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TOWARD SMART ACTIVE ROAD STUDS FOR LANE DELINEATION

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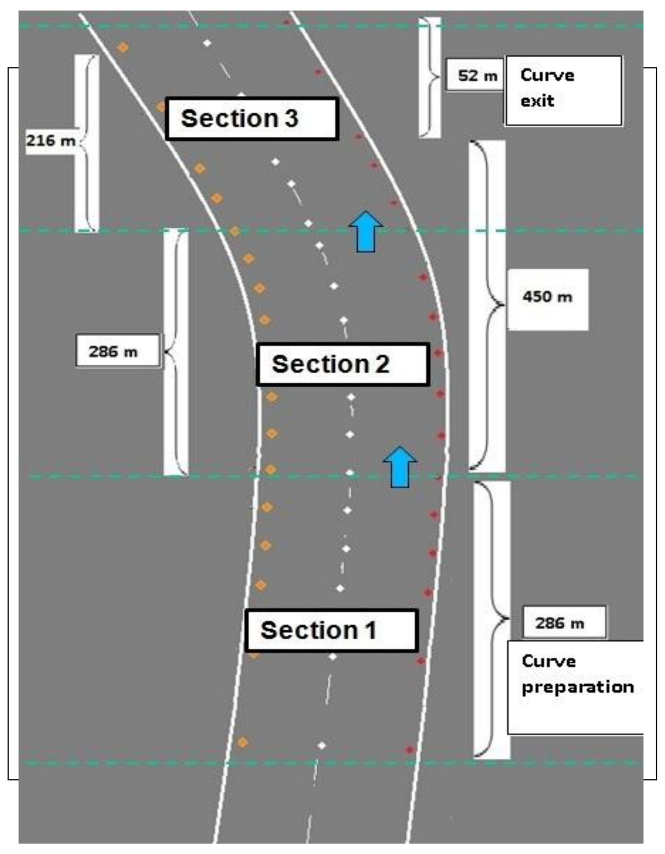
Introduction

Lane delineators enhance the ability of drivers to select and adjust their positions and speeds to the road demands. Retro-reflective road studs have long been used to delineate traffic lanes at night-time and in weather conditions of poor visibility, but they are not as conspicuous as the more recently introduced, self-illuminative (active) road studs.

In the framework of INROADS, a European project devoted to developing intelligent road lighting applications, we designed an Active Lane Delineation (ALD) application where active studs are turned on to outline the lane and road edges for vehicles approaching to and passing through curves. This simulator study compared its effects on driving, against a control condition of an unlit-road.

Application

The application has preparatory-, curved- and curve-exit sections, with perceptual countermeasures for speed (before the curve) and vision adaptation back to darkness (after). As a vehicle approaches, the preparatory and the section to follow, turn on. As the vehicle passes a section, it extinguishes and the one to follow (the already lit) next, turns on.



ALD and illumination sequence for a 400 m long curve.

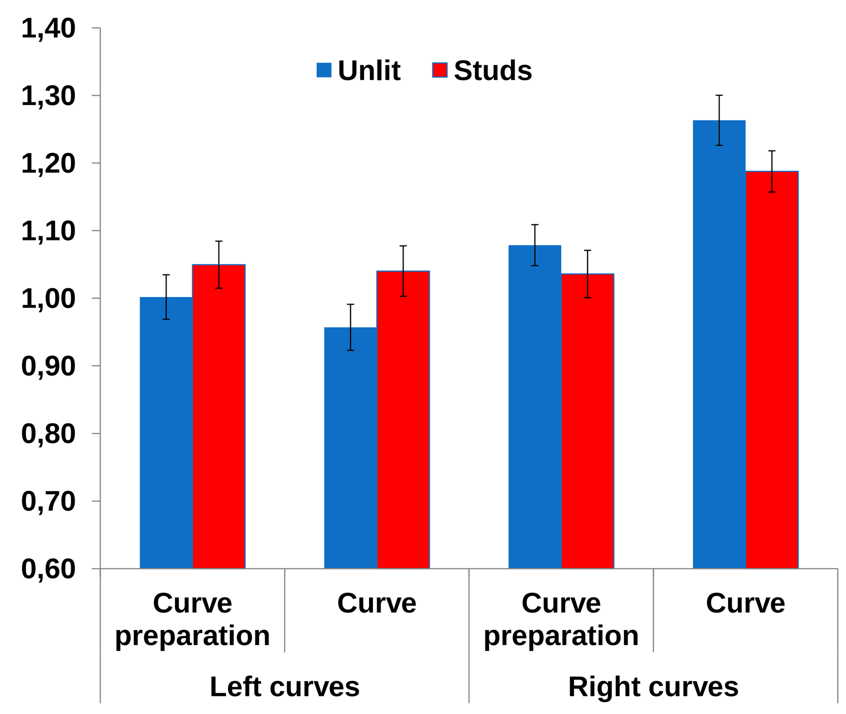
Method

Twelve drivers completed a night drive on a road consisting of 16, 150 m and 400 m long right and left curves, separated by 16 straight road stretches, in the presence and absence (within-subjects and counterbalanced) of the ALD application.

The dependent variables were calculated to reflect performance on the *straight* sections, the *preparatory* (straight) section leading to curves and the *curved* sections, and analyzed with a series of ANOVAs.

Laboratory setup and screenshots of the unlit and studded conditions

Results - trajectory and speed

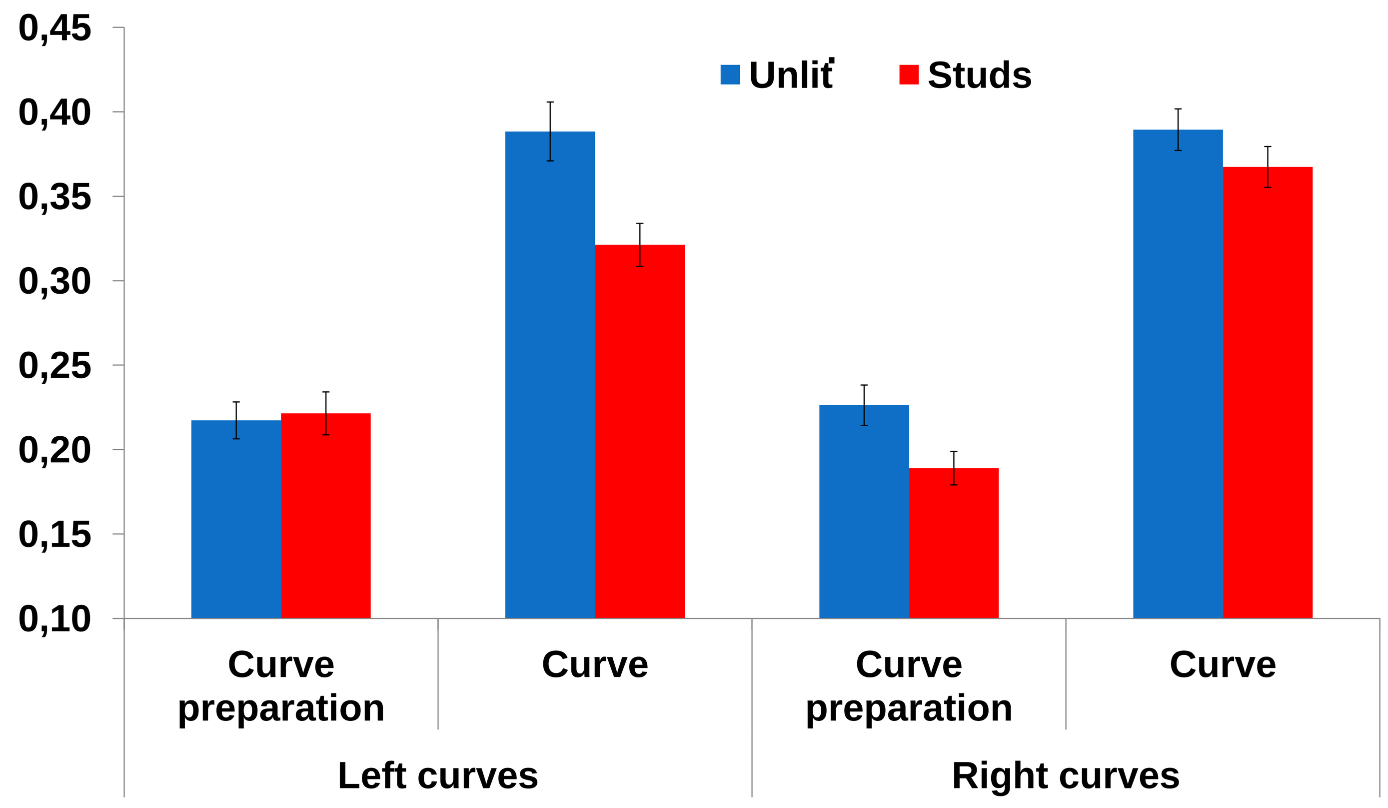


Means lateral position with standard errors added. At 0.90 the car is at the centre of the lane.

-The participants drove near the lane centre in both road conditions.

-The studded condition induced slightly faster speeds (3 Km/h) than the unlit condition on straight stretches at large distances from the curves, but significant differences were found neither in the preparatory sections nor inside the curves.

Lateral control



Means standard deviations of the means lateral position, with standard errors added.

- The unlit condition induced greater lateral variability than the studded condition, across the preparatory plus right curved sections and inside the left curves.

- These findings objectify the subjective impressions of the participants, who rated the studded condition relative to the unlit road, as safer and as allowing for better vehicle control.

Conclusions

The lighting application helped drivers to reduce the virtual car's lateral displacement, hence, to control the lateral position of the car.

Future directions: Evaluation of a), potential adverse (masking and other) effects that might be associated with stud lighting or with specific designs, and b), alternative ALD designs that would produce the safest driving measures while minimizing such adverse effects.

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