

Estimating the Traffic Impacts of Green Light Optimal Speed Advisory Systems Using Microsimulation

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Abstract : Even though signalised intersections are necessary for urban road traffic management, they can act as bottlenecks and disrupt traffic operations. Interrupted traffic flow causes congestion, delays, stop-and-go conditions (i.e. excessive acceleration/deceleration) and longer journey times. Vehicle and infrastructure connectivity offers the potential to provide improved new services with additional functions of assisting drivers. This paper focuses on one of the applications of vehicle-to-infrastructure communication namely Green Light Optimal Speed Advisory (GLOSA). To assess the effectiveness of GLOSA in the urban road network, an integrated microscopic traffic simulation framework is built into VISSIM software. Vehicle movements and vehicle-infrastructure communications are simulated through the interface of External Driver Model. A control algorithm is developed for recommending an optimal speed that is continuously updated in every time step for all vehicles approaching a signal-controlled point. This algorithm allows vehicles to pass a traffic signal without stopping or to minimise stopping times at a red phase. This study is performed with all connected vehicles at 100% penetration rate. Conventional vehicles are also simulated in the same network as a reference. A straight road segment composed of two opposite directions with two traffic lights per lane is studied. The simulation is implemented under 150 vehicles per hour and 200 per hour traffic volume conditions to identify how different traffic densities influence the benefits of GLOSA. The results indicate that traffic flow is improved by the application of GLOSA. According to this study, vehicles passed through the traffic lights more smoothly, and waiting times were reduced by up to 28 seconds. Average delays decreased for the entire network by 86.46% and 83.84% under traffic densities of 150 vehicles per hour per lane and 200 vehicles per hour per lane, respectively.

Keywords : connected vehicles, GLOSA, intelligent transport systems, vehicle-to-infrastructure communication

Conference Title : ICCTST 2019 : International Conference on Connected Transportation Systems and Technologies

Conference Location : New York, United States

Conference Dates : January 30-31, 2019