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Examining Instrumented Roadways for Speed-Related Problems

The National Highway Traffic Safety Administration categorizes speeding as a risky driving behavior. Consequences of speeding include increases in the stopping distance and crash severity, and decreases in the effectiveness of occupant protection equipment. In 2020 there were 38,824 traffic fatalities. Of those, 11,258 (29%) resulted from crashes in which at least 1 driver was speeding (National Center for Statistics and Analysis, 2022).

Law enforcement agencies (LEAs) have critical roles in reducing speeding and speeding-related fatalities. LEAs use a variety of tactics to mitigate speeding; however, agencies are increasingly faced with limited resources and pressure to focus on public safety issues outside of traffic and speed enforcement. Therefore, it is essential that LEAs have the information to make strategic decisions on which speed management strategies to use as well as the best times and locations for deployment. The data-driven deployment of speed management resources can help LEAs accomplish this.

Methodology

This observational study examined efforts used by law enforcement officers to reduce speeding on roadways. Researchers coordinated with Virginia's Stafford County Sheriff's Office (SCSO) to examine implementation of countermeasures on corridors with speeding-related safety concerns. Collecting speed and enforcement data allowed researchers to analyze the impacts of the enforcement efforts. Speed sensors placed on test and control road segments collected data for the study. Each of the seven roadway segments was instrumented with sensors placed on either side of the speed reduction activity (SRA) to monitor traffic speeds.

Roadside sensors recorded continuous roadway data, including the speed and size of each observed vehicle. Those vehicles traveling at least 10 mph above the posted speed limit were considered speeders for the purpose of categorizing data. After completion of baseline data collection, the data were shared with SCSO throughout the rest of the project. Law enforcement officers were able to use the data to make decisions on the type of countermeasure to deploy as well as the time and location of deployment.

The LEA countermeasures or SRAs deployed in the study included deputy presence with on-site enforcement, decoy cars, speed trailers with digital feedback signs, and changeable message signs. The deputies in the field documented the time and location of each SRA. The SCSO also made public service announcements on social media, including posts about the dangers of speeding.

Traffic Volume, Speeders, and Crashes

Continuous data collection from the deployed sensors allowed the research team to examine the relationship between traffic volumes, speeders (i.e., passenger vehicles traveling at least 10 mph over the posted speed limit), and speed-related crashes. The number of speeders on roadways was a statistically significant predictor of speeding-related crashes. Specifically, a 1-percent increase in speeders during a given month was associated with a 0.84-percent increase in crashes ($p<0.05$). The number of non-speeders did not have a significant effect on crashes.

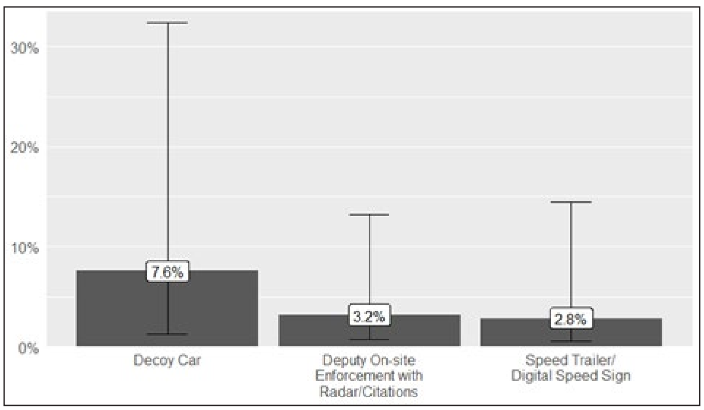
While more volume of either type of driver increases the opportunity for crashes and thus should increase the rate of crashes, the number of vehicles within the range observed was not a significant predictor. This implies that total volume can increase without yielding more crashes *if the increased volume is composed of all non-speeders.* Overall, speeders accounted for 12.4 percent of total volume. Therefore, if monthly volume on any road is expected to increase by 10 percent, the number of speeders would be expected to increase by 1.24 percent, and the number of crashes to increase by 1.04 percent.

Speed Reduction Activities and Traffic Speeds

SRAs are intended to reduce the number of speeders observed on a roadway. In this study, an SRA was considered successful if it both yielded a statistically significant decrease in hourly speeders, and that decrease was larger in magnitude than any concurrent decrease observed on the control road. SRA success was measured for two time periods: within 24 hours of the SRA deployment and longer than 24 hours after the deployment.

Type of SRA: The type of SRA deployed was a statistically significant predictor of success beyond 1 day. Decoy cars proved to be the most successful of the speed reduction activities for reducing speeds more than 1 day after SRA deployment ceased, followed by speed trailers, and then deputies on-site issuing citations (see Figure 1). The decoy car's estimated success rate given average values for other variables in the model was 7.6 percent, versus 2.7 percent for the speed trailer and 3.0 percent for active on-site enforcement. These percentages represent the probability of successfully reducing the number of speeding drivers at any point more than 1 day after implementing the SRA. While the result might not be intuitive, deputy presence is limited to only a few hours at a time (at most) so the deputy would typically spend less time than the time that another SRA would be in place at a given site.

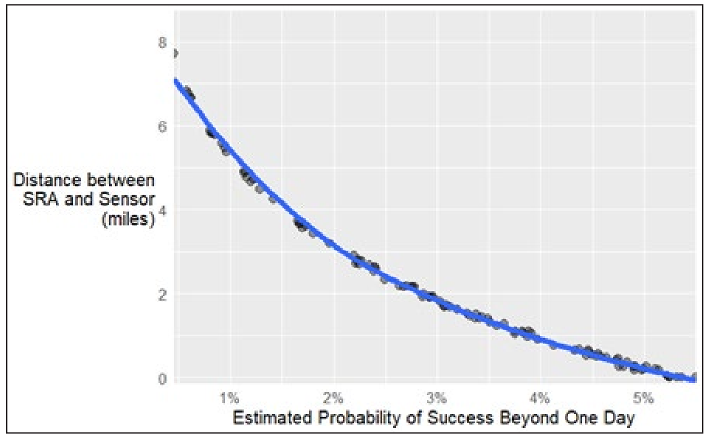
Figure 1. Predicted Probability of SRA Success Beyond 1 Day, by SRA Type



Distance From SRA: The distance from the sensor was a statistically significant predictor of success beyond 1 day. Figure 2 shows the estimated success rate by distance between SRAs and sensors, using average values of other variables. At 1 mile, the estimated success rate is 3.8 percent, versus 2.8 percent at 2 miles, 2.0 percent at 3 miles, 0.7 percent at 6 miles, etc. Thus, the farther drivers are from an SRA, the less likely they are to reduce their speed in response to the SRA. This suggests that SRAs exert a very localized effect on speeding.

SRA Volume: The total number of prior SRAs in a month on a given roadway had a statistically significant negative effect on success more than 1 day after the SRA's conclusion. Each prior SRA in a given month decreased the odds of a given SRA's success by a factor of 0.94. Though the effect is small, it suggests that drivers may become desensitized to seeing SRAs, thus diminishing their effects over time. It may also indicate a "floor effect." If many SRAs are successful, the number of speeders may reach a natural minimum, leading to subsequent "failed" SRAs. It is also possible that the increased enforcement pushed speeding behavior to areas or times with less SRA activity.

Figure 2. Estimated Probability of SRA Success Beyond 1 Day Following the SRA, by Distance



Social Media Campaign

The social media campaign may have had a slight impact in reducing speeds; however, given the small audience, it was difficult to determine if this had a causal effect.

Conclusions

Decoy cars, digital speed signs, and on-site enforcement were all successful in reducing the number of speeding drivers more than 1 day after deployment. While decoy cars proved to be the most successful SRA in this study, this was likely influenced by length of deployment time at a given location. SRA effects seemed to be localized, indicating SRAs should be deployed as close to a problem area as possible. There may also be a point of diminishing returns for increased SRA activity as drivers become desensitized to the presence of SRAs. Finally, this study showed that traffic volumes can increase without a concurrent increase in crashes if the increased volume is made up of non-speeders. This bears out the importance of speed management in reducing speeding-related crashes.

Reference

National Center for Statistics and Analysis. (2022, June). *Traffic safety facts: 2020 data - Speeding.* (Report No. DOT HS 813 320). National Highway Traffic Safety Administration.

How to Order

Download a copy of *Examining Instrumented Roadways for Speed-Related Problems*, prepared by toXcel, from https://rosap.ntl.bts.gov/. Randolph Atkins, Ph.D., was the task order manager for this project.

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