

Operational integration of autonomous and conventional vehicles on motorways

Summary

There is still considerable public hesitance towards AVs acceptance. Therefore, it is necessary to understand which factors influence its approval or rejection. As its market penetration is expected to start on motorways, this research work examines the factors inducing motorway users' intention to use highly automated vehicles (HAVs-Levels 4 SAE) based on an extension of the technology acceptance model (TAM). The model integrates psychological factors, perceptions, and attitudes. It was empirically tested using a covariance-based structural equation modelling (CB-SEM). A questionnaire was applied to 2991 motorway users of a Portuguese private motorway customers' database.

Technology and risk perceptions, the context in which they will be used, driving pleasure, openness, social influence, emotional and cognitive attitudes, were found to be direct predictors of HAVs acceptance. Mediation analysis showed that technology and risk perceptions, social influence and emotional attitudes also indirectly affect HAVs acceptance. Furthermore, knowledge and trust perception, as well as resistance to change, were indirect predictors of its acceptance. The developed model can be used by road infrastructure managers to develop dedicated actions to uptake HAVs on motorways.

Nevertheless, the interaction between autonomous and conventional vehicles remains a major gap. To better understand that interaction, a microscopic traffic simulation (VISSIM) and a Surrogate Safety Assessment Model (SSAM) approaches were used to assess AVs' impact on both traffic and safety performance, of a heavily congested motorway, according to two traffic management strategies (reserved lane and shared space), within two scenarios (25% and 50% AVs fleet penetration).

Results show that shared space traffic management strategy significantly improved traffic flow and reduced predicted two-vehicle crashes as the percentage of AVs increased, although a non-negligible increase in the severity of both potential conflicts and crashes may occur. Also, during the transition period, it is impossible to improve road network performance without worsening safety.

Keywords

Autonomous vehicles (AVs), AVs Acceptance, Covariance Based Structural Equation Modelling (CB-SEM), traffic and safety performance assessment, transition period.



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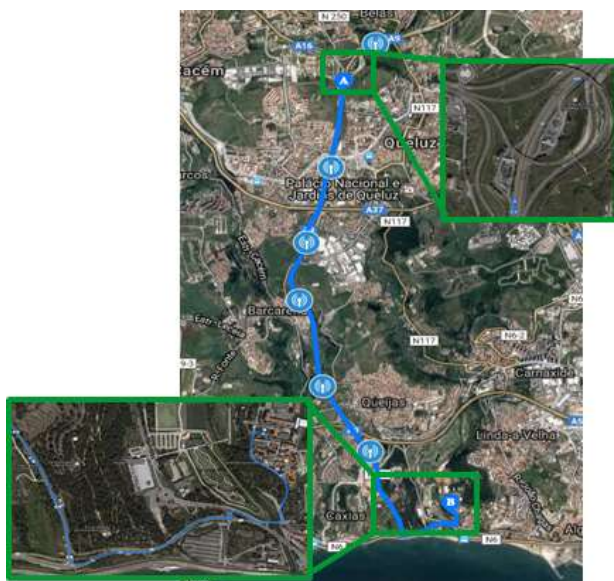
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Schematic representation of Lisbon Pilot.