Evaluating the Accuracy of Micro Simulation Models for Unsignalised Intersections in Sri Lanka

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Abstract

Traffic congestion is a major problem in most of the cities around the world; hence, there is a need to find effective solutions to minimize prevailing excessive traffic. The nature of traffic is diverse in developing countries; thus, to find solutions for traffic-related issues, micro-simulation tools have gained popularity in the recent past due to their adaptability to the local context. However, there are still various unknown factors when modelling heterogeneous traffic, especially in developing countries. In the Sri Lankan context, the VISSIM microsimulation tool is used widely to model traffic conditions. However, there is limited research conducted to simulate traffic behaviour in unsignalised intersections in Sri Lanka at the moment. Therefore, this study was conducted to fulfill the research gap by identifying relevant calibration parameters and quantifying them. For the simulation, five unsignalised three-leg intersections, which are located in the Colombo district, were selected. The evening peak hour was identified based on the past traffic data, and then a video survey and manually classified count were conducted to calculate the directional flow values. Moreover, intersection geometry data such as the number of lanes, lane width, shoulder width, and center median geometry were measured. Further, queue length and travel time were measured using manual measurements and validated using video survey data. Afterwards, the collected data was used to generate micro-simulated models for five selected intersections. Eleven calibration parameters were identified for the calibration based on state-of-the-art studies in Sri Lanka and other developing countries where heterogeneous traffic conditions exist. The calibration parameters were included as average standstill distance, additive part of safety distance, multiplicative safety component distance, looking ahead distance, looking back distance, waiting time before diffusion, minimum headway, safety distance reduction factor, distance standing at 0 kmph, distance driving at 50 kmph, maximum deceleration for cooperative braking. In the analysis, a total of 90 sets of parameters were used for the simulation with 18 sets of parameters used for one intersection. The performance evaluation has been conducted for queue length and travel time analysis separately. The optimum calibration factors were identified by using an optimization process corresponding to a minimum mean absolute error in both queue length and travel time analysis. Furthermore, The Pearson correlation value was used to identify the most sensitive parameter, and it was found that five key parameters were based on the sensitivity values. The sensitivity parameters were identified where the Pearson correlation value was greater than 0.2. The sensitivity parameters identified based on the queue analysis include multiplicative safety component distance, looking ahead distance, and safety distance reduction factor with Pearson correlation coefficient values of 0.36, 0.31 and 0.27, respectively. To identify the best input values, these five parameters were further simulated by considering the queue length and travel time separately. This resulted in the lowest percentage error for the difference between the observed and simulated queue lengths and travel time. The best calibration values for calibration purposes are also developed using the GEH statistic for turning movements. The methodology is composed of calibration and validation procedures. Regarding the five unsignalised three-leg intersections in the Colombo district, the

best set of parameter values for the previously mentioned parameters were identified under the queue length and travel time separately. The identified parameters and respective values were future validated using two unsignalised three-leg intersections in the Colombo district. The mean absolute percentage value will decide the identified parameters and respective values' suitability. Future traffic and transportation microsimulation studies can adopt the parameter values that were successfully calibrated using two unsignalised three-leg intersections in Sri Lanka.

Key Words: *Microsimulation, Unsignalized intersections, Traffic congestion, Optimization*

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