



Effect of Higher-Conspicuity Warning and Regulatory Signs on Driver Behavior

Several sign materials have become available in recent years that improve the conspicuity of signs. These improvements include higher retroreflectivity for microprismatic materials that increase nighttime conspicuity, adding fluorescence that improves daytime conspicuity, and adding light emitting diodes (LEDs) in the sign face to improve daytime and nighttime conspicuity.

While prior evaluations have shown these materials to have higher conspicuity than current materials, there has been limited assessment of these materials on actual driver behavior. This research was conducted to evaluate driver response to actual field installations of higher-conspicuity materials. In this project, Texas Transportation Institute (TTI) researchers conducted before-and-after field studies of several different higher-conspicuity materials.

What We Did...

TTI researchers conducted before-and-after field evaluations of the effectiveness of various higher-conspicuity sign material applications

at 14 sites. The higher-conspicuity applications included fluorescent yellow microprismatic Chevrons (Figure 1), fluorescent yellow microprismatic Curve signs and Stop Ahead signs,

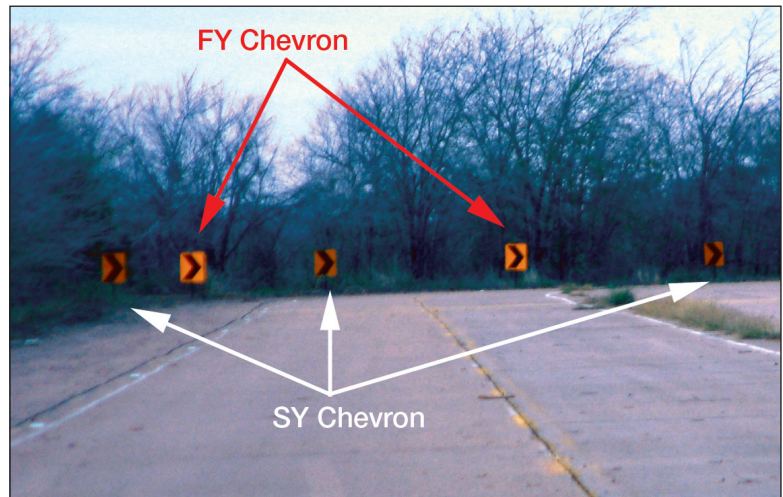


Figure 1. Fluorescent vs. Standard Yellow Chevrons.



Figure 2. Fluorescent vs. Standard Red Stop Sign.



Figure 3. Red Flashing LED Stop Sign.





Figure 4. 3-Inch Red Microprismatic Border on Speed Limit Sign.

fluorescent red microprismatic Stop signs (Figure 2), Stop signs with red flashing LEDs embedded in the corners of the sign face (Figure 3), and a red microprismatic border on the initial Speed Limit sign upon entry to a speed zone (Figure 4). At each site, researchers measured various operational characteristics of approaching vehicles to assess the impacts of the higher-conspicuity materials. Data were collected during daylight, twilight, and night periods because photometric properties of sign sheeting materials are known to change based on ambient illumination.

Researchers measured vehicular speed data at each

site using either LIDAR (i.e., police laser) or automated traffic counters (pneumatic tubes or piezoelectric sensors). Speeds were measured so that vehicles could be “tracked” through the site, which allowed researchers to determine the effect of the signs on speeds of individual vehicles, rather than simple spot-speeds. Edge line encroachment data were collected at selected locations where Chevrons were evaluated. Stop-compliance data were also measured at selected intersections where the Stop sign was evaluated. Table 1 indicates the type of data that were collected at the different study sites.

What We Found...

Many statistically significant beneficial results occurred. In general, most of the signs resulted in at least a small reduction in speeds. The Chevron signs produced a significant reduction in edge line encroachments, and both of the Stop sign treatments reduced the number of non-stopping vehicles. The data showed no undesirable

impacts for the measures-of-effectiveness for any of the signing treatments. The primary findings from the analyses are shown in Table 2.

The Researchers Recommend...

Recommendations for implementation of higher-conspicuity sign materials have been split into three categories:

- statewide implementation (maintenance replacement or new installations),
- spot implementation as needed, and
- optional implementation (either statewide or as needed).

Table 3 presents a summary of recommended TxDOT applications for higher-conspicuity sign materials.

Table 1. Traffic Operations Data Measured at Study Sites.		
Curves <ul style="list-style-type: none"> • Vehicle speeds prior to the curve and signs coming into view (control point) • Vehicle speeds on the approach to the curve • Vehicle speeds at the curve • Vehicle encroachment on the edge line or centerline at the curve midpoint (Chevron sites only) 	Stop-Controlled Intersections <ul style="list-style-type: none"> • Vehicle speeds prior to intersection or signs coming into view (control point) • Vehicle speeds on the approach to the intersection • Driver compliance with the Stop sign (Stop sign evaluations only) 	Rural Speed Zone <ul style="list-style-type: none"> • Vehicle speeds prior to signs coming into view • Vehicle speeds approaching the designated Speed Limit sign • Vehicle speeds at the designated Speed Limit sign • Vehicle speeds downstream of the designated Speed Limit sign



Table 2. Primary Findings for Higher-Conspicuity Sign Applications.




















Sign Treatment	Number of Sites	Primary Finding	Beneficial Impact?
 Fluorescent Yellow Chevron	1	<ul style="list-style-type: none"> • 38% overall reduction in edge line encroachments • Overall mean and 85th speeds at curve reduced by 1 mph • 11% overall reduction in vehicles exceeding safe speeds at the curves 	Yes
 Fluorescent Yellow Chevron Posts	1	<ul style="list-style-type: none"> • Speeds reduced slightly 	Marginal
 Fluorescent Yellow Curve Warning	3	<ul style="list-style-type: none"> • Speeds reduced slightly • 20% overall increase in vehicles initiating deceleration prior to reaching the sign 	Marginal
 Fluorescent Yellow Exit Ramp Advisory	1	<ul style="list-style-type: none"> • Inconsistent effect on speeds 	No
 Fluorescent Yellow Stop Ahead	2	<ul style="list-style-type: none"> • Approach speeds reduced at night 	Marginal
 Flashing LED Stop	2	<ul style="list-style-type: none"> • 29% overall reduction in vehicles not fully stopping • Blow-throughs reduced by half 	Yes
 Fluorescent Red Stop	5	<ul style="list-style-type: none"> • 24% overall reduction in vehicles not fully stopping • Daytime approach speeds reduced 	Yes
 Red Reflectorized Border	1	<ul style="list-style-type: none"> • 18% overall reduction in vehicles exceeding 55 mph speed limit shortly after entering speed zone • 2 mph reduction in daytime passenger vehicle speeds shortly after entering speed zone • 4 mph reduction in daytime heavy truck speeds shortly after entering speed zone • Nighttime speeds reduced slightly 	Yes

Table 3. Implementation Recommendations for Higher-Conspicuity Sign Materials.

Sign Treatment	Implementation Recommendations		
	Statewide	As Special Treatment	As an Experimental Device ¹
 Fluorescent Yellow Chevron	Yes	---	---
 Fluorescent Yellow Chevron Posts	---	Yes, on an as-needed basis	---
 Fluorescent Yellow Curve Warning	---	Yes, on an as-needed basis	---
 Fluorescent Yellow Curve Warning with Advisory Speed Plaque	---	Yes, on an as-needed basis	---
 Fluorescent Yellow Large Arrow	---	Yes, on an as-needed basis	---
 Fluorescent Yellow Exit Ramp Advisory	---	Yes, on an as-needed basis	---
 Fluorescent Yellow Stop Ahead	---	Yes, on an as-needed basis	---
 Flashing LED Stop	---	---	Yes, on an as-needed basis
 Fluorescent Red Stop	---	---	Yes. However, the product is not available commercially. Microprismatic sheeting should be considered for Stop signs.
 Microprismatic Red Stop	---	Yes, on an as-needed basis	---
 Red Reflectorized Border	---	---	Yes, where the speed limit is reduced with no apparent change in roadway conditions

¹ Permission to experiment must be obtained through the Federal Highway Administration (FHWA).



For More Details . . .

The research is documented in [Report 4271-1, Traffic Operational Impacts of Higher-Conspicuity Sign Materials](#).

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The objective of this research project was to evaluate driver behavior in response to field installations of high-conspicuity materials on signs and sign posts. These materials were installed at locations where it was believed that they would provide a significant benefit to traffic safety. One product was required for this project: recommendations for the application of advanced sign sheeting materials, included in Chapter 6 of research report 4271-1. There were 11 applications for higher-conspicuity sign and sign post materials evaluated in the field. One application can be implemented statewide immediately, seven applications can be implemented as special treatments, or on an as-needed basis, and three applications can be implemented as experimental devices by permission of the Federal Highway Administration.

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YOUR INVOLVEMENT IS WELCOME!

Disclaimer

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the U.S. Department of Transportation, Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of TxDOT or the FHWA. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and are not for product endorsement.

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