Development of a Concept for the Simulative Evaluation of the Effect of Platooning on Urban Junction Capacity

Master‘s Thesis of Sayed Hedayatullah Omar

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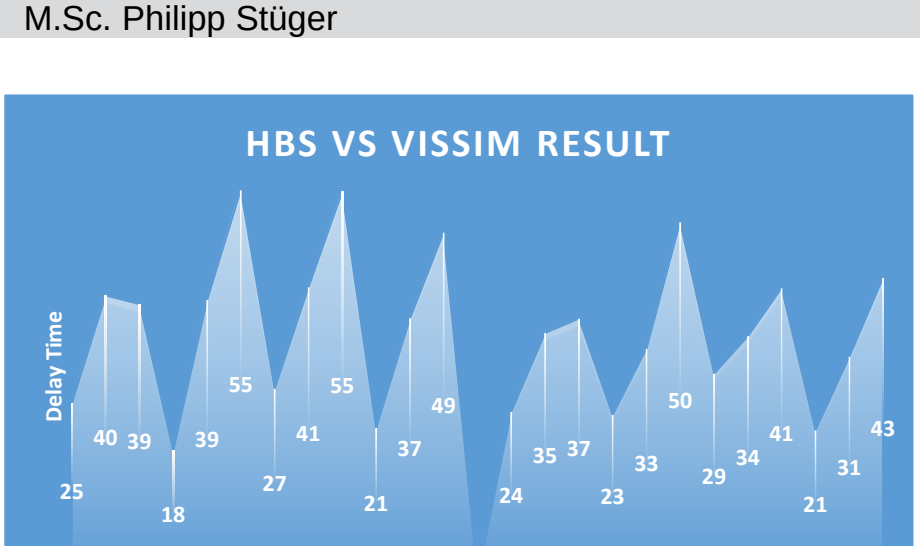

Fig 1: HBS Calculation vs VISSIM Simulation result comparison

The calibrated network is used to define the maximum capacity of the intersection, which is the main objective of this thesis. To define the maximum capacity of the intersection traffic flow has been taken as the main parameter. 20 scenarios have been simulated by VISSIM and calculated manually by HBS calculation methods. For each scenario, the traffic volume has been increased by 5%. Each scenario is increased 5% in traffic volume and in the last scenario the traffic volume is doubled, and it reaches 100%. The finding of these scenarios resulted in the same maximum capacity as the HBS calculations. As the main parameter for defining the LOS of a lane or an urban intersection is the delay time, **Fig 1** shows the delay time comparison between the HBS calculation results and VISSIM. The traffic flow base scenario is the normal traffic which has been taken from the RiLSA Beispielsammlung in this thesis. The result of this comparison shows little differences between these two methods which is acceptable. Results are achieved after model is calibrated.

This thesis presents a concept for the simulative evaluation of the traffic quality of an urban junction with traffic signals, which is based on the evaluation procedures of the HBS parameters. Thus, with the developed method and model the impacts of public transport bus platooning should be investigated on the capacity of urban junctions. The concept which is developed by this thesis confirms that the simulative evaluation of a signalized urban junction results are the same as HBS evaluation procedure results. The simulation model is calibrated based on the HBS conforming reference lanes and the findings show that the HBS calculation results are the same as the simulation results of the VISSIM. Waiting time, queue length, and traffic flow are the main calibration parameters that have been defined in this thesis. The comparison of delay time, queue length, and traffic flow results from simulation runs of VISSIM are almost the same as the waiting time, queue length, and traffic flow results from HBS calculations for the base scenario. The delay time comparison is shown in **Fig 1**.

Fig 2: Platooning – the Future of Munich City Buses (KIT 2021)

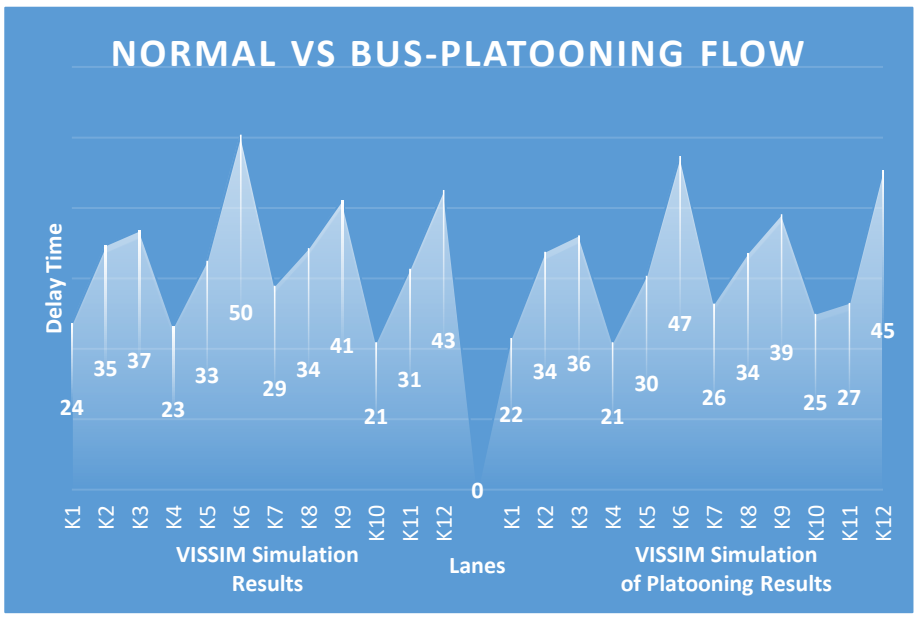

Fig 3: Normal vs Bus-Platooning flow result comparison

After finding the maximum capacity of the signalized intersection, the bus platooning impacts have been simulated in five scenarios. The results from bus platooning in an urban signalized intersection show that if two buses are platooned and could pass the intersection in the normal traffic flow situation for a 1-hour interval the delay for the specified lanes in this thesis results in a 3sec decrease, **Fig 3**. The queue lengths show a decrease of 10 to 30m and the maximum capacity is not reached in the base scenario, so it is not evaluated. The third scenario of bus platooning, which two buses are platooned with a 50% increase in the traffic volume results in a 27veh/h increase in the maximum capacity of the intersection. Finally, through other bus platooning scenarios, it can be concluded that the bus platooning in a signalized intersection has positive impacts on the delay, queue length, and traffic flow. The maximum capacity of the intersection can be increased, and the congestion would be less.

Reference:

KIT 2021, available at: https://www.kit.edu/kit/english/pi_2021_050_platooning-the-future-of-munich-city-buses.php. Accessed 01/07/2021