

The impact of perceptual road edge marking on driving behaviour in horizontal curve: a driving simulator

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Situation

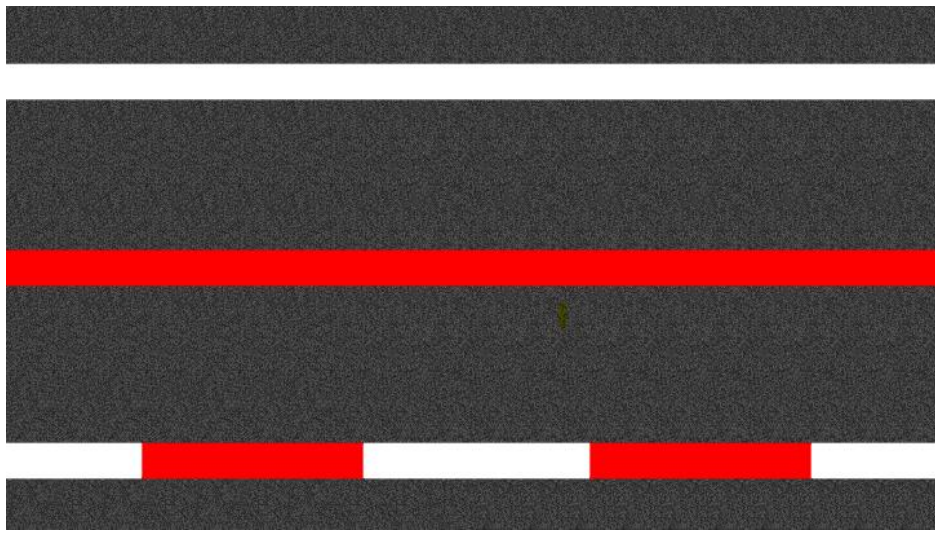
Horizontal curves have been a significant **safety concern** on roads for many years. The poor design of these curves often leads to a high number of accidents. According to a European Road Safety Observatory report in 2020 [1], **53% of all road fatalities** in the European Union occurred **on roads outside urban areas**, mainly due to misjudging these curves. This study aims to investigate innovative and low-cost solutions to address this issue using a driving simulator in the Institute for Mobility (IMOB), as shown in Figure 1.



Figure 1: Driving simulator

Method

A **driving simulator** was used to study various road markings, such as **solid red (RE)** and **red-white patterns edge lines (RWE)**. The objective was to compare the effectiveness of these innovative markings with **the standard** ones used in Flanders, as shown in Figure 2. **Fifty volunteers** participated in this study, including 35 men and 15 women aged between 20 and 75. The roads were designed according to the regulations set by the Flanders road agency Agentschap Wegen en Verkeer (AWV). The study included. Using **repeated measures ANOVA within-subjects**, **12 horizontal curves** with 125 m and 350 m radii for left and right horizontal curves. Seven data points were extracted for each curve, as shown in Figure 3.



Standard marking (Control)

Solid Red marking (RE)

Red-white pattern marking (RWE)

Figure 2: Edge road markings

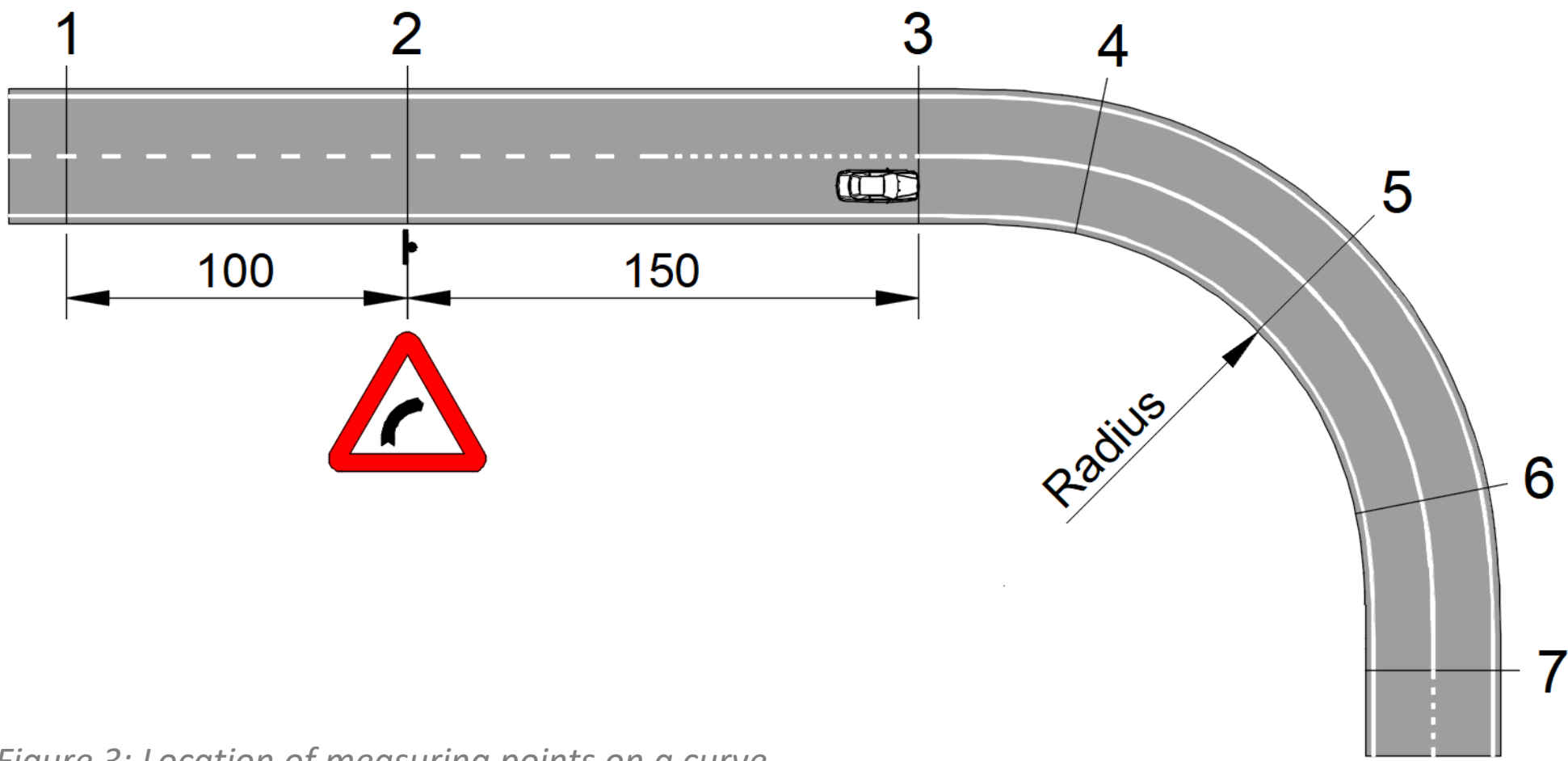


Figure 3: Location of measuring points on a curve

Results

Figures 4 and 5 illustrate the car’s **average driving speed** under varying radii and implemented conditions. Figures 6 and 7 demonstrate **acceleration and deceleration**, and Figures 8 and 9 illustrate the **lateral position under varying radii and implemented conditions**.

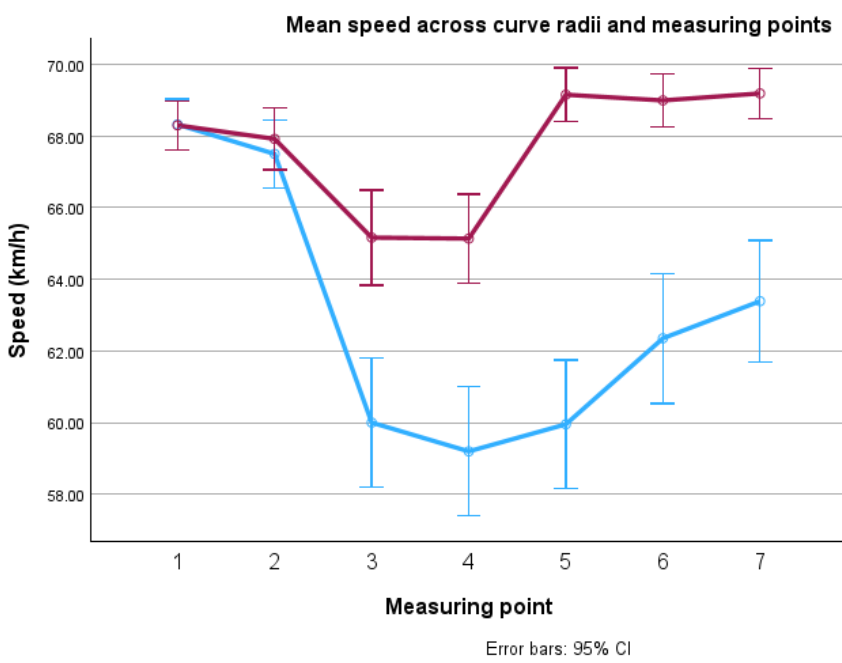


Figure 4: Average speed across curve radii and measuring points

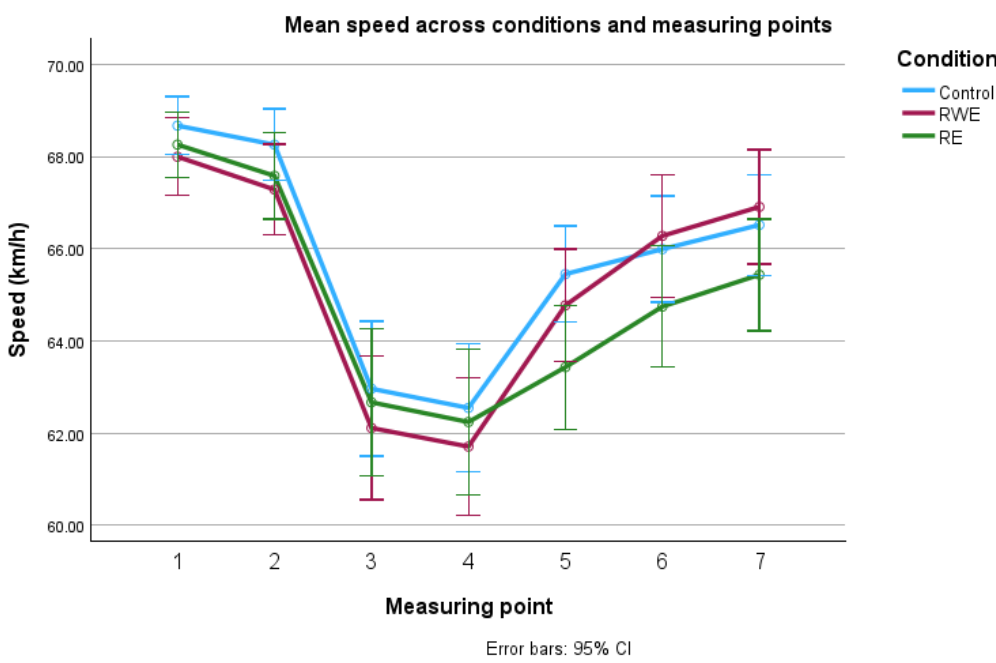


Figure 5: Average speed across conditions and conditions and measuring points

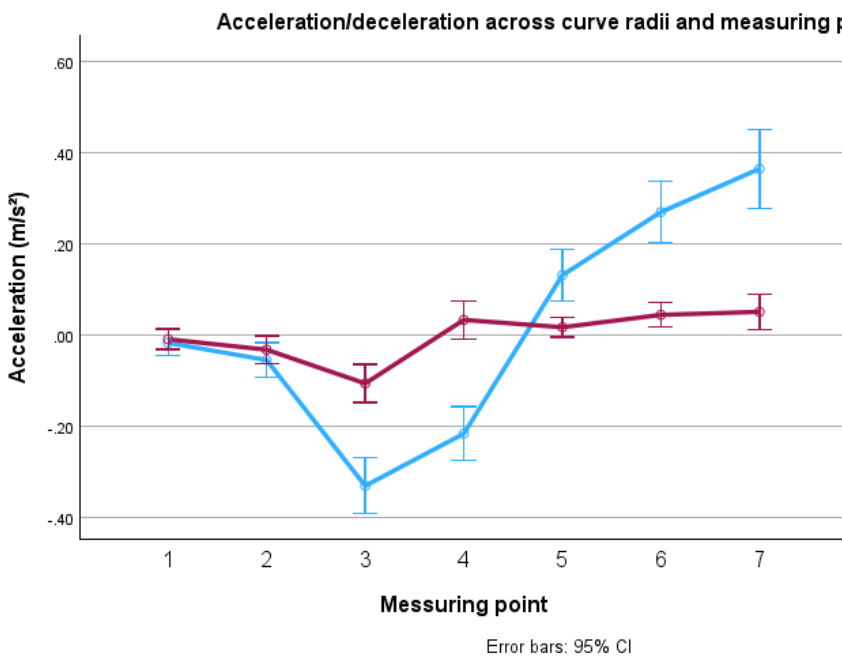


Figure 6: Average acceleration/deceleration across curve radii and measuring points

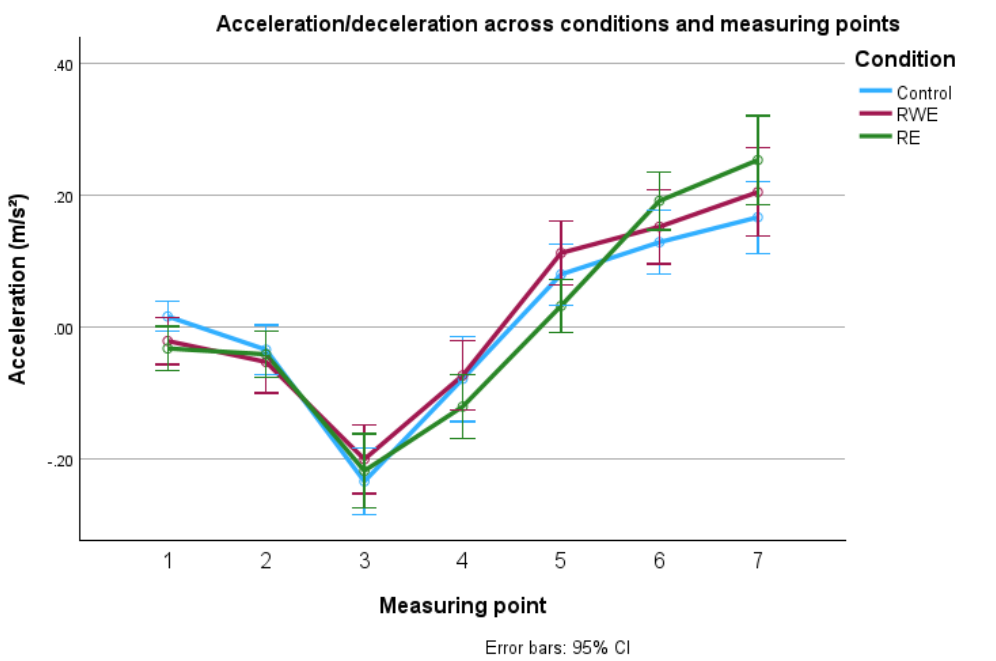


Figure 7: Average acceleration/deceleration and conditions and measuring points

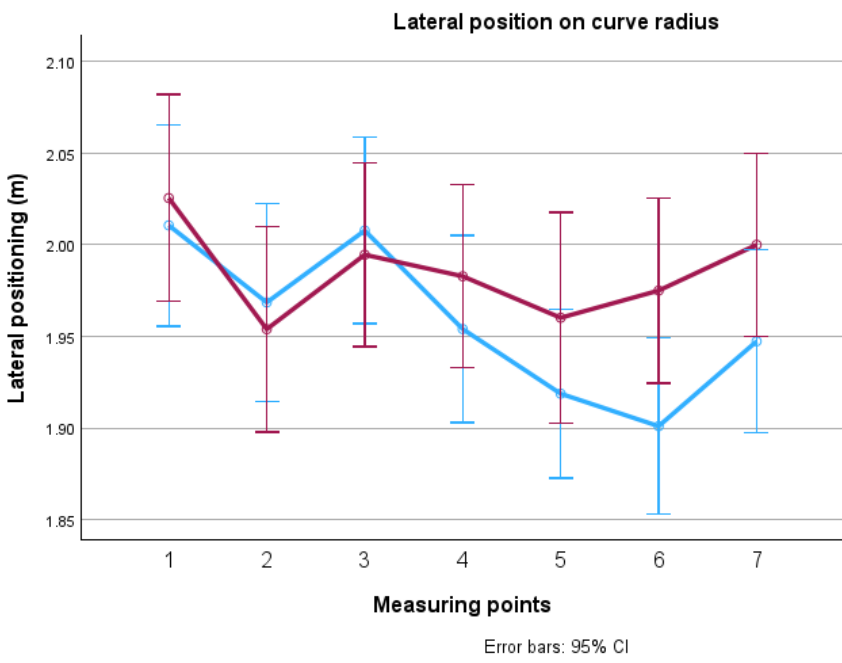


Figure 8: Average lateral position across curve radii and measuring points

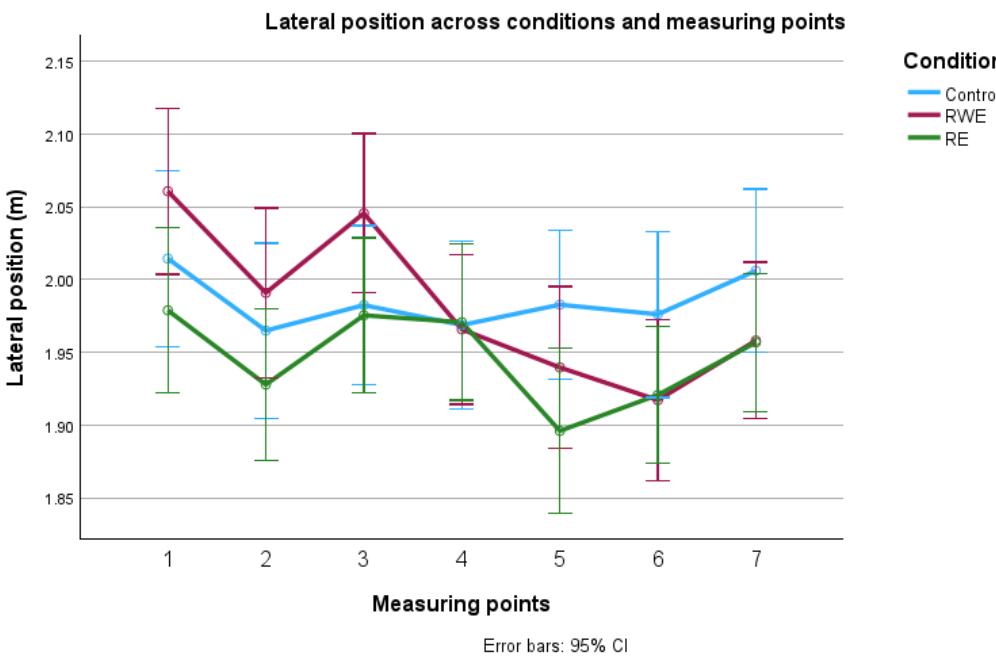


Figure 9: Average lateral position across conditions and measuring points

Discussion

Preliminary findings suggest three essential conclusions:

- The RWE road markings stimulated drivers to shift the **lateral positioning** of the **vehicle towards the centreline** when navigating curves.
- The speed **decreased the most at the beginning of the curve** under the RWE conditions.
- The acceleration was **not affected by road marking treatments**.

Conclusion

The study found that red-white patterns and solid red edge road markings **reduce driving speeds** in horizontal curves and **improve drivers’ control and road safety**.

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Reference:
[1] European Commission, "Facts and Figures Roads outside urban areas," Brussels, 2022.