

The effect of digital billboards at intersections on driving performance

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Abstract

The impact on driving performance of digital billboard installations at intersections was evaluated. Lane drift and stopping over the line errors were assessed through video recording of vehicle movements before and after activation of the billboards. While it is very plausible that digital billboards at demanding locations will create enough distraction to negatively affect vehicle control performance, the current evaluation found that, in general, vehicle control performance either improved or was unaffected by the digital billboard's presence.

Background

Digital billboards have the potential to cause driver distraction by diverting the driver's attention away from the driving task, potentially compromising safety. Driving environments which are cognitively demanding, such as intersections and high traffic areas, have generally been assumed to increase this safety risk.

An evaluation of the impact on driving performance of new digital billboards installations at two intersection locations was conducted. This evaluation took the form of a video survey of vehicle control at two locations and two additional matched control sites, both before and after the digital billboards were installed.

Method

The digital billboards were loaded with typical content and static images were displayed. For Site 1, the dwell times were; 8sec, 16sec and 24sec. At Site 2, the dwell times were; 10sec, 20sec and 30sec.

This video data in these periods were coded to extract:

- Lane drift (number of instances of drifting outside of the lane in each time period)
- 'Stopping-over-the-line' (number of instances of stopping over the stop line in each time period)
- Incidents (number of instances in each time period)

Results

No incidents were recorded at any of the sites.

Change scores ('before' – 'after') were calculated for both the lane drift and stopping over the line observations. Thus, a positive change score reflects a decrease in lane drift and stopping over the line behavior while a negative change score reflects an increase. Change scores at billboard sites were then compared to the equivalent change at control sites using Bonferroni-corrected t-tests ($p < .05$ equivalent).

With only one exception (to be discussed below), for both billboard sites and all three dwell times, the presence of active digital billboards either reduced, or had no effect, on the occurrence of lane

drift and stopping over the line errors. As an example, figure 1 below depicts the effect for lane drift at Site 1.

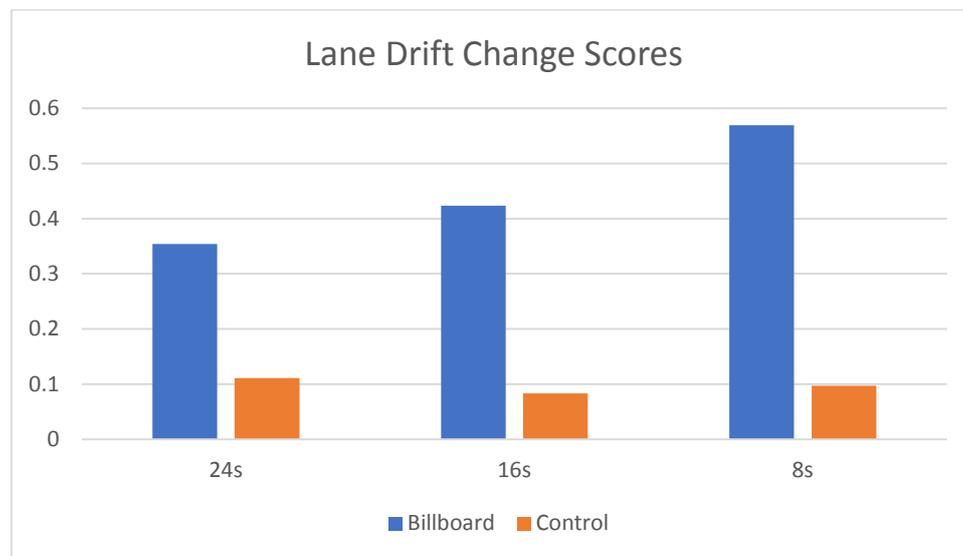


Figure 1. Lane drift change scores

Conclusions

The current evaluation found that, at all dwell times (with one exception¹), vehicle lateral control and stopping over the line performance either improved or was unaffected by the digital billboard's presence.

These results beg the question of why previous research has often demonstrated a negative impact on vehicle control from visual distraction (e.g. Kountouriotis & Merat, 2016; Liang & Lee, 2010). A possible explanation is that the source of visual distraction in these studies usually comes from a source that requires drivers to take their eyes off the forward roadway. For example, Schieber et al. (2014) placed the billboard off to the side of the road under conditions that encouraged drivers to take their eyes off the forward roadway. By contrast, in the current evaluation, the billboards were straight ahead for the assessed drivers. As a result, the billboards did not require drivers to move their eyes from the forward roadway in order to apprehend the content of the billboards.

References

- Kountouriotis, G. K., & Merat, N. (2016). Leading to distraction: Driver distraction, lead car, and road environment. *Accident Analysis and Prevention*, 89, 22–30.
- Liang, Y., & Lee, J. D. (2010). Combining cognitive and visual distraction: Less than the sum of its parts. *Accident Analysis & Prevention*, 42(3), 881–890.
- Schieber, F., Burns, D., Myers, J., Gilland, J. & Willan, N. (2004) Driver Eye Fixation and Reading Patterns while Using Highway Signs under Dynamic Night-time Driving Conditions: Effects of Age, Sign Luminance and Environmental Demand. USD Technical Report.

¹ The explanation for this anomaly is unclear at this stage. However, post hoc analysis of the logs of the material presented during the study shows that the anomalous dwell time missed out on a subset of the adverts and received a higher proportion of the remaining adverts than the other dwell times.