
SSM			X	X	X	X
SMM			X	X	X	X
SSMM					X	X
SMU				X	X	X
DMM/MU					X	X
DSMM/MU					X	X
NPV	X	X	X	X	X	X

Note: NPV = no patrol vehicle.

observed by roadway and vehicle type. Differences between two- and four-lane roadways are evident. Higher percentages of automobiles and general trucks on two-lane roadways indicate the higher proportion of commuter and local traffic on these roads. Higher percentages of 18-wheelers on four-lane roadways indicate the larger proportion of commercial through traffic on the Interstate highway.

STUDY DESIGN

Table 2 gives the study design arranged by time phase, roadway type, and patrol tactic. An X indicates that vehicle speed (in miles per hour) and associated data (e.g., vehicle type, day of the week, time of day, etc.) were collected. Within each of the time phases (PSE and SE), the patrol tactics were randomly assigned to experimental roadway segments (i.e., two- or four-lane) and days within the first half of the period. The randomization process was then repeated for the second half of the period.

On any given day, only one patrol tactic was observed on an experimental segment and its corresponding matching control roadway segment was also observed. All observations were made between 1:00 and 4:00 p.m. During the B period, patrol tactics were not used but days for observing roadway segments were randomly selected. A given patrol tactic in the PSE period was always equivalent to that used in the SE period. However, there was no attempt to ensure that other variables, such as the day of the week, were equivalent.

Data were collected continuously over time phases B, PSE, and SE. A radar-equipped van was used to gather vehicle speed and associated data. The van was continuously moving throughout the 12-mile length of each studied segment; therefore, at various times it was either upstream or downstream of the patrol vehicles used on experimental segments.

BASELINE CONTROL VERSUS EXPERIMENTAL ROADWAY COMPARISONS

Speeds on the four-lane control segment (4C) tended to exceed those on the respective experiment segment (4E). Sample means for 4C and 4E were 61.4 and 60.4 mph, respectively. Standard deviations were 5.80 and 5.36 mph. Table 3 gives relative and cumulative relative frequencies of vehicle speeds by speed class. For each class, the cumulative relative frequency of 4E exceeded that of 4C (except for the ≥76-mph class interval).

The following table gives pth quantile speeds for 4C and 4E:

Quantile (p)	pth Quantile Speed (mph) Control	Experimental
0.50	61.0	61.0
0.60	63.0	62.0
0.70	64.0	63.0
0.75	65.0	64.0
0.80	66.0	65.0
0.85	67.0	66.0
0.90	69.0	67.0
0.95	71.0	69.0

The 4C pth quantile speeds at least equaled and in all cases but one exceeded corresponding speeds for 4E. Although quantile speeds were not very different, the differences were statistically significant at a level of significance 0.01 based on the Smirnov test (20).

On 2C and 2E, sample means were 54.5 and 54.2 mph and standard deviations were 6.88 and 5.94 mph, respectively. Table 4 gives relative and cumulative relative frequency of speeds on the two-lane roadways. The 2C segment had a larger proportion of vehicles traveling below 49 mph. However, for all higher speeds, 2E had a higher proportion of vehicles traveling at or below corresponding speeds; e.g., 87.9 percent of all vehicles on 2E were traveling less than 61 mph whereas on 2C the figure was 84.7 percent.

The following table gives pth quantile speeds for two-lane segments:

Quantile (p)	pth Quantile Speed (mph) Control	Experimental
0.50	55.0	54.0
0.60	56.0	56.0
0.70	58.0	57.0
0.75	59.0	58.0
0.80	60.0	59.0
0.85	61.0	60.0
0.90	62.0	61.0
0.95	65.0	64.0

The 2C pth quantile speeds equaled or exceeded cor-

Table 3. Speed frequencies on four-lane roads.

	Control Segment		Experimental Segment	
Class (mph)	Relative Frequency	Cumulative Relative Frequency	Relative Frequency	Cumulative Relative Frequency
1-45	0.3	0.3	0.6	0.6
46-48	1.0	1.3	1.2	1.8
49-51	2.5	3.8	3.1	4.9
52-54	5.1	8.9	7.2	12.1
55-57	14.9	23.8	15.9	28.0
58-60	20.5	44.3	21.5	49.5
61-63	21.2	65.5	22.9	72.4
64-66	17.3	82.8	15.2	87.6
67-69	9.4	92.2	8.1	95.7
70-72	5.0	97.2	3.1	98.8
73-75	1.2	98.4	0.8	99.6
>76	1.6	100.0	0.4	100.0

Table 4. Speed frequencies on two-lane roads.

	Control Segment		Experimental Segment	
Class (mph)	Relative Frequency	Cumulative Relative Frequency	Relative Frequency	Cumulative Relative Frequency
1-45	8.2	8.2	6.6	6.6
46-48	7.7	15.9	7.3	13.9
49-51	13.3	29.2	17.4	31.3
52-54	17.7	46.9	19.5	50.8
55-57	21.4	68.3	22.8	73.6
58-60	16.4	84.7	14.3	87.9
61-63	8.7	93.4	6.8	94.7
64-66	3.5	96.9	3.5	98.2
67-69	1.7	98.6	1.0	99.2
70-72	0.9	99.6	0.7	99.9
73-75	0.2	99.7	0.1	100.0
>76	0.3	100.0	0.0	100.0

responding speeds for 2E. Speed differences were statistically significant at a 0.05 level of significance.

RESULTS AND DISCUSSION

Three vehicle speed characteristics were analyzed: mean speed, 0.85 quantile speed, and speed variance. Data for all vehicle types were collectively analyzed. For various subsets of data, the Lilliefors test (20) was used to test for normality. Due to large sample sizes, the tests indicated nonnormality for most subsets, although a visual test of normality appeared to be reasonable. Therefore, parametric statistical tests based on the normality assumption were used. Analyses are discussed one by one by specific objective.

Overall Effect of SE Program on Speed

Objective 1 was to determine whether the SE program had any overall effect on speeds. To obtain an evaluation independent of the patrol tactics studied, only roads 2C and 4C were evaluated. Two approaches were taken. For each control road and vehicle speed characteristic, the following analyses were performed:

1. A linear regression equation regressing vehicle speed characteristics on time was derived by using data over the entire study period (i.e., B, PSE, and SE periods) in order to assess any trend effects.
2. Sample data for the combined B and PSE periods were compared with SE period data to test for significant differences.

Hypotheses of zero slope parameters were tested for fitted equations. At the 0.05 level of significance, all slope hypotheses were accepted. Based on trend analysis, there were no significant speed trends that could be attributed to the SE program.

The t-test was used in one-sided tests of hypotheses conducted on differences between means before and during the SE program. Before and during speed variances were compared by using the two-sided F-test. An adaptation of the median test (20) was used to test differences in 0.85 quantiles. Hypothesis test results are summarized below:

Road	Parameter	Sample Statistic	Level of Significance
4C	Means	t = -1.75	0.05
	0.85 quantiles	T = 0.0005	
	Variances	F = 1.091	0.05
2C	Means	t = -0.342	
	0.85 quantiles	T = 0.0003	
	Variances	F = 1.202	0.01

The alternative hypothesis for means and quantiles tests was that the SE period speed was lower than the before speed.

Table 5 gives summary values for roads 2C, 4C, 2E, and 4E. The text table above indicates a significant reduction in the mean speed on 4C and variance on 2C but an increase in variance on 4C. Thus, it could be concluded that the overall selective enforcement program had only limited success in reducing speeds.

Effect on Speed of Patrol Tactics in PSE Period

Objective 2 was to determine the effect on speed of each patrol tactic used in the PSE period. Hypothesis tests comparing B-period speeds with PSE-period speeds were conducted. Calculations were similar to those for objective 1 tests except that PSE experimental road data were adjusted by using corresponding control road data. Adjustments were made to account for any possible shift in speed characteristic means between the B and PSE periods. The adjustment factors (albeit small) were based on data from roads 2C and 4C during the B and PSE periods. Table 6 gives (adjusted) speed summary data for the PSE period.

Twelve hypothesis tests were conducted, one for each combination of road, patrol tactic, and speed characteristic. For mean and 0.85 quantile tests, the alternative hypothesis was that the speed was lower during the PSE period than during the B period. Variance tests were two-sided.

Highly significant reductions in mean speeds were indicated for both tactics on 2E and 4E. Estimated percentage reductions for the four road-tactic combinations were as follows:

Road-Tactic Combination	Reduction in Mean Speed (%)
4E, SSM	2.9
4E, SMM	1.0
2E, SSM	4.6
2E, SMM	3.9

The only significant reduction in 0.85 quantile (from 60.0 to 58.2 mph) was for the SMM patrol tactic on road 2E. The conclusion drawn was that patrol tactics were effective in reducing mean speeds

Table 5. Summary speed data for objective 1 by road and time phase.

Road	Time Frame	No. of Obser-vations	Speed Data (mph) Mean	0.85 Quantile	Standard Deviation
4C	B	1 065	61.4	67.0	5.80
	PSE	1 346	61.6	67.0	5.50
	B+PSE	2 411	61.5	67.0	5.63
	SE	2 148	61.2	67.0	5.88
4E	B	1 093	60.4	66.0	5.36
	PSE	2 354	59.9	65.0	5.45
	SE	7 949	59.1	64.0	5.34
2C	B	1 128	54.5	61.0	6.88
	PSE	392	53.5	60.0	7.10
	B+PSE	1 520	54.2	60.0	
	SE	748	54.1	60.0	6.34
2E	B	944	54.2	60.0	5.94
	PSE	1 267	51.9	58.0	6.29
	SE	3 925	52.4	58.0	6.51
Total		24 359			

Table 6. Adjusted summary speed data for objective 2 by tactic.

Road	Tactic	No. of Obser-vations	Speed Data (mph) Mean	0.85 Quantile	Standard Deviation
4E	SSM	1059	59.6	65.8	5.59
	SMM	818	59.8	64.8	5.19
2E	SSM	590	52.0	58.2	6.44
	SMM	677	52.1	58.2	6.22

during the PSE period but that they had little effect on 0.85 quantile speeds and variances.

Effect on Speed of Patrol Tactics in SE Period

Objective 3 was to determine the effect on speed of each patrol tactic in the SE period. Procedures and statistical tests were the same as for objective 2. A total of 36 tests were conducted, one for each combination of road, patrol tactic, and speed characteristic. Table 7 gives relevant speed summary data.

Significant reductions in mean speeds resulted for all patrol tactics except SMU on 4E. The percentage reductions are given below:

Road	Tactic	Reduction in Mean Speed (%)
4E	SSM	2.6
	SMM	1.5
	SSMM	2.3
	DSMM/MU	2.5
	DMM/MU	1.5
2E	SSM	3.3
	SMM	3.5
	SMU	2.6
	SSMM	2.4
	DSMM/MU	2.2
	DMM/MU	1.3

Significant 0.85 quantile reductions of 1.8 mph, or 2.7 percent, were obtained on 4E for all tactics except SMU, which increased. On 2E, however, only tactic DSMM/MU resulted in a significantly lower 0.85 quantile. Variances were mostly unaffected on 4E except under DSMM/MU, for which a decrease was observed. Variances increased on 2E for all patrol tactics except DSMM/MU. Thus, the patrol tactics used in the SE period clearly had a significant effect on speed.

Table 7. Adjusted summary speed data for objective 3 by tactic.

Road	Tactic	No. of Obser-vations	Speed Data (mph) Mean	0.85 Quantile	Standard Deviation
4E	SSM	1378	58.8	64.2	5.13
	SMM	1674	59.5	64.2	5.33
	SMU	1161	60.5	66.2	5.68
	SSMM	1011	59.0	64.2	5.39
	DSMM/MU	1228	58.9	64.2	5.01
	DMM/MU	1497	59.5	64.2	5.38
2E	SSM	571	52.4	58.4	6.78
	SMM	612	52.3	59.4	6.95
	SMU	731	52.8	59.4	6.65
	SSMM	581	52.9	58.4	6.45
	DSMM/MU	816	53.0	58.4	5.77
	DMM/MU	614	53.5	59.4	6.80

Halo Effect for SSM Tactic in PSE and SE Periods

Objective 4 was to determine the halo effect for the SSM tactic in the PSE and SE periods. The halo effect refers to speed reduction as a function of distance from the patrol vehicle (PV). Subsets of vehicle speeds recorded at the PV location and at approximately 1-mile intervals in either direction from the PV were created. Vehicle locations were accurate to within 0.5 mile. Vehicle direction was also noted: primary direction refers to vehicles traveling in the same direction that the PV faced and secondary direction to vehicles traveling in the opposite direction.

The halo effect was examined from four perspectives:

1. Only vehicles traveling in the primary direction were examined.
2. Vehicles traveling in the secondary direction were considered.
3. Speeds were combined for both directions by their absolute distance from the PV--i.e., relative to the PV direction.
4. Speeds were combined by their relative distance from the PV--i.e., either approaching or departing.

The effects of the PV on mean speed are evident in Figures 1-4. Points on the right side of Figures 1 and 4 and on the left side of Figure 2 represent vehicles that have passed the PV. Similar effects in both the primary and secondary lanes are indicated from Figures 1 and 2, with perhaps greater influence in the primary lane. The general effect is speed reduction nearest the PV.

For 4E, the mean speed decreased approximately 0.15 mph/mile from 5 miles to 1 mile upstream, then dropped sharply within 0.5 mile of the PV. Mean speeds increased an average of 0.7 mph/mile after vehicles passed the PV and the halo effect diminished after approximately 3 miles downstream. Mean speeds at 4 and 5 miles downstream continued to increase above the rather stable approach level, which perhaps indicates an effort by some motorists to compensate for the temporary speed reduction.

A different effect occurred on 2E. The mean speed gradually decreased as traffic approached the PV from 5 miles upstream, then increased very gradually from 1 to 5 miles downstream. At 5 miles downstream, the mean speed was still lower than any of the five upstream mean values. The halo effect was at least 5 miles on the downstream side and about 3 to 4 miles on the upstream side. Motorists were much more cautious on 2E, perhaps due to a much shorter visibility span and lower traffic volumes.

Effects on the 0.85 quantiles were similar to effects on the means. No clear-cut effect on speed variability could be determined, however. On 4E, variability appeared to be slightly more stable downstream but not significantly. There was a moderate lowering of variance on 2E after vehicles passed the PV, particularly at the 2- and 3-mile points.

Comparison of Patrol Tactic Effects on Speeds in PSE Period

Objective 5 was to compare patrol tactic effects on speeds in the PSE period. Relative differences between patrol tactic effects were sought by comparing all patrol tactics. The 2C and 4C data were used to make adjustments to 2E and 4E data. Adjustments were made to account for natural day-to-day fluctuations in speeds during the PSE period and were based on a computed daily index that gave the overall PSE speed mean for a particular day. Table 8 gives a summary of adjusted data.

Six statistical tests were conducted, three for each experimental road. Tests were for differences (SSM versus SMM) in means, 0.85 quantiles, and vari-

Figure 1. Mean spot speed: vehicles traveling in primary direction.

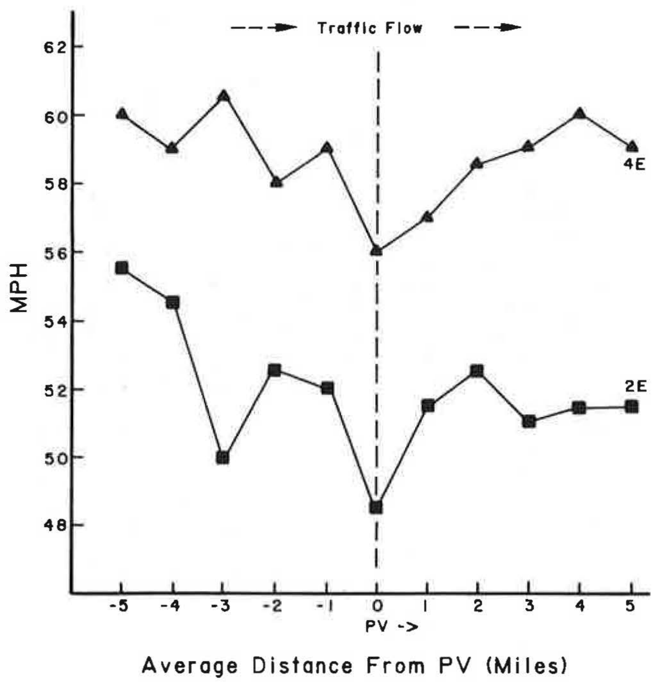

Figure 2. Mean spot speed: vehicles traveling in secondary direction.

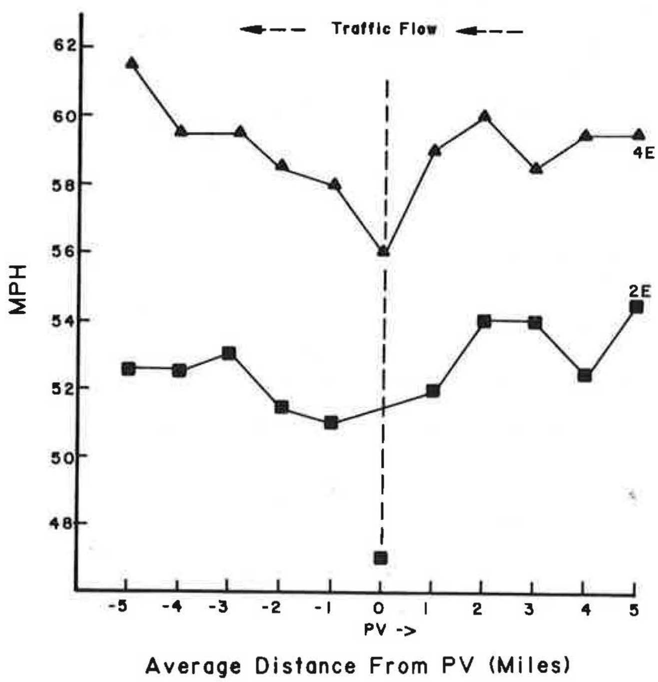

Figure 3. Mean spot speed by absolute distance from PV: all vehicles.

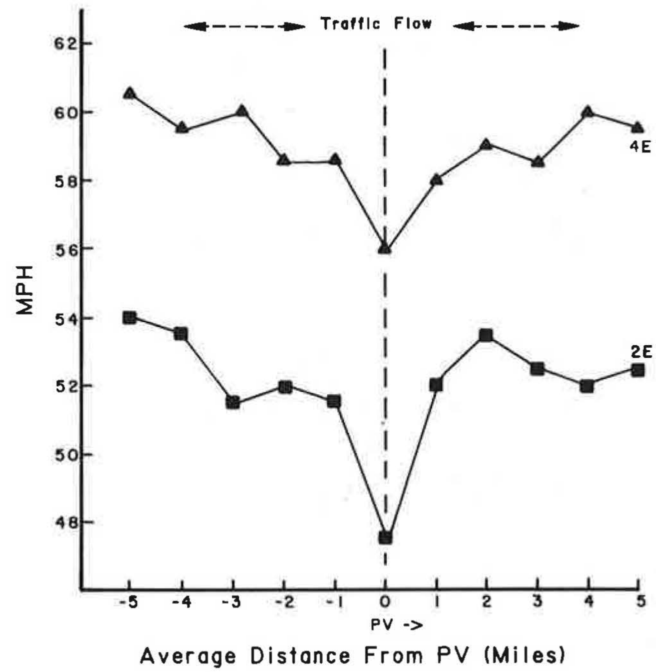

Figure 4. Mean spot speed by relative distance from PV.

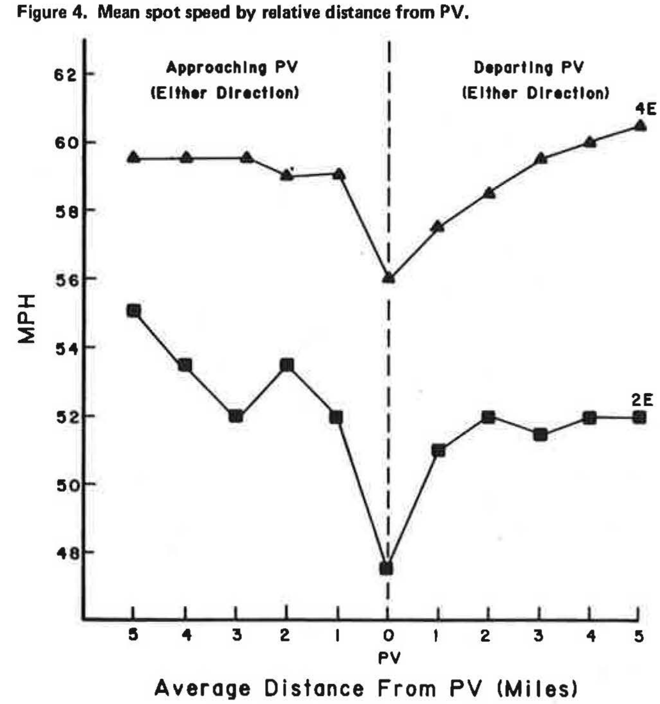

Table 8. Adjusted summary speed data for objective 5 by tactic.

Road	Tactic	No. of Obser-vations	Speed Data (mph) Mean	0.85 Quantile	Standard Deviation
4E	SSM	1059	60.0	65.8	5.63
	SMM	818	60.2	65.6	5.21
2E	SSM	590	51.94	58.3	6.41
	SMM	677	51.86	57.9	6.18

Table 9. Adjusted summary speed data for objective 6 by tactic.

Road	Tactic	No. of Obser-vations	Speed Data (mph) Mean	0.85 Quantile	Standard Deviation
4E	SSM	1378	58.4	63.4	5.15
	SMM	1674	59.2	64.5	5.32
	SMU	1161	60.3	66.0	5.76
	SSMM	1011	58.8	64.2	5.41
	DSMM/MU	1228	58.5	63.6	4.99
	DMM/MU	1497	59.7	64.5	5.40
2E	SSM	571	51.4	57.9	6.65
	SMM	612	52.9	60.0	7.04
	SMU	731	52.8	59.0	6.65
	SSMM	581	52.6	58.1	6.42
	DSMM/MU	816	52.3	57.4	5.70
	DMM/MU	614	52.5	58.7	6.64

Table 10. Effectiveness of patrol tactics ranked by speed.

Road	Rank	Mean	0.85 Quantile	Standard Deviation
4E	1	SSM	SSM	DSMM/MU
	2	DSMM/MU	DSMM/MU	SSM
	3	SSMM	SSMM	SMM
	4	SMM	SMM	DMM/MU
	5	DMM/MU	DMM/MU	SSMM
	6	SMU	SMU	SMU
2E	1	SSM	DSMM/MU	DSMM/MU
	2	DSMM/MU	SSM	SSMM
	3	DMM/MU	SSMM	DMM/MU
	4	SSMM	DMM/MU	SSM
	5	SMU	SMU	SMU
	6	SMM	SMM	SMM

ances. The only significant differences were on 4E, where the 0.85 quantile and variance were lower for SMM. Thus, generally no significant differences in speed due to patrol tactics were found during the PSE period.

Comparison of Patrol Tactic Effects on Speeds in SE Period

Objective 6 was to compare patrol tactic effects on speeds in the SE period. Speeds were adjusted in the same way as for objective 5. Table 9 gives a summary of adjusted results. All six patrol tactics were tested for significant differences between at least two. Means, 0.85 quantiles, and variances for each road were tested. The one-factor analysis of variance was used for means. The quantile differences test was used for 0.85 quantiles, and Cochran's test for homogeneity of variances was used for variances.

Significant differences were indicated for all speeds on 2E and 4E. A postanalysis of variance comparison (ANOVA) of means on 4E, using Scheffe's method, yielded the following contrast results at the 0.05 level of significance:

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(SSM)   (DSMM/MU)   (SSMM)   (SMM)   (DMM/MU)   (SMU)
 X̄1       X̄5         X̄4       X̄2       X̄6        X̄3
58.4     58.5       58.8     59.2     59.7      60.3
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Means underlined by the same line are considered not significantly different. Thus, means for SSM, DSMM/MU, and SSMM were not significantly different, but SSM and DSMM/MU had lower means than SMM, DMM/MU, or SMU. The same post-ANOVA analysis for 2E gave the following results:

```
(SSM)   (DSMM/MU)   (DMM/MU)   (SSMM)   (SMU)   (SMM)
 X̄1       X̄5          X̄6        X̄4       X̄3      X̄2
51.4     52.3        52.5      52.6     52.8    52.9
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Only the mean for SSM was significantly lower than means for both SMU and SMM.

Table 10 ranks patrol tactics for effectiveness by speed sample means, 0.85 quantiles, and standard deviations by their effectiveness, where a lower sample value was considered more effective. SSM and DSMM/MU gave the best results overall. Of the four single-vehicle patrol tactics, SSM was superior in reducing mean speed and 0.85 quantiles on both roads. SSM and SSMM were not significantly different in mean speeds on either road but were significantly lower than SMU on 4E.

SMM and SMU did not do well on a comparative basis. This is reinforced when one considers the two dual-vehicle tactics. Mean speeds were not significantly lower under DMM/MU than under either SMM or SMU alone. In fact, on 4E, SMM ranked above DMM/MU for all speeds. DSMM/MU was relatively effective but not in comparison with SSMM. Thus, addition of the unmarked vehicle to the stationary-moving mode had little or no effect on reducing speed parameters.

CONCLUSIONS

The following conclusions were inferred from the analyses:

1. The general areawide SE program may have reduced mean speeds on the Interstate road studied but did not affect speeds on the two-lane road.
2. Mean speeds were more affected by the patrol tactics studied than were 0.85 quantiles or variances. Reductions in mean speeds that were significant, although small in absolute value, were obtained with stationary, moving, and stationary-moving tactics. Reductions in 0.85 quantiles were smaller. Variances were not affected on the four-lane road but increased with five of six tactics on the two-lane road.
3. The most effective tactic on four-lane roads was the stationary mode. Average reductions in mean speed over the experimental segments were estimated to be 1.6 mph, or 2.6 percent, and in 0.85 quantile 1.8 mph, or 2.7 percent. This tactic was significantly better than the moving or unmarked tactic.
4. Results were less consistent on the two-lane segment, perhaps because of greater variability in speed data. In a direct comparison of all tactics, however, the stationary mode was superior to the moving and unmarked modes.
5. The unmarked tactic, either by itself or in combination with another vehicle, had little, if any, effect on speeds.

6. There was no significant difference between the stationary and the stationary-moving modes.
7. A greater halo effect occurred on the two-lane road than on the four-lane road. This effect extended from 3 to 4 miles upstream to at least 5 miles downstream from a stationary PV on the two-lane road. On the Interstate segment, vehicle speeds were affected, to a lesser extent, from 2 miles upstream to 3 miles downstream from the PV; speeds even increased from 3 to 5 miles downstream as motorists apparently attempted to make up lost ground.

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Evaluation of the Bonneville County, Idaho, DUI Accident Prevention Program

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The results of an impact evaluation of the first 15 months of an accident prevention program in Bonneville County, Idaho, are presented. Project Safety is a comprehensive driving under the influence (DUI) program implemented in Bonneville County in October 1979. It provided an integrated systems approach to the drinking-driver problem by the enhancement of treatment, sentencing and parole, and rehabilitation processes. DUI enforcement teams were added to the Bonneville County Sheriff's Office and the Idaho Falls Police Department. A public information component was also developed. Specific personnel were assigned system liaison responsibilities. A before-and-after analysis, which included two comparison locations, used an alcohol proxy measure (nighttime fatal and injury accidents occurring between 8:00 p.m. and 5:00 a.m.) to identify reductions in alcohol-related accidents. There was a reduction of 4.6 alcohol proxy accidents/month (a total of 64) during the study period. Reductions did not occur in comparison counties in the alcohol measure, although the direction of daytime accident trends was similar for all counties studied. State alcohol proxy accidents remained stable during the program period. An estimated $1 million in fatal and injury accident costs was avoided during the program period compared with actual total project costs of $312 471. The $1 million accident cost estimate excludes probable reductions in property-damage-only accidents.

The results of an impact evaluation of the first 15 months of the Bonneville County, Idaho, Project Safety program, implemented October 1, 1979, are presented in this paper. The program was designed to reduce alcohol-related motor-vehicle accidents in the county. The results of this study will contribute to the growing body of literature concerning the design, implementation, and effectiveness of alcohol-related countermeasures. The methodology adopted was designed to determine the following:

1. Has there been a measurable reduction in alcohol-related accidents that can be correlated with the implementation of Project Safety?
2. Is there reasonable evidence to indicate that such reductions can be attributed to Project Safety?
3. What are the cost savings in accident reduction due to Project Safety?