

# CASE STUDIES ON RADAR SPEED SIGN EFFECTIVENESS

## **Innovative Operational Safety Improvements At Unsignalized Intersections**

*Florida Department of Transportation*

2008

### **Author(s)**

John R. Freeman, Jr., P.E. PTOE, Justin A. Bansen, P.E., Beth Wemple, P.E., Richard Spinks

### **Summary**

The intent of this research is to identify innovative methods of improving safety at unsignalized intersection locations, particularly on high-speed, multi-lane roadways. The information contained in this Final Report is intended to serve as a guideline, synthesizing the broad range of potential treatments that were identified through this project. Some of the treatments are more experimental, with just a few prior implementations nationwide, while others are more recognizable (but may not be widely used currently within Florida). Methods reviewed in this study include among others: various meridian markings, LED raised pavement markers, LED stop signs, flashing beacons and radar speed signs (dynamic speed signs).

The study finds that radar speed signs have been shown to significantly impact speeds on horizontal curves and in work zones; however the placement of the device can impact its effectiveness. When coupled with a warning sign, the dynamic speed/warning combination is expected to raise awareness of the approaching intersection and provide active notification to drivers to slow down. The study suggests that, through the use of radar speed signs, speed reductions within the intersection area may have a direct impact on intersection safety. Reduced speeds allow for an increased time for perception and reaction to conflicting vehicles. Additionally, slower travel speeds may result in fewer severe collisions.

## **Effectiveness of Photo-Radar and Speed Display Boards**

*Road Injury Prevention & Litigation, Journal Volume 1973*

2006

### **Author(s)**

(various)

### **Summary**

This study examined three approaches to speed control: "photo-radar, (unenforced) speed display board, and a speed display board with intermittent enforcement."

Results of the study revealed "that both speed display boards and photo-radar effectively reduce vehicle speeds while deployed" and are "particularly effective in reducing the number of vehicles traveling ten or more miles over the speed limit." However, "only the display boards demonstrated carry-over effects," particularly in the long term. Already the most cost-effective of the speed control devices, the speed reduction capabilities of display boards can be greatly enhanced with "intermittent police enforcement."

The un-enforced speed display board was the most cost-effective device on both an hourly and daily basis, and photo-radar was the least cost-effective of the three speed control devices.

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## Comparative Study of Speed Reduction Effects of Photo-Radar and Speed Display Boards

*Journal of the Transportation Research Board, Transportation Research Board of the National Academies, Volume 1640 / 1998*

2007

### **Author(s)**

Steven A. Bloch  
Automobile Club of Southern California

### **Summary**

Two forms of automated motor-vehicle speed control, speed display boards and photo-radar, are compared. The study was conducted on three comparable streets in Riverside, California, over a 4-week period.

Although both devices produced substantial speed reductions while in operation, only display boards demonstrated carryover effects. The enforced display board produced a substantial short-term (but not longer-term) carryover effect; the unenforced display board demonstrated a longer-term (but not short-term) carryover effect, but only at the alongside location, 1 week after its removal. The three cost-effectiveness estimates generated showed that the unenforced speed display board was the most cost-effective; the enforced display board came in second; and the photo-radar placed third.

## Survey of Safety Professionals Regarding Traffic Calming Options

*Survey sponsored by Information Display Company*

2007

### **Author(s)**

Information Display Company

### **Summary**

- More than 96.5 percent (of those surveyed) said they strongly agree (66.7%) or agree (30%) that driver feedback signs are effective in reducing traffic speeds on residential streets. This is compared to only 3.3 percent that strongly agree (and 33.3% that agree) that speed bumps are effective. Rumble strips were ranked as being least effective.
- Respondents perceived "Police with radar guns" as being the most expensive traffic-calming option. "Speed bumps" were perceived as being the least expensive.
- Driver feedback signs were ranked as having the most immediate and long-lasting effect on calming traffic. This was followed in order by "Police with radar guns," "speed bumps," "static speed limit signs," and "rumble strips."

## Evaluation of Dynamic Speed Display Signs

*Journal of the Transportation Research Board, Transportation Research Board of the National Academies, Volume 1918 / 2005*

2006

### **Author(s)**

Gerald L. Ullman, Elisabeth R. Rose

### **Summary**

This paper describes an analysis of the effectiveness of dynamic speed display signs (DSDSs) installed in several permanent locations. Sites evaluated included a school speed zone, two transition speed zones in advance of a school speed zone, two sharp horizontal curves, and two approaches to signalized intersections on high-speed roadways.

Overall, average speeds were reduced by 9 mph at the school speed zone. Elsewhere, the effect of the DSDS was less dramatic, with average speeds reduced by 5 mph or less depending on the location tested. As expected, those motorists traveling faster than the posted speed limit did appear to reduce their speed more significantly in response to the DSDS than did motorists traveling at or below the posted speed limit. The results of this project suggest that DSDSs can be effective at reducing speeds in permanent applications if appropriate site conditions apply.

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## **Effectiveness of Dynamic Speed Display Signs (DSDS) in Permanent Applications**

*Texas Transportation Institute, Texas A&M University System, Project Summary Report 0-4475-S*

2004

### **Author(s)**

Gerald L. Ullman, Elisabeth R. Rose

### **Summary**

Texas Department of Transportation personnel identified several test sites to try out permanently installed DSDSs. TTI researchers conducted field studies to determine whether the signs reduced speeds at each site. Researchers also examined whether the signs increased vehicle conflicts or other types of erratic maneuvers.

DSDSs were installed at four common types of roadway situations where excessive speeds can be a significant safety or operational problem:

- at the beginning of regulatory school speed limit zones that are active only during the times when students are arriving or leaving school,
- at speed zones installed upstream of a school speed zone (to transition motorists down to the school zone speed limit),
- upstream of high-speed signalized intersections, and
- upstream of sharp horizontal curves.

Researchers found that a DSDS significantly reduced vehicle speeds at a school speed zone. Prior to the installation of the sign, the average speed entering one speed zone was nearly 10 miles per hour (mph) higher than the posted speed limit through that zone. After the DSDS was installed, the average speed decreased more than 9 mph. Furthermore, average speeds were still 9 mph lower when researchers returned to that site and measured speeds four months after DSDS installation.

## **Stationary Radar Sign Program Report**

*City of Bellevue, WA transportation Department Stationary Radar Sign, Program Report*

2005

### **Author(s)**

Prepared by Ray Godinez

### **Summary**

This report shares Bellevue's experience with (20 radar speed signs previously installed by the city over a five year period) from installation techniques to effectiveness levels and considerations for future placement.

(2004-2005) Studies show that the majority of the stationary radar signs continue to reduce 85th percentile speeds even though some have been installed for more than four years.

With the success to date of the stationary radar signs, it is recommended that the city continue to install the signs at appropriate locations. These signs provide a tool for those streets that cannot receive traditional traffic calming measures. However, as this report confirms, speed reductions are limited when 85th percentile speeds are below 10 mph over the posted speed limit. Therefore, the City's guidelines on radar sign placement has been updated to reflect the following:

- two-lane roadway
- does not qualify for typical physical traffic calming measures due to high traffic volumes and/or roadway characteristics, such as curves, or steep grades
- 85th percentile speeds 10 mph or higher than the posted speed limit
- As additional uses for these signs are explored, the City's guidelines may be revisited.

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## Guidelines for Selection of Speed Reduction Treatments At High-Speed Intersections

*NCHRP Research, Report 613*

2008

### **Author(s)**

Various

### **Summary**

This study evaluated the effectiveness of treatments to reduce vehicle speeds at high-speed intersections. The treatments included geometric design features as well as signage and pavement markings. Radar speedcheck signs (dynamic displays) proved effective at slowing cars months after first being installed. In one study cited in this report, the speedcheck signs were installed at curved roadways where 10 truck rollover crashes were previously reported. Three years after the signs were in operation, no rollover crashes had been reported.

## **School Zones**

### Distracted Drivers In School Zones: A National Report

*Safe Kids USA, Department of Evaluation And Research*

2004

### **Author(s)**

Jurek G. Grabowski, PhD, MPH, Stephanie Goodman, MPH

### **Summary**

This study begins with a review of previous research that highlights the increased use by drivers of cell phones, GPS and other potentially distracting devices. It also provides data on how driver distraction can have a significant impact on response time, stopping distance and severity of accidents.

This information is followed by a review of an original study conducted by Safe Kids USA that looks at the prevalence and characteristics of driver distraction in school zones. To gather this data, trained observers were posted at 20 middle schools located in 15 states across the U.S. These observers collected data regarding the number of distracted drivers, the nature of their distraction and various other observational facts.

Findings of the study show that one in six drivers were distracted. Both male and female drivers had a high rate of distraction. Leading distracters included cell phones and other electronics followed by eating/drinking/smoking.

Given that radar speed signs are designed to grab the attention of distracted drivers and refocus their attention on to their own driving speed, this study offers a strong case for the high effectiveness of radar speed signs in slowing traffic in school zones.

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## **Effectiveness of Speed-Monitoring Displays in Speed Reduction in School Zone**

*Transportation Research Board of The National Academies, Volume 1973*

2006

### **Author(s)**

Choulki Lee (Graduate School of ITS, Ajou University, San 5, Wonchon-Dong, Youngtong-Gu, Suwon 442-749, South Korea), Sangsoo Lee and Youngtae Oh (School of Environmental Civil and Transportation Engineering, Ajou University, San 5, Wonchon-Dong, Youngtong-Gu, Suwon 442-749, South Korea), Bongsoo Choi, (Division of Traffic Operation and Safety, City of Gwacheon, 72 Gwanmun-Ro, Gwacheon City, Gyeonggi-Province, South Korea)

### **Summary**

Speeding is one of the major causes of the frequent and severe traffic accidents that occur in school zones. Two field studies were conducted to assess the short-term and long-term effectiveness of speed-monitoring displays (SMDs) for speed reduction in school zones. The performance difference is discussed according to several dependent variables, including the average speed, the 85th percentile speed, and the distribution of speeds.

The short-term study results showed that the speed of vehicles began to be reduced when the driver recognized the presence of an SMD, and the average speed was reduced by about 17.5% (8.2 km/h) at the SMD location.

This speed reduction was observed throughout the day, regardless of the time of day. A similar performance trend was identified from the long-term study results, but the average speed reduction was slightly reduced to 12.4% (5.8 km/h) at the SMD location. However, statistical analyses showed that the speed differences were statistically significant. In addition, analysis of the results of the speed distribution showed that the number of speeding vehicles was greatly reduced after the SMD was installed, and the 85th percentile speed also decreased from 54.3 to 46.3 and 45.0 km/h in the short-term and the long-term studies, respectively.

Therefore, it was concluded that the application of SMDs in school zones produced a positive impact on the drivers' behaviors for a long period of time.

## **Speed Monitoring Displays: Increasing Speed Limit Compliance in Reduced Speed School Zones**

*Utah Department of Transportation, Research and Development Division*

2005

### **Author(s)**

Mitsuru Saito, Ph.D., P.E., Kelly G. Ash, EIT

### **Summary**

The field study found that the Speed Monitoring Displays (SMDs) analyzed proved to increase speed compliance in most cases. In some cases, the SMDs maintained their effectiveness at increasing speed compliance; on the other hand, some gradually lost some of their effectiveness.

The distribution of speeds at essentially every location demonstrated a reduction in excessive speeds. For the most part, these SMDs helped improve school zone safety by decreasing speeds and increasing speed compliance as manifested by the decrease in mean speed, standard deviation, 10 mph pace range and the percentage of vehicles exceeding the 20 mph school zone speed limit.

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## Work Zones

### **Innovative Traffic Control Devices for Improving Safety at Rural Short-Term Maintenance Work Zones**

*Texas Transportation Institute, Texas A&M University System 3135 TAMU*

2008

#### **Author(s)**

Michael D. Fontaine

#### **Summary**

Five different traffic control devices were selected for further evaluation:

1. Speed display trailers
2. Radar drones
3. Portable rumble strips
4. Alternative worker vests, and
5. Fluorescent orange roll-up signs

This paper describes the results of the evaluation of these devices.

- The speed display trailer produced the largest speed reductions of all the devices tested. Average speed reductions of approximately 5 mph were achieved.
- (Workers) felt that the trailer produced significant speed reductions and the installation and removal of the trailer was reasonable for a short-term work zone.
- The radar drone produced smaller speed reductions than the speed display trailer, averaging less than 1 mph. Workers felt that the drone was very easy to set up and remove, but questioned its effectiveness when applied for long periods.
- Speed reductions for the rumble strips were between 1.5 and 4 mph.
- Maintenance crews were concerned that the amount of time required to install the portable rumble strips would be excessive for many short-term work zones.
- The fluorescent orange signs did not have any measurable impact on the speed of traffic in the work zone.

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## Efficacy of Speed Monitoring Displays in Increasing Speed Limit Compliance in Highway Work Zones

*Brigham Young University, Department of Civil & Environmental Engineering, Report UT- 03.12*

2003

### **Author(s)**

Bowie, Jeanne Marie

### **Summary**

This study focuses on the goal of reducing speed in work zones. First, methods of speed reduction used by state DOTs throughout the country are identified, and the research surrounding them is summarized. Next, the methodology and results of a field study that tests the efficacy of the Speed Monitoring Display (SMD) are presented. For the field study, three main conditions were analyzed: a no-treatment case, with the MUTCD signs and barriers; a treatment case using the SMD; and a treatment case using a police vehicle. In the no-treatment case, average vehicle speed was reduced about 3 mph as vehicles entered the work area of the work zone. With the SMD, average vehicle speed was reduced an additional 4 mph. With the police vehicle, average vehicle speed was reduced about 6 mph more than in the no-treatment case.

Thus, average vehicle speed was reduced in all treatment cases; however, the police vehicle was slightly more effective than the SMD at reducing average speeds. (These conclusions are valid at a 95 percent confidence level.) The results of the survey also suggest that the SMD is a promising option for state DOTs. According to drivers' self-reports, those who normally drive a little faster than the speed limit are likely to slow down in reaction to an SMD, but drivers who normally ignore the speed limit are likely to ignore an SMD. The majority of drivers surveyed had positive reactions to SMDs, reporting that they feel SMDs are accurate, not distracting, and not difficult to read.

## Use of Speed Display Trailers in Work Zones

*Maryland State Highway Administration, Office Of Traffic & Safety*

2005

### **Author(s)**

Various – see report's bibliography

### **Summary**

#### **ADVANTAGES**

- Speed limit compliance is increased by 10 to 40 percentage points.
- The speed display trailer is an effective speed reduction measure in work zones. Mean speeds are reduced by 2 to 7 mph.
- Drivers have shown positive attitudes toward the speed monitoring display.
- Set-up and removal of the speed display trailer is easily accomplished.
- The speed display trailer is a cost-effective speed control measure.

#### **DISADVANTAGES**

- The effectiveness of the speed monitor display (may) decrease over time. Some factors affecting the effectiveness of the speed monitoring display include its size, placement and design of the trailer. (also) Larger speed displays are easier to read and attract more attention.
- Although an effective speed control countermeasure, speed reductions attained with the SDT are usually less than what is desired.

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## Evaluation of speed displays and rumble strips at rural-maintenance work zones

*Texas Transportation Institute, Texas A&M University System, Transportation research record ISSN 0361-1981*

2001

### **Author(s)**

Fontaine Michael D. ; Carlson Paul J.

### **Summary**

An evaluation of the effectiveness of speed displays and portable rumble strips at reducing speeds in rural-maintenance work zones is described.

The results for the portable rumble strips were mixed, with passenger cars experiencing less than a 3.2-km/h (2-mph) reduction in mean speed approaching the temporary traffic-control zone. The impact of the rumble strips on trucks was more pronounced, with mean speed reductions approaching the temporary traffic-control zone of up to 11.6 km/h (7.2 mph) lower than normal traffic control. The percent of vehicles exceeding the speed limit in the advance warning area was also reduced when the rumble strips were used.

The speed display was generally more effective than the rumble strips at reducing speeds in the advance warning area. Mean speeds were often reduced approaching the activity area, with speed reductions of up to 16.1 km/h (10 mph) being achieved. The percentage of vehicles exceeding the speed limit was also reduced in the advance warning area.

## **Intersections**

### Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections

*National Cooperative Highway Research Program, Transportation Research Board of the National Academies, Final Report for NCHRP Project 3-74*

2007

### **Author(s)**

Kittelson & Associates Inc.  
Midway Research Institute  
Synectics Inc.  
Transportation Research Corp.

### **Summary**

This project identified and evaluated treatments and developed guidelines for reducing vehicle speeds on approaches to high-speed intersections (approach speeds of 45 mph or greater).

The treatments investigated were: reduced lane width, visible shoulder treatments, speed tables, rumble strips, roadway environment, approach reverse curvature, roundabouts, splitter islands, wider longitudinal pavement markings, transverse pavement markings, and dynamic warning signs.

1. All three treatment types may reduce speeds on high-speed intersection approaches; however, speed reduction is likely to be minimal (i.e., less than 3 mph).
2. Of the three treatment types tested, dynamic warning signs activated by speed may be the most effective at reducing speeds. However, this conclusion is based on only three intersection approaches.
3. Peripheral transverse pavement marking also appear potentially effective at reducing speeds.
4. Based on a limited number of sites, rumble strips do not appear to be as effective at reducing speeds as dynamic warning signs or transverse pavement markings



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## Transition Zones

### Evaluating Effectiveness of Dynamic Speed Display Signs in Transition Zones of Two-Lane Rural Highways in Pennsylvania

*Transportation Research Board, Annual Meeting – Paper #09-0171*

2009

#### **Author(s)**

Transportation Research Board

#### **Summary**

The Pennsylvania Department of Transportation has invested in several portable dynamic speed display signs and selected several locations to implement them along two-lane rural highway transition zones. Transition zones are longitudinal roadway sections that contain a high-speed segment followed by a low-speed segment and are commonly encountered in Pennsylvania along two-lane rural highways that pass through rural communities. A before-during-after observational study of free-flow passenger car operating speeds was undertaken at 12 transition zones to determine the effectiveness of the dynamic speed display signs.

The results of the analyses indicate that the dynamic speed display signs are effective in reducing free-flow speeds by an average of 6.4 mph (10.3 km/hr) while in place and activated. However, observed operating speeds increased by an average of 6.6 mph (10.6 km/hr) after the devices were removed from the study sites.