

Driver Visual Behavior in the Presence of Commercial Electronic Variable Message Signs (CEVMS) Summary of Conclusions

This study was conducted to investigate the effect of CEVMS outside the public right-of-way regulated by the Highway Beautification Act of 1965 on driver visual behavior. The study used an instrumented vehicle with an eye tracking system to measure where drivers were looking when driving past CEVMS and standard billboards. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant variables to extensively characterize these visual stimuli. Unlike previous studies on digital billboards, the present study examined CEVMS as deployed in two US cities that did not contain dynamic video or other dynamic elements. These billboards changed content approximately every 8 to 10 seconds. In addition, the eye tracking system had nearly a two-degree level of resolution that provided significantly more accuracy in determining what objects the drivers were looking at compared to an earlier study. Two experiments are reported that were conducted in two separate cities employing the same methodology but taking into account differences with respect to such variables as daytime or nighttime driving and the complexity of the roadway visual environment. The results and conclusions from the present study are presented in response to the three main research questions listed below.

1. Do drivers look at CEVMS more than at standard billboards?
2. Are there long glances to CEVMS that would be indicative of a decrease in safety?
3. Do drivers look at CEVMS and standard billboards at the expense of looking at the road ahead?

Key Research Questions:

1. Do drivers look at CEVMS more than at standard billboards?

- In general drivers devoted more glances to CEVMS than to standard billboards; however, there were no significant decreases in the proportion of time to the road ahead (i.e., eyes on the road) that could be directly attributed the CEVMS at the measured luminance and contrast levels.
 - In Study 1, drivers looked at CEVMS proportionally twice as much as standard billboards (3% vs. 1.5%), but there was no difference in the time spent looking at the road ahead (83% and 84%, respectively).
 - In Study 2, the only condition in which drivers looked at CEVMS proportionally more than at standard billboards was at night in low visually complex environments (4.5%).
 - Looking at the number of glances to advertising (per sign), the results from both studies show substantially more glances to CEVMS than to standard billboards both during the day and night conditions.

	Day		Night	
	CEVMS	Standard	CEVMS	Standard
Study 1	3.57	1.82	2.62	1.37
Study 2	4.26	1.60	3.11	0.92

- Regardless of study location or type of billboard, the mean percent of time drivers spent looking at target billboards was less than 5 percent.
- Whereas Study 1 showed a greater proportion of glances to CEVMS situated in high visually complex surroundings relative to low visually complex surroundings, Study 2 showed the opposite: a greater proportion of glances to CEVMS situated in low visually complex surroundings relative to high visually complex surroundings.
 - In the high visual complexity area of Study 1 there were two CEVMS and so there was overall more visual complexity but also more opportunity for drivers to look at CEVMS.
- Study 1 showed a greater proportion of glances to CEVMS during the day than at night whereas Study 2 showed the most attention to CEVMS at night (under low visual complex conditions).
 - The difference in Study 2 is largely due to the “bright beacon in the night” effect of the CEVMS in low visually complex surroundings.

2. Are there long glances to CEVMS that would be indicative of a decrease in safety?

- Across both studies, the longest glances were less than 1.3 seconds.
- The average glance durations were 0.07 sec and 0.097 sec for the two studies, respectively.
- The proportions of glances above three threshold levels are shown in the table below. The maximum glance duration observed across both studies was 1.28 seconds.

	Proportion of Glances to Advertising		
	Above .75 sec	Above 1.0 sec	Above 1.6 sec
Study 1	1.0%	.37%	0%
Study 2	1.2%	.65%	0%

- The NHTSA 100-car study showed a significant increase in crash odds at 2 second glances. An older analysis concluded 1.6 seconds is a duration threshold that is associated with increased risk. The most conservative threshold in the literature is .75 seconds, which is based on standard perceptual-reaction times.

3. Do drivers look at CEVMS and standard billboards at the expense of looking at the road ahead?

- No, the differences between time spent looking at CEVMS and standard billboards were not reflected in the time spent looking at the road ahead.
 - The only factor that reduced driver gazes to the road ahead was the visual complexity of the overall environment. More visually complex environments reduced time spent looking at the road ahead.
 - This is evidence to support restricting the concentration of roadside information sources: whether regulatory signs and/or advertisements (regardless of CEVMS or standard billboards).