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Calibration of Simulation Models using the VISSIM Software – A Review

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Abstract - *The term "calibration" of a simulation model is defined as the process in which the parameters are adjusted until the model represents the field volume. Traffic flow in the urban areas varies at the roads, at the intersections, and also at crossings. By using microsimulation software like VISSIM, it will be easy to evaluate and estimate the different traffic behavior of the area by considering the suitable traffic flow parameters like speed, density, and delay in the heterogeneous traffic at major city road networks. This paper represents the review of works of literature based on the calibration of microsimulation software VISSIM and its effects on the various areas in the urban roads for the heterogeneous traffic.*

***Key Words*: VISSIM, calibration, microsimulation software, heterogeneous traffic.**

1.INTRODUCTION

Most of the Asian countries like India, Pakistan, Bangladesh, Sri–Lanka, Vietnam, etc have heterogeneous traffic flow. The traffic is characterized by different vehicle classes with varying static (length, width) and dynamic (Speed, acceleration, etc) characteristics. And also, the road geometry is not uniform. So, it is necessary to model and study the heterogeneous traffic flow by using microsimulation software like VISSIM. But it is also necessary to first calibrate the model according to the local area before its application.

It is the leading micro-simulation software that can model multi-modal traffic. VISSIM will create better conditions to test the model with different traffic flows before actually implementing the changes on the field. The software is now preferred by almost everyone including academics, corporate consulting firms. In addition to the simulation of vehicles by default, you can also use VISSIM to perform simulations of pedestrians based on the Wiedemann model i.e., Wiedemann 74 and 99. Besides private transportation, you may also model rail- and road-based public transportation. The traffic flow is simulated under various constraints of lane distribution, vehicle composition, signal control, and the recording of and vehicles. VISSIM allows you to test and analyze the interaction between systems, such as adaptive signal controls and route recommendations in networks.

VISSIM may be deployed to answer various issues. There are various areas of applications like:

- Comparison of junction geometry.
- Traffic development planning.
- Capacity analysis.
- Traffic control systems.
- Signal systems operations and re-timing studies.
- Public transit simulation.

1.1 Definitions

Calibration: It is the process in which input parameters are refined so that model accurately represents the field traffic condition.

Validation: It is the process used to confirm the predictive power of calibrated model.

Sensitivity analysis: It is a method that measures how the impact of uncertainties of one or more input variables can lead to uncertainties on the output variables. In simple words, changing one variable, while keeping other variables constant and note the effect on model.

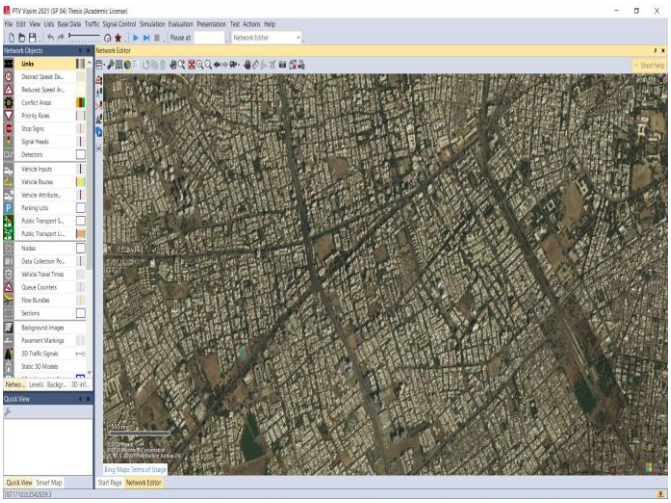

Figure -1: Interface of VISSIM software

2. LITERATURE REVIEW

Yaron Hollander & Ronghui Liu, 2008 [1] In this study, the detailed steps for the calibration of micro-simulation models are suggested. In calibration, the parameters are adjusted until it represents the field conditions. Proposed suggestions are advised for calibration and validation. Validation is used to check the accuracy of the calibrated model. Validation may be performed both visually and through the use of the measure of fit or statistical validation.

M.Fellendorf, P. Vortisch, 2010 [2] In this study, different types of micro-simulation models structures are explained. This chapter starts with a review of typical applications and is followed by modeling principles presenting the overall architecture of the simulator. This chapter closes with remarks on interfacing VISSIM with other tools.

Tom V. Mathew and Padma kumar Radhakrishnan, 2010 [3] In this study, sensitivity analysis is done to evaluate and identification of parameters for calibration. Values for those parameters have been identified in this study by reducing the error of field and simulated delay with the help of an optimization tool namely a genetic algorithm. A two-stage process is proposed in this study, First, the sensitive parameters are identified by changing each parameter value while keeping other parameters at their default values. And second, sensitive parameter ranges are fixed with the help of an iterative process. Eight car-following parameters CC0 to CC7 from the Wiedemann 99 model are selected based on the sensitivity analysis for calibration. The time and effort required to accurately tune a large number of simulation parameters are reduced by the proposed heuristics and the GA-based optimization.

Monica Menendez &Qiao Ge, 2012 [4] In this study, the VISSIM model for Zurich city was created to analyze and calibrate it. Improved Sensitivity analysis method, which is based on the Elementary Effects method, was proposed and applied in this project. This method reduced the computation time required for the Sensitivity analysis from 77 days to 2 days for this specific case. This shows that the proposed method is accurate and efficient, especially for dealing with the sensitivity analysis of complex VISSIM networks.

Pruthvi Manjunatha, Peter Vortisch &Tom V Mathew, 2012 [5] In this paper, systematic steps were explained for the calibration of a microsimulation model for heterogeneous traffic. By using multiple sensitivity analysis, Calibrated parameters were identified, and accurate values of these parameters were obtained by reducing errors from the field data and simulated data with the help of an optimization tool namely a Genetic Algorithm. Parameters that are significantly affecting in the current study were found to be CC8, CC1, CC7, CC0, and CC2. Future models having heterogeneous traffic flow can be exactly built upon based on the observations in this study.

Dong Lin, X. Yang & C. Gao, 2013 [6] For this analysis, a road model was built in VISSIM software. Various traffic agency plans were compared. The objective of this study was to use a simulation method to analyse the traffic operational state of the CBD area as well as its surrounding road network under the most adverse traffic demand conditions. The differences and evaluations identified in this study include travel speed, queue length, travel time, and delay. To investigate the congestion degree of the CBD area in 2020, it is essential to conduct a traffic simulation study. After comprehensive analysis about the indices of travel time, delay, queue length, and travel speed, one-way organization scenarios inside core areas have generally better performance compared to two-way organizations.

Siddharth S M P & G. Ramadurai, 2013 [7] In this paper, sensitivity analysis is carried out by both optimized trajectories for elementary effect and ANOVA within the study. With the help of the Genetic algorithm tool of MATLAB Automatic calibration is done through the COM interface of VISSIM. Sensitive parameters were Car following, Lane changing and lateral parameters. p-values of those parameters which are less than 0.2 are chosen as sensitive parameters. Calibration of the model was done by keeping other parameter values constant and varying the values of sensitive parameters. From the study, it is concluded that both the ANOVA and Elementary effects are very effective in finding the sensitive parameters which affect a model.

A.C. Dey, S. ROY & M.A. Uddin, 2018. [8] This paper gives the process for the Calibration & Validation of the VISSIM model for Dhaka city. Data was collected like classified volume count, Geometric data, Signal timing. The study was performed on the manually signalized intersections. Data collected for 2 hours in morning peak 9:00 am – 11:00 am & evening peak 5:00 pm – 7:00 pm. Calibration of the model is done by optimization tools like genetic algorithms. Validation of the model is done by GEH statistics. The GEH value of the model was 2.863, which indicates a well-calibrated model.

Nagesh Jayantibhai Patel, &Dr. Gargi Rajpara, 2018 [9] In this study, the capacity of the intersection is evaluated, and a VISSIM model is created for the traffic volume. The Data is collected by video – graphic method & data collected for 3 hours in morning & evening peak. Then after analysis of data, the VISSIM model was created & it was calibrated & validated. Suggestions were: updating the signal timing, improvement to capacities of intersection can be achieved.

P. Maheshwary, K. Bhattacharyya, B. Maitra, & M. Boltz, 2018 [10] The proposed study was done to provide guidelines and suggestions for the calibration of the microsimulation models. Sensitivity parameters are identified by developing a linear regression model. Finding out optimal parameter values, an optimization tool called a genetic algorithm is used. Recommendations were given for Different sets of driving behavior parameters for distinctive

vehicle classes. The Optimal parameter set turned was observed to differ considerably throughout vehicle classes. The parameters set turned were seen to differ consequently in all vehicle classes. The best values were identified which are differentiating in all vehicle classes up to 95% significance level.

3. CONCLUSION

So, by the above works of literature, it can be noted that the calibration of the simulation model can be done by the processes adopted in these works. And also, because utilizing the simulation software can be useful as it is not expensive, simulation is safer as the results are obtained in software and after the analysis, it gets implemented in the field. And simulation is an effective tool for the analysis and evaluation of proposed improvements in the field study.

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