A REPLICATION OF THE USE OF PUBLIC POSTING IN TRAFFIC SPEED CONTROL

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In an attempt to replicate several previous studies, a reversal design was used to assess the effects of publicly posted feedback on vehicle speed reduction. The intervention phases consisted of daily posted feedback that supplied drivers with either accurate or inaccurate information regarding the percentage of vehicles exceeding the speed limit on the road. Results from the two feedback conditions indicated no speed reduction in comparison to baseline levels. These results are discussed in light of previous studies that found strong effects for such feedback. Baseline levels of driver compliance and methodological differences may limit the effectiveness of posted feedback in reducing speeding.

DESCRIPTORS: public posting, speeding behavior, feedback, safety, replication.

Given the high incidence of motor vehicle collisions associated with excessive speed (*Accident Facts*, 1983), many interventions have been developed to increase driving safety. Traditional interventions often include the use of police patrols and public education and information campaigns. Van Houten and his colleagues have developed an alternative method of speed control that provides drivers with public feedback regarding their safe driving performance such that speeders modulate their behavior to comply with the nonspeeding majority. The first experiments (Van Houten & Nau, 1981, 1983; Van Houten, Nau, & Marini, 1980) established that behavioral control could be achieved over driving through the use of posted feedback. Feedback consisted of a sign reporting the percentage of drivers not speeding along a particular stretch of roadway on the previous day or week and the best record to date. Those researchers noted that feedback had a greater effect on those driving at higher speeds; the feedback tended to bring their speeds closer to the mean speed of the traffic flow.

The Van Houten reports suggested that public posting was more effective in reducing speed (and more efficient in terms of time and money) than traditional forms of police enforcement.

Shinar and McKnight (1985) have argued that the effectiveness of feedback signs is due to their implied surveillance. Similarly, Van Houten and Nau (1983) observed that drivers may have assumed that with high posted percentages, speeding would be easily detected. However, they also suggested that social comparison, introduced through the use of feedback and drivers' braking reaction to the sign, proved an important factor in the results. The generality of these procedures to other settings and populations has become a focus of additional research (Sherer, Friedman, Rolider, & Van Houten, 1984; Van Houten et al., 1985).

Other independent replications have not produced significant reductions in speeding. Hunt (1984) implemented the feedback sign on a major arterial two-lane road with a high volume of traffic, whereas Martin and McClure (1984) used the sign on a low-volume residential road. Both studies (conducted in Tuscaloosa, Alabama) employed a feedback sign identical to that used in the Van Houten studies, but placement of the monitoring equipment varied from the original studies in that speed detection was made in closer proximity to the feedback sign. Both Tuscaloosa studies may be seen as logical extensions of Van Houten's work in which variations of the basic feedback were examined.

This article is based, in part, on a thesis submitted by the first author under the direction of the second author in partial fulfillment of the requirements for the Master of Arts degree.

The authors wish to thank Joe Robinson, Director, Department of Transportation, and David Griffin of Tuscaloosa Traffic Engineering for their assistance in conducting this study. Appreciation is also extended to Ronald L. Blount and Forrest Scogin for serving on the examination committee.

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The purpose of the present study was to replicate the study of Van Houten et al. (1980). The site physically resembled that used in Van Houten's research: Both roads were four-lane urban highways and both required total speed reductions of approximately 20 mph (32.2 km/hr). An additional issue under consideration was whether posted feedback alone is sufficient to reduce speeding or whether high posted percentages are necessary to induce compliance.

METHOD

Participants and Setting

The participants in this study were all drivers traveling along an urban roadway in Tuscaloosa, Alabama, during the summer months of June, July, and August for a total of 142,289 observations. Participants remained anonymous, and speeding data were not released to the police. During the present study, this section of roadway carried approximately 3,560 vehicles each day.

Drivers along this section of roadway are required to reduce their speeds from 55 mph (88.5 km/hr) to 35 mph (56.3 km/hr) because they are entering a commercial area where stores are set close to the highway. Only westbound traffic (entering the business area) was monitored. This particular roadway was selected for several reasons: (a) It carries a high volume of traffic, (b) the police and Tuscaloosa Traffic Engineering Department (TTED) have defined speeding as a major problem along this roadway, (c) cars and trucks entering and leaving the parking areas for the roadside businesses make failure to reduce speeds particularly dangerous, and (d) the site selected resembles the setting of previous research (Van Houten et al., 1980). No obstruction to normal traffic flow was observed during this study.

Apparatus

Vehicle speeds were monitored by Stevens Model LD 811® Inductive Loop Detectors and Stevens PDR II® Print Punch Traffic Classifiers. The inductive loops were four loops (1.8 m by 1.8 m)

placed in grooves cut into the traffic lane pavement. Two loops were installed in each traffic lane. Vehicles crossing over the loops caused fluxes in the electrical current passing through the loops, which were detected by a classifier. The classifier computed vehicle speeds by the interval of time it took the front axles of a vehicle to cross over the leading edge of both sets of inductive loops.

At 1-hr intervals, the classifier recorded the total number of vehicles that crossed the inductive loops during that period, as well as the number of vehicles traveling at each 5-mph (8-km/hr) increment. The classifier is capable of sorting vehicle speeds into six categories based on 5-mph increments. It also provides global readings of the number of vehicles traveling above and below the six speed categories. The classifiers were calibrated for accuracy when installed by the TTED.

One classifier was connected to inductive loops in each of the two lanes. The classifiers were contained within a metal box (0.9 m by 0.46 m by 1.4 m) set approximately 4.6 m from the side of the road in a wooded area. Approaching traffic could not see the traffic box until they were almost abreast of it and in most cases would not be aware of its purpose. The use of the inductive loops is different from Van Houten's procedures in which possibly visible radar units were used.

The feedback sign was constructed of standard gauge highway sheet metal. The sign was placed on the right shoulder along the legal right-of-way. The feedback sign was set approximately 0.6 m from the edge of the roadway at its closest point and was highly visible for approximately 122 m. The sign was white with black lettering, was 1.2 m tall by 2.4 m wide, and stood approximately 4.6 m above the ground. Reflective letters on the feedback sign were all 15 cm high, and numbers were either 15 or 20 cm high. The numbers were mounted on plywood panels so that they could be changed easily. The sign read "DRIVERS NOT SPEEDING YESTERDAY, XX%" and on the line below, "BEST RECORD, XX%" (wording identical to Van Houten et al., 1980). The feedback sign stood 206 m before a 35 mph (56 km/

hr) speed limit sign and the monitoring equipment and 116.7 m beyond a permanent warning sign that read, "Reduced Speed Ahead, 35 mph."

General Procedure

Vehicle speeds were monitored continuously during the entire experimental period. A 24-hr period ran from 1:01 p.m. one day to 1:00 p.m. the following day. Data were collected from the classifiers at approximately 1:00 p.m., at that time the recharged classifier batteries were also put into place.

The raw data were transformed into the percentage of drivers traveling below 45 mph (72.4 km/hr). During the intervention phases of this study, that information was then relayed to the TTED. In addition, they were also provided with the percentage of highest driver compliance to date. Between 7:00 and 7:30 a.m. the following morning, the signal crew from the TTED posted the appropriate percentages on the feedback sign. Data collected from Sunday through Friday were used in the behavioral analyses.

Experimental Design

The study consisted of four experimental phases: (a) Baseline 1, (b) daily posting, (c) Baseline 2, and (d) inaccurate posting. A reversal design across participants was used to assess the effects of posted feedback in vehicle speed reduction.

Baseline 1. During this phase, motorists' speeds were monitored using the apparatus and procedures described above. The feedback sign was erected but remained covered by a plywood board during this phase. This phase and each of the following conditions continued for 10 days.

Daily posting. Vehicle speeds continued to be monitored daily under this condition for 10 days. The feedback sign was uncovered during this phase. The posted numbers reflected the percentage of motorists driving at or below 45 mph. This speed was chosen as the cutoff point because preliminary baseline data analysis revealed that the 45 mph speed reliably coincided with at least 50% driver compliance.

Baseline 2. This baseline phase was conducted in an identical manner to the first baseline. The feedback sign was covered and remained covered during the remainder of this 10-day condition.

Inaccurate posting. The apparatus and procedures for monitoring vehicle speeds and posting feedback remained the same as in the daily posting condition. However, in this phase, posted percentages reflected an inaccurate and inflated semblance of compliance and ranged between 80% and 86% for 10 days in this condition.

RESULTS

Figure 1 illustrates the results obtained in this study. The lowermost curve indicates that compliance with the posted speed limit of 35 mph remained low and stable despite interventions to increase that behavior. The mean number of drivers traveling within the speed limit varied between 13.8% and 15.5%. It appears that, regardless of the experimental conditions, only a few drivers complied with the speed limit. However, posted feedback appeared to have a small, but consistent, effect in speed reduction, although this reduction did not extend to actual compliance with the speed limit. Figure 1 also presents the percentage of drivers traveling at or below 40 mph (64.4 km/hr), 45 mph (72.4 km/hr), and 50 mph (80.5 km/hr).

Baseline 1. The data obtained during this phase showed little variability. The mean rate of compliance with the speed limit was 13.8% ($SD = 0.75$). An average of 29.4% of the drivers were traveling at or below 40 mph, 56.4% at or below 45 mph, and 82% at or below 50 mph.

Daily posting. A readily apparent reduction in speeding was produced in the first 2 days of this phase. During these first 2 days, a 12% reduction in speeding from previous baseline levels was obtained for drivers traveling at or below 45 mph. Unfortunately, results were confounded by a police radar unit that ticketed motorists on the 2nd day of this phase. An analysis of the different speed levels for this day indicates little effect on the overall

Figure 1. Summary of results indicating vehicles traveling at or below various criteria.

mean speed. No other speed traps were in effect during the study.

The posted feedback had the greatest effect on low and middle range speeders, those traveling at or below 40 mph and 45 mph, respectively, than on higher rate speeders. However, the impact of feedback on speed reduction was variable. During the middle portion of this daily posting phase, speeding showed a slight increase and then began to decrease, although rates of compliance did not again reach the levels obtained during the first 2 days. The mean percentage of drivers traveling at 35 mph during this phase reached 15.5%. An average of 35% of the drivers traveled at or below 40 mph, 63.2% at or below 45 mph, and 86.3% at or below 50 mph.

Baseline 2. An increase in speeding was observed across all groups of drivers during this phase. This shift represented an increase in speeding from daily posting levels, but the increase did not match preintervention levels of speeding. Driver compliance with the 35 mph speed limit dropped to a

mean rate of 14.9%. A mean rate of 31.9% of the drivers were recorded traveling at or below 40 mph, and an average of 59.8% and 84.1% of the drivers were traveling at or below 45 and 50 mph, respectively.

Inaccurate posting. This intervention phase generally did not have the same impact on drivers' behavior as the daily posting condition. During the last 5 days, the posted inaccurate feedback was gradually increased from 80% to 86%. The higher posted feedback seemed to have the most pronounced effect on the high speeder group, those traveling at or below 50 mph. The posted inaccurate feedback reflected increases of 20 to 23 percentage points over previously posted 45 mph compliance rates. Previous research had suggested that the feedback sign achieved best results when percentages posted ranged between 80% and 90% (Van Houten & Nau, 1983). The inaccurate posting procedure did not yield significantly improved compliance rates in the present study. The mean rate of compliance with the 35 mph speed limit

was 15.5%. An average of 33.3% of the drivers were recorded traveling at or below 40 mph, 61% at or below 45 mph, and 84.8% at or below 50 mph.

DISCUSSION

Results of the present experiment indicate that public feedback was not effective in increasing compliance with posted speed limits. Although Van Houten and associates (Sherer et al., 1984; Van Houten & Nau, 1981, 1983; Van Houten et al., 1980, 1985) have consistently reported significant decreases in speeding with implementation of posted feedback, that finding was not replicated in the present study. Whereas speeding was sharply curtailed in feedback studies conducted in both Nova Scotia and Israel, practical extensions of this work conducted in the United States have not yielded similarly positive results. However, results from the present study are consistent with findings from previous replication attempts conducted in the Alabama area (Hunt, 1984; Martin & McClure, 1984).

The sites in both the Van Houten et al. (1980) study and the present investigation share similar speeding problems. Both sites showed low baseline rates of compliance with posted speed limits. At the Nova Scotia site, only 8.7% of the drivers were in compliance, whereas at the Tuscaloosa site, adherence to the posted limit stood at 14.4%. However, upon examining the speed distributions of the entire traffic stream, some dissimilarities between the two traffic patterns may be discerned. Although actual compliance with posted speed limits was lower in the Van Houten study, the majority of drivers (75%) traveled within 9 mph of the speed limit. In the present study, speeds were normally distributed but the curve was flatter; only 58.1% of the drivers were recorded traveling within 10 mph of the speed limit.

Possibly, characteristics of the environment that induce drivers to travel near the speed limit may also influence their receptivity to interventions aimed at modifying their driving habits. In the present research, although the sign had overall minimal effect in terms of absolute compliance with the posted speed limit, what influence it may have had was reflected by the fastest drivers. This latter find-

ing is similar to those found by Van Houten and associates (1980). The "Reduced Speed Ahead" warning sign was set up at a point where, if drivers remove pressure from the gas pedal, their cars' speed will decrease to the proper speed in the distance between the warning sign and the speed zone sign. In Alabama, speed zone enforcement begins at the point of the zone sign itself. The warning speed zone sign should have similar discriminative control as a speed limit sign. This aspect prompted the placement of the feedback sign a short distance past the warning sign and before the speed zone sign (which was visible for a distance before the feedback sign). If this placement interrupted the sign's action, then the posting benefits are not as robust as indicated in other studies. Additional research should determine whether the feedback sign's effectiveness relies on its contiguity to other signs of greater discriminative value.

The inaccurate posting condition was developed to evaluate whether high posted percentages were sufficient to induce compliance, as suggested by Van Houten and Nau's (1983) observations that posted compliance figures of 80% to 90% produced maximal benefits from the feedback. It was hypothesized that high posted compliance rates would enhance speeders' perceptions that their behavior did not conform to the majority of drivers and that they would consequently reduce their speeds in the social comparison process articulated by Van Houten and Nau (1983). Both the present study and Martin and McClure's (1984) research found that posting artificially inflated percentages did not have the anticipated effects, perhaps because casual observation of surrounding traffic alerted drivers that others were exceeding the speed limit. It may be that drivers who are observed speeding may serve a social comparison function. This condition was introduced to test the possibility that the level of reported compliance regardless of actual compliance was a key factor in the sign's efficacy. However, the inaccurate posting results should not, in isolation, be viewed as antithetical to posted feedback. It may be that the extent of speeding was so pervasive that social comparison processes were not viable because there first must be a group norm toward which to gravitate. The Van Houten proj-

ects may have been successful because they compared minority noncompliance (high speeders) to a dominant majority compliance (low or nonspeeders). These replication attempts may not have been successful because a dominant compliant majority was not available for comparison purposes.

Van Houten et al. (1985) found that different site characteristics correlated with feedback sign effectiveness. The greater the number of intersections and residences around the sign, the greater the speed reduction. In the present project, the congested business area past the sign shares many characteristics of residential neighborhoods such as frequent pedestrians and intersections. Still, minimal effects of the sign were obtained. Similarly, the study by Martin and McClure (1984) in a residential area resulted in only a small increase in driver compliance.

The present study site had a lower traffic flow than did sites in several of the previous studies. Van Houten et al. (1980) considered this an important feature because following drivers can view other drivers responding to the sign by the brake lights. Where traffic volume is lower, the chances of being influenced by such observation decreases. Thus, a restricting factor on the feedback sign's effectiveness may be the necessity for a large number of vehicles passing the sign to provide "chain reaction" effects (Van Houten et al., 1980, 1985). Another limitation may be that the effects are restricted to daylight hours. In the Van Houten studies, the observations were made during the day. In the present study, 24-hr recording was made, but no differential results were obtained for day or night. The use of loop detectors virtually unnoticeable to the average person is a technological improvement over studies relying on radar units. However, it may have removed a potentially reactive element adding to the sign's efficacy.

Public posting may imply increased surveillance, and the presence of equipment or personnel, as in the study of Van Houten and Nau (1983), may confirm this perception. In this way, the sign may be viewed as not working independently, but in

concert with high traffic volume, with police surveillance either implied or overt, and with other human observers. It is clear that posted feedback cannot be effectively applied without taking into consideration various factors such as the extent of speeding, majority norms, site characteristics, and traffic volume. Given these limitations, the suggestion that public posting can supplant conventional police enforcement (Van Houten & Nau, 1983) may warrant qualification.

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Received September 8, 1988

Initial editorial decision January 1, 1989

Revisions received February 10, 1989; April 26, 1989

Final acceptance May 31, 1989

Action Editor, Brandon F. Greene