ABSTRACT

Autonomous vehicles are emerging as a promising solution for the future of urban mobility and public transport. Across Europe, numerous pilot projects are testing the integration of autonomous shuttles and autonomous buses into real-world road networks to assess their operational feasibility and their potential contribution to more sustainable and efficient transport systems. However, the low operating speeds adopted by these vehicles for safety reasons, and particularly their controlled and reactive driving behaviour, can disrupt conventional traffic, making it necessary to identify strategies to facilitate their integration into urban environments. This PhD thesis aims to assess the effectiveness of easily implementable traffic management solutions, within a microsimulation environment, designed to support the introduction of autonomous vehicles operating as public transport services, whilst limiting negative impacts on other road users. Existing literature on lane management focuses mainly on traditional buses for public transport without considering the specific needs of autonomous vehicles. In particular, the analysis focuses on soft solutions such as lane reservation, traffic light priority, dynamic speed reduction and road sharing strategies, which require design, testing and refining in a simulation environment before real-life implementation. The study not only proposes a methodology for the management and simulation of the proposed solutions, but also includes three case studies, carried out in the urban roads of Turin (Italy) and Valencia (Spain). The first case study, based on the pilot area of a European project in Turin, analyses the use of autonomous shuttles and evaluates various lane management strategies to improve their performance. Subsequently, the study was extended to an urban corridor in the city of Valencia, characterised by the absence of public transport services, to explore the potential development of new services based on autonomous shuttles in a different geographical and operational context. Finally, the method was expanded to consider an urban corridor in Turin with public transport operated with full-size autonomous buses, which are interesting options for their higher capacity to transport more passengers and require further testing in simulation. Overall, the proposed methodology enables testing traffic management solutions according to real-time operational logic, allowing the assessment of their effectiveness in achieving the set objectives and identification of any side effects on other users. By validating alternative solutions under different traffic and network conditions before real-world implementation, the methodology supports transport authorities in identifying the most suitable solution for a specific urban context.