Evaluation of the Halo Effect in Speed Detection and Enforcement

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The halo effect is the effect on driver behavior beyond the point and time when enforcement is applied or when an enforcement symbol, such as a patrol vehicle, is observed. Research indicates that driving behavior is affected for about 1.5 to 6.5 km (1 to 4 miles). Some researchers (1, 2) have found that drivers reduce their speed when they observe a stationary patrol but not when they observe a moving patrol vehicle.

The purpose of this study was to determine if specific treatments on a section of NC-55, a two-lane rural roadway, could extend the halo effect. The study was done simultaneously with a study to evaluate a visual speed indicator (VSI) sign that displayed the message YOUR SPEED IS _____ as the vehicle passed over induction loop detectors buried in the northbound-lane pavement. If the vehicle was traveling at 90 km/h (56 mph) or more, the words SLOW DOWN were displayed. The sign and its related logic and data collection system (station 2) were located about 13 km (8 miles) south of Durham, North Carolina. Two other logic and data collection systems were located about 3.2 km (2 miles) upstream (station 1) and downstream (station 3) from the sign. The three stations also served as data collection locations in this study. The induction loop indicators for each station were placed at the approximate midpoint section of the roadway. Additional downstream speed profiles were collected in the vicinity of the VSI by an observer operating a radar unit mounted on a post near the roadway and connected to a speed-recording chart.

HALO EFFECT STUDY

The initial evaluation of the VSI was to determine whether the sign display would alter driver speed characteristics without police enforcement. The measurement taken at station 3 was intended to identify any carry-over or halo effect.

Since the VSI involves a static or point measurement of speed, it was thought desirable to compare the relative effectiveness of this technique with three other static enforcement techniques that involve the use of the static radar device.

1. The speed-check zone method (4) involves using a sign designating the zone and a partially concealed radar-equipped enforcement unit. The enforcement unit was located some 305 m (1000 ft) upstream from the VSI detector loops. The speed-check zone sign was placed near station 1.
2. The parked patrol car method involves using a marked patrol unit parked along the east side of NC-55 near the VSI detector loops.
3. The speed enforcement scene method involves using a patrol unit with its roof flasher activated to simulate an arrest. The patrol unit was parked on the east shoulder of NC-55, near the covered VSI, behind the "arrestee's" vehicle.

Thus, it was possible to have five-treatment experimental designs: the three static enforcement methods, the VSI sign display, and a control treatment in which the VSI sign was covered and no patrol unit was present. Each treatment was replicated three times over a 3-week period and assigned randomly each week. All recording devices at VSI sites were activated between 7:15 and 8:00 a.m., and other data that depended on the treatment were collected between 8:30 and 10:15 a.m.

Special Procedures

Whereas previously reported studies and the evaluation of VSI used downstream stations at 1.6, 3.2, 4.8, or 6.4-km (1, 2, 3, or 4-mile) distances, this research measured effects within the first 0.4 to 0.8 km (¼ to ½ mile) past the treatment point. The three enforcement methods provided speed observations upstream from the location of the enforcement unit. The latter measurement was provided by the radar unit deployed by the highway patrolman.

Downstream radar profiles were provided by a radar unit mounted near the roadway about 61 m (200 ft) before the VSI sign. The radar antenna was concealed in a grey

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box, which resembled a mailbox, located about 2.4 m (8 ft) east of the pavement edge. The radar-power unit and recorder were located behind a natural screen of small pine trees above the ditch.

Data Collection and Analyses

Field studies were performed over the 3-week period from April 21, 1975, to May 12, 1975. The data accumulated in the 3-week period primarily consisted of individual speed readings recorded at the three induction loop locations and of 100 to 150 radar profiles recorded at downstream stations for each 2-h study period. Although the halo effect study could not provide matched speeds other than near the treatment location, it was possible to correlate general speed characteristics (mean and median) because of the relatively short time period.

The analyses were primarily concerned with the speed characteristics (mean, median, 85th percentile, speed variance) at the three VSI recording stations. Analyses of variance were also conducted for mean speed, 85th percentile speeds, and percentage of all speeds exceeding 88.5 km/h (55 mph).

RESULTS

Speed characteristics obtained for each treatment and replication were analyzed, and the following trends were noted.

1. All enforcement treatments caused a substantial reduction in mean, median, and 85th percentile speeds in the vicinity of the enforcement unit (the VSI treatment caused only a minor reduction);
2. At a point 305 m (1000 ft) past the VSI sign detectors, all treatments experienced a speed increase of 3.2 to 9.7 km/h (2 to 6 mph) over the lowest values measured at station 2;
3. At the recording station 3.2 km (2 miles) downstream, all treatments experienced speeds that were almost equal to values measured 3.2 km (2 miles) upstream;
4. Variation of vehicle speeds was somewhat reduced near enforcement units compared to stations 1 and 3; and
5. All enforcement treatments greatly reduced the number of vehicles traveling faster than 88.5 km/h (55 mph) by 30 to 50 percent and greatly increased the number of vehicles traveling slower than 72.4 km/h (45 mph) at station 2 near the VSI sign by 10 to 30 percent.

Figure 1 shows the approximate average speed profiles of all vehicles passing through the study section. As shown by the control curve, there is a slight effect at station 2. This effect is due to either the highway geometry or the minor intersection and gas station a short distance downstream from the station. Compared to the control, the VSI sign has only a minor effect, less than 1.6 km/h (1 mph), on the mean speed of vehicles passing the display. All three static enforcement techniques produce a substantial speed reduction from 8 to 13 km/h (5 to 8 mph) at the treatment location. However, traffic began to recover speed within 305 m (1000 ft) past the treatment, and then completely regained its speed within 3.2 km (2 miles) upstream from the treatment.

ANALYSIS OF VARIANCE

The speed data were organized into two-way analysis of variance tables; the three replications and five treatments yielded 14 deg of freedom. Mean speeds, 85th percentile speeds, and percentage of vehicles traveling faster than 88.5 km/h (55 mph) were selected as the most important speed characteristics to be analyzed.

As a result of these analyses, it was found that there were no significant differences among replications (or days of the week) at any location for any of the variables studied. There was a very significant difference (at a level smaller than 0.5 percent) at most locations in the effects of the treatments studied, but there was no significant difference (at a 5 percent level) at station 3.

Since there were no differences in replications, data were combined for each treatment at each location. Each of the three variables was again organized into two-way analysis of variance tables; the 5 treatments and 5 locations yielded a total of 24 deg of freedom. These analyses yielded the following results.

1. There were no significant differences (at a 5 percent level) among the three enforcement techniques, between the activated VSI sign and the control condition, and between the speed characteristics for station 1 and station 3;
2. There was a very significant difference (less than 0.5 percent level) between enforcement treatments and

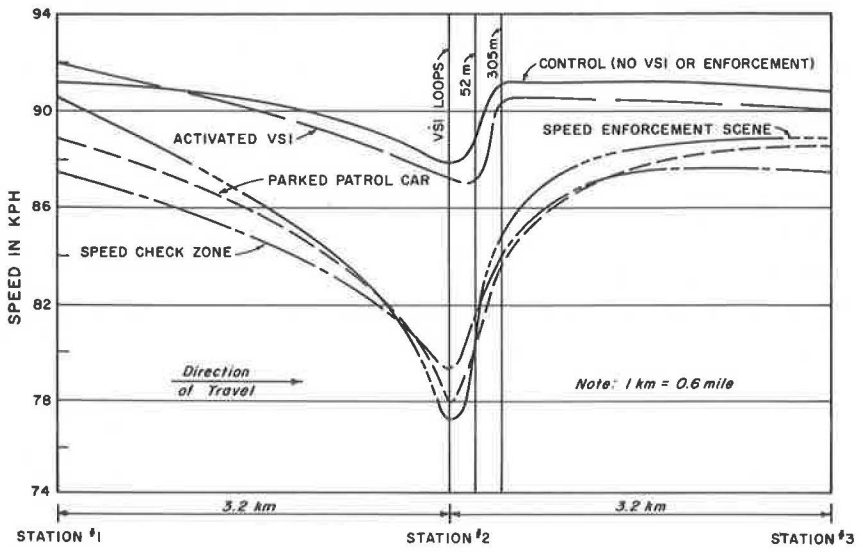

Figure 1. Northbound mean speed profiles on NC-55, spring 1975.

nonenforcement treatments (VSI and control) and between observations at station 2 and at stations 1 and 3; and

3. Mean and 85th percentile speeds and percentage of vehicles traveling over 88.5 km/h (55 mph) were significantly higher at a point 305 m (1000 ft) past the enforcement treatment than corresponding values measured at either the VSI detector loops or 152 m (500 ft) past the loops.

CONCLUSIONS

1. The use of a speed enforcement scene, a speed-check zone, or a parked patrol vehicle produces substantial and significant reductions in mean, median, and 85th percentile speeds in the vicinity of the enforcement unit.
2. All three enforcement techniques significantly reduce (and almost eliminate) the percentage of vehicles traveling faster than 88.5 km/h (55 mph). Furthermore, they also reduce the speed of all vehicles to the point of increasing the percentage of vehicles traveling slower than 72.4 km/h (45 mph).
3. All three enforcement techniques reduce the variability of speeds at the enforcement location.
4. The VSI sign had no significant effect on vehicle speed and was no substitute for actual enforcement activity.
5. The halo effect began to disappear 305 m (1000 ft) past the enforcement treatment and was completely gone at a point 3.2 km (2 miles) downstream.

The use of various enforcement techniques has received rather widespread attention over the years; however, a firm relationship does not exist between the various techniques and resultant effects on traffic behavior. The studies fail to show that the halo effect continues for any considerable distance beyond the symbol, a perplexing problem for enforcement agencies with limited staffs.

There are perhaps other innovative enforcement techniques that may be considered in the future, especially as efforts increase to obtain compliance with the 88.5-km/h (55-mph) limit. However, before any ideas are advanced to any degree, the concepts should be evaluated to determine the maximum payoff for each enforcement dollar spent.

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