IMPACT OF MOTOR VEHICLES-BICYCLES INTERACTION ON ROUTE SELECTION, TRAFFIC PERFORMANCE, EMISSIONS AND SAFETY

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Motor vehicles routing problems (VRP) and drivers' behavior studies already have been conducted widely in transportation engineering studies. Considering cyclist safety, multi-objective optimal routing strategy for motor vehicle (MV)-bicycle need to more research. Urban areas are complex because of variety of possible routes between origin and destination and different design of roundabouts, intersections and lanes for road users. MV-bicycle interaction can be one of the key challenges regarding the safety concerns besides emissions and traffic performance as well.

Drivers' instantaneous decisions regarding speed and acceleration represent the driving behavior. MVs acceleration/deceleration and the time rate of change of acceleration (jerk) can result in the volatility driving behavior with significant impact on cyclist safety.

This PhD thesis is focused on two main sections which is developed based on the previous presented work at GET2017; (*i*) the main characteristics/impacts of MV-bicycle interaction for a proper route selection (*ii*) the main characteristics/impacts of MV-bicycle volatility on safety, emissions and traffic performance at two different two-lane roundabouts. Traffic flow, and bicycle GPS and flow data were collected from urban area in the city of Aveiro, Portugal. The present work uses a microscopic simulation platform of traffic (VISSIM). Vehicle Specific Power (VSP) methodology was used to estimate pollutant emissions produced by vehicles and Surrogate Safety Assessment Methodology (SSAM) was used to assess the safety concerns. Three dimensional Pareto Fronts of signal operation, which were expressed through traffic performance, emissions and safety, were analyzed using the fast Non-Dominated Genetic Algorithm (NSGA-II) for optimum route selection.

Moreover, each point of optimum solutions from Pareto front based on its travel time, safety and emissions value can be defined in one or more selected routes. Regarding the impact of MV-bicycle at roundabouts, the findings showed that the trend of jerk variation was identical for both bicycles and MVs regardless of roundabout design with a higher severity for MVs. It was also found that the impact of speed and roundabout design was more important than bicycle volume at roundabouts. Finally, the results of emissions dictated good relationships ($R^2 > 0.70$) between acceleration and VSP modes distributions in both case studies.

KEYWORDS: Microscale modeling, Multi-objective analysis, Driving volatility, Traffic, Safety, Emissions
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