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The impact of perceptual treatments on driver's behavior: From driving simulator studies to field tests—First results

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ABSTRACT

Our study focused on the lateral position of drivers in relation to risk on rural crest vertical curves, using a field site proposed by a local operator of the French road network (*Conseil Général de Maine-et-Loire, 49*). The final goal was to test one road treatment on this field site. The study consisted of three stages. The first, using driving simulators, selected two perceptual treatments (i.e., rumble strips on both sides of the centerline and sealed shoulders) from five that were tested in order to help drivers maintain lateral control when driving on crest vertical curves. The rumble strips were installed first on the field site.

The second stage was to develop a diagnostic device specifically in order to evaluate, on the field site, the impact of a perceptual treatment on the driver's performance (i.e., lateral position). This diagnostic device was installed in the field upstream and downstream of the target crest vertical curve. The third stage was to collect the data during two periods, before and after the centerline rumble strips were installed. We then compared the results obtained in the field study with those from the driving simulator studies. The comparison showed that, as in the simulator studies, the centerline rumble strips on the crest vertical curve affected lateral positions, causing the participants to drive closer to the center of the lane. Finally, the results showed the usefulness of driving simulators in the road design process.

1. Introduction

In Europe, 80% of all accidents on rural roads can be divided into four categories: single-vehicle accidents (e.g., running off the road, head-on collisions with an obstacle), head-on collisions between two vehicles, collisions at intersections and accidents involving vulnerable road users. Single-vehicle and head-on collisions (which relate to trajectory control) account for 48% of all crashes (OECD, 1999). In France, 40% of road fatalities occur in single-vehicle accidents without a third party. In 90% of cases, they involve a loss of control generally leading to a head-on collision with a rigid obstacle at the side of the road (ONISR, 2010). The proportion of deaths due to this kind of collisions (i.e., 12%) has hardly changed in the last 10 years (ONISR, 2010). Head-on collisions are responsible for half the deaths in collisions between two vehicles and mostly occur during overtaking maneuvers (ONISR, 2010). Head-on collisions also account for 10% of all injury accidents and 20% of all deaths (ONISR, 2010). Single-vehicle accidents account for 21% of injury accidents and 40% of deaths (ONISR, 2010). Head-on collisions with a fixed obstacle account for 67% of injury accidents and 86% of deaths (from ONISR, 2010). In addition, poor lateral positioning is one of the primary factors leading to crashes (RISER, 2006) and human error is estimated to play a part in around 90% of crashes (Dewar and Olson, 2002; Wegman, 2007). These failures could result from a false perception of the road layout and/or environment, which has been identified as a contributing factor to about 30% of crashes (O'Cinneide, 1998; Rumar, 1985). Indeed, the information provided by the road and road environment is essential for the driver to be able to modulate driving control parameters and avoid risky behavior (Saad, 2002; Theeuwes and Godthelp, 1995). In this context, we have determined which perceptual treatment could most effectively improve trajectory control, more specifically lateral position control (our subject) on crest vertical curves (CVCs). The final goal was to test one road treatment on a field site with a crest vertical

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