

# Research Report Summary



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## The Effect of Roadside Vegetation and Clear Zone Design on Driver Behavior

### A Driving Simulator Study

Roadside vegetation provides a myriad of environmental and psychological benefits to drivers. Research has shown that, although natural landscapes cause less stress and frustration to the driver, the same vegetation may potentially increase the severity of run-off-the-road crashes. This study evaluates the relationship between clear zone design and the presence of roadside vegetation on driver speed, lateral positioning, and drivers' visual scan patterns. A driving simulator was utilized to test six combinations of clear zone sizes and roadside vegetation densities. Participants' driving performance was measured throughout the virtual drive. While there were no statistically significant differences between

drivers' speeds, the speed trends that were found correlate to statistically significant observations in previous research, further validating the effect of clear zone size on driver speed. Along left curves, drivers drove closer to the centerline when

there were trees near the edge of the road. Based upon the recorded drivers' eye movements, the horizontal scan pattern did not significantly change between combinations, suggesting that drivers use their peripheral vision to monitor potential hazards.



There were no statistically significant differences in speed observed between the different combinations for the straight, right curve, or left curve analysis points. There are a variety of possible reasons that no statistically significant speed differences were observed. One possibility is that drivers were not afraid of running off the road because they were in a safe simulated environment. Another potential influence could have been the 35 mile per hour (56.3 kph) speed limit signs at the beginning of each segment. These signs were included in the virtual environment in order to increase the realism of the environment. However, the speed limit signs may have been detrimental to the study because the eye tracking data revealed that the average number of glances, approximately 9.5 for each combination, correlated with a glance at the speedometer roughly every 20 seconds. Future driving simulator studies should consider removing speed limit signs or obscuring the speedometer from drivers so that they do not know how fast they were driving.

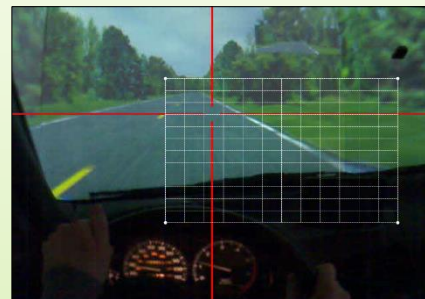
*“The horizontal scan pattern did not significantly change between combinations suggesting that drivers use their peripheral vision to monitor potential hazards.”*

There were no statistically significant differences in lane positioning during tangent segments. However, when navigating left curves, drivers drove almost a foot further from the edge of the road when the clear zone was small than in other combinations, a statistically significant difference. This finding validates the previous field observations conducted by Fitzpatrick et al. [2].

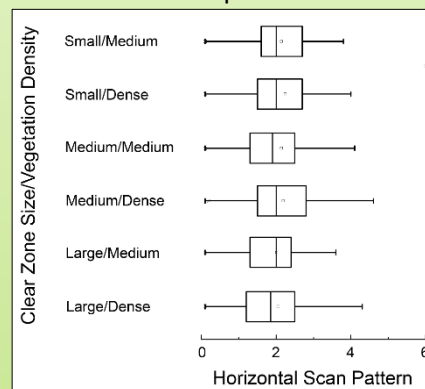
## References

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2. Fitzpatrick, C. D., Harrington, C. P., Knodler, M. A., and Romoser, M. R. E. 2014. The influence of clear zone size and roadside vegetation on driver behavior. *Journal of Safety Research*, 49: 97–104. doi:10.1016/j.jsr.2014.03.006.
3. Naderi, J. R. 2007. Landscape design in clear zone: effect of landscape variables on pedestrian health and driver safety. *Transportation Research Record: Journal of the Transportation Research Board*, 1851(03): 119–130. doi:10.3141/1851-12.

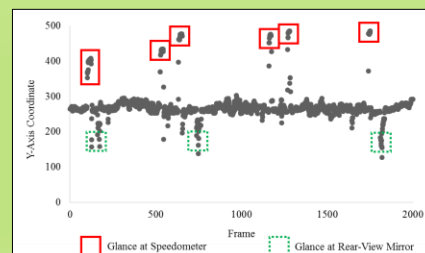
## Eye Tracking Reveals Drivers' Scan Patterns



A virtual grid superimposed on the eye tracking video allowed for the measurement of horizontal scan patterns.



Horizontal scan patterns revealed that, in all six combinations, drivers scanned the roadside primarily with their peripheral vision.



Vertical coordinates for the participants' eye movements were utilized to quantify the number of glances at the speedometer and rear-view mirror.