A Review Paper on Driving Behavior Modelling

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Abstract: ***The Micro- Scopic traffic simulation model. PTV VISSIM has been widely in use for management analysis as well as transportation operations. Step wise simulation, less expensive, safer simulation and quicker in analyzing makes it superior when compared with other Micro- Scopic simulation software. These models completely rely on their accuracy and reliability for decision making and traffic controlling decisions. Although VISSIM possess default values for every input parameters, it is necessary to change the values that replicate the present traffic conditions. The major traffic conflicts were identified at intersections for both signalized junction as well as un-signalized junctions. Drivers tend to enter the paths though the capacity of those paths were lesser than its volume. One of the major reason behind these conflicts were identified as the driving behavior. Therefore the VISSIM provides the luxury to enhance the driving behavior parameters such as Car-following, Lane changing priorities, number of preceding vehicles, Lateral behavior, signal decisions and standstill headway parameters were calibrated accurately to replicate the present conditions. The Micro- Scopic simulation results suggest that the default values produce higher speed, large queue length and short travel time than observed in the field. The measure of effectiveness were generated. Thus, calibration process requires a careful examination on how the simulated vehicles behave and its importance in balancing the values of parameters that enhance the network performance.***

Keywords: Traffic Simulation, VISSIM, Driver Behavior Parameters, Sensitivity Analysis

1. Introduction

Micro-Scopic Traffic simulation models are well known for conducting a research in traffic engineering and transportation planning. Future of these models completely relies on the realistic representation of the traffic data they provide. The flexibility that the software offers in extracting all possible solutions for mobility related traffic problems as well as the tremendous savings in time and cost is regarded as the major advantage of Micro-Scopic Traffic simulation models. In many developing countries, absence of lane marking and lane discipline, haphazard movement at intersections and dis-organized movement of a variety mix of different vehicle types is commonly observed structure which makes it difficult to replicate using traditional analytical models. Hence creating a wide demand for micro-scopic traffic simulation models. The efficiency as well as acceptability of this traffic simulation model in evaluating various scenarios rely on its ability to reflect the local driver characteristics, study area network and infrastructure.

VISSIM utilizes the Wiedemann 74 and Wiedemann 99 car-following model for Diving Behavior analysis. This model contains ten modifiable car-following parameters (CC0 – CC9) which represent four driving modes such as free driving, following approaching and braking. The main requirement was to gain a greater understanding in different driver behavior parameters and their interactive influence on capacity and its use in understanding the calibration processes. These studies mainly focused on the relationship between the capacity and each and every driving behavior parameters individually and cautiously examining into the driver behavior interactions with each the parameters. The parameters of the model that require calibration include traffic flow, traffic control operations and Driver behavior, Model validation results are tested for their accuracy by comparing the generated data from simulation model to the data collected from the study area.

2. Data Collection

Data of heterogeneous traffic flow such as data on turning vehicles movement, network geometry, vehicle mix, traffic volume data, vehicles characteristics, traffic control systems, and stop signs, were been collected using digital camera at selected study locations.

2.1 Determination of Measures of Effectiveness

The determination a performance measure is carried out to identify the controllable input parameters and un-controllable input parameters. Un-controllable input parameters were traffic counts, existing geometry, current signal timing plans, etc. Controllable input parameters were lane changing distances, waiting times before diffusion, minimum headways, minimum and maximum look-ahead and look-back distances etc. Thus, it is necessary to identify all such performance measures before proceeding further for calibration and validation process.

2.2. Building VISSIM Model

2.2.1. Method 1

Detailed network geometry is coded through VISSIM graphical user interface. To make model representative of the real field both MV such as bus, truck, car etc. and NMV such as rickshaws, bi cycle etc are defined. It is difficult to model non-lane based flow but modifying different parameter values such as driving behavior, lateral distance and lane changing can be done in VISSIM with sophisticated programming. It is possible to build the intersection model. The base model is run with Wiedemenn 74 car following driver behavior model. Calibration is done in which various parameters of the simulation model are adjusted till the model accurately represents field conditions.

VISSIM has several parameters that can be changed during calibration. But all the parameters in VISSIM may not affect the output of the model in a significant way. Sensitivity analysis is used to find the parameters which have a significant effect on the model.

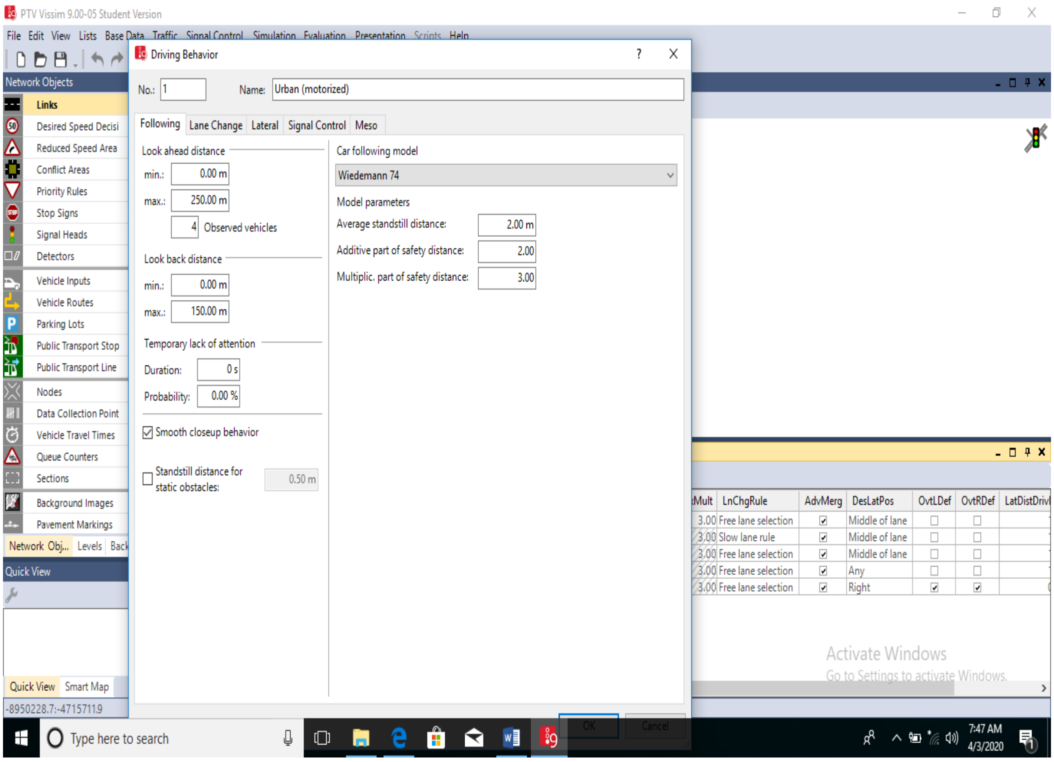

Figure 1 Wiedemann 74 Parameter

Model Validation

The calibrated models are then evaluated with a new set of data under untried conditions, including the input volumes, traffic composition, and other required data

2.2.2 Method 2:

In this method, wiedemenn 99 car following parameters is used. Data collection remains same. The sensitivity analysis differs.

VISSIM's wiedemenn 99 car-following parameters run from CC0 to CC9. These parameters are arranged on the way they affect a vehicle while following another vehicle on the same lane. The four parameters such as CC0 - CC3 deals with the vehicle distance separation, the next three parameters CC4 - CC6 deals with the speed of the following vehicle and the last three parameters CC7 – CC9 deals with the acceleration in the process of following a vehicle.

The parameters description with their default values:

- CC0 (Standstill distance): The desired distance between stopped vehicles, default value is 1.50m.
- CC1 (Headway Time): The desired time headway in seconds between lead and following vehicle, default value is 0.90 sec.
- CC2 (Following Variation): The additional distance over safety distance that a vehicle requires and controls the longitudinal oscillation, default value is 4 m.
- CC3 (Threshold for Entering 'Following'): It controls the start of the deceleration process before reaching the safety distance, default value is -8 sec.
- CC4 and CC5 (Following Threshold): It controls the speed variation between lead and following vehicle, default value is +/-0.35 m/s.
- CC6 (Speed Dependency of Oscillation): It influence on distance on speed oscillation, default value is 11.44.
- CC7 (Oscillation Acceleration): The acceleration during the oscillation process, default value is 0.25 m/s2.
- CC8 (Standstill Acceleration): The desired acceleration starting from standstill, default value is 0.35 m/s2.
- CC9 (Acceleration at 80km/h): Desired acceleration at 80km/h, default value is 1.50m/s2.

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From papers and case studies, the parameters has been modified accordance to the data collected for the study area conditions.

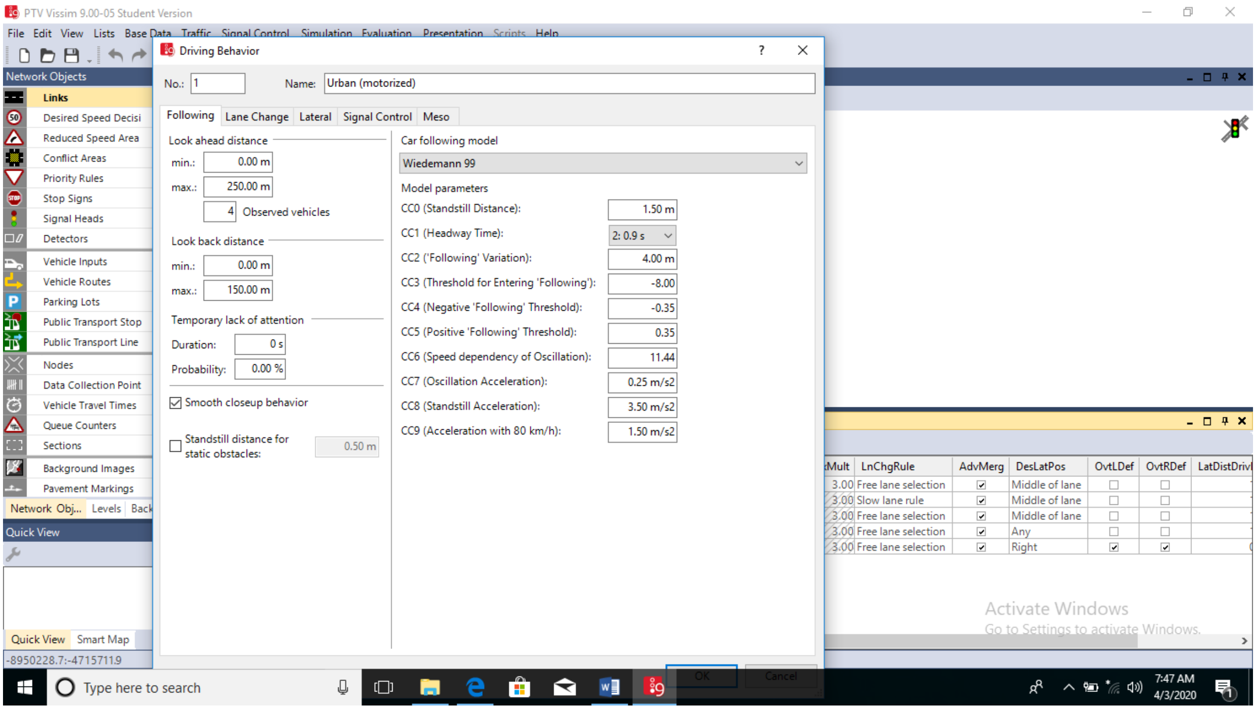

Figure 2: Wiedemann 99 Parameter

3. Critical Review on Driver Behavior Modelling

D.C. Dey, S. Roy and M. A. Uddin (December 2018): This Paper narrates the detailed procedure for calibration as well as validation of microscopic model of a congested intersection. With a help of PTV VISSIM model, driving behavior parameters were modified to construct a virtual environment which replicates the traffic scenarios and Optimizing the problem and visualizing the output that is necessary to face the challenges at present and for the betterment for the future.

Performance measure has been identified. Identification was done by differentiating controllable input parameters such as waiting time before diffusion, lane changing distance, minimum and maximum look ahead distance, minimum headway and next set of un-controllable input parameters such as current signal timing plans, traffic counts, and existing geometry. These several parameters were indulged with VISSIM parameters and were changed during the calibration process.

This paper encountered two main issues one being the importance of visualizing and calibrating and the other issue deals with the statistical testing of calibrated model with field data. (A.C.Dey, et al., December 2018). [1]

Hassan M. Al-Ahmadi, Arshad Jamal, Imran Reza, Khaled J. Assi and Syed Anees Ahmed (May 2019): This paper describes the model deriving the driving behavior parameter through micro-simulation software called VISSIM. Sensitive parameters were identified such as amber signal, minimum headway, lane change distances, the number of preceding vehicle and desired safety distances.

Performance measure were been identified. Identification was done by differentiating controllable input parameters such as waiting time before diffusion, lane changing distance, minimum and maximum look ahead distance, minimum headway and next set of un-controllable input parameters such as current signal timing plans, traffic counts, and existing geometry. A specific set of driving behavior parameters were been optimized. The parameters had been adjusted over a specific number of iterations under the specified range unless the optimized performance measures i.e. travel speed, queue length and travel time agreed with the specifications. Driving behavior parameters were been compared with the field data.

It concluded that the VISSIM model with the default parameter values was incapable in replicating the existing field conditions, thus the parameters were enhanced by performance measure parameters. Thus this research was helpful in identifying some of the important driver behavioral parameter which can be used as bench mark for future studies. (M.Hassan, et al., 28 May 2019). [2]

Filmon G. Habtemichael and Luis de Picado Santos (July 2013): This paper describes the quantitative evaluation for the impact parameters through sensitivity analysis for total 21 driving behavior parameter in VISSIM which includes 10 for the car following and 11 for the lane changing model.

Two base models were developed for different geometric layouts. Sensitivity analysis for VISSIM car-following and lane-changing models on safety for simulated vehicles were conducted through setting a realistic maximum and minimum value for each and every parameter along with an intermediate value in between the maximum, minimum and the default values. The values of each parameter were changed four times and the impact of the parameters on increase and decrease of simulated vehicle conflicts were noted and compared with the respective base model.

The results indicate that the parameter values have a significant impact on the output of simulations that the common calibration process requires cautiously examination on the way the simulated vehicles behave, especially on their aggressiveness or defensiveness. VISSIM driving behavior parameter which impact the safety as well as operations of simulation models were identified. The findings of this paper are that it can be used as guide for the microscopic traffic simulation in calibrating the VISSIM model for the safety and operational analysis of the transportation facilities. (Habtemichael & Santos, January 2013) [3]

Vincenzo Gallelli and Rosolino Vaiana (2008): This paper consists of the results of a wide range survey conducted on roundabout with different scenarios through the use of simulation software called VISSIM. The simulation for roundabout traffic condition often leads to many complexities because it is difficult to define the geometric and user behavioral parameters. VISSIM provides flexible platform which allows the user to develop a more realistic model of a roundabout.

The driving behavior analysis is done in VISSIM which uses a car following model along with a rule based algorithm for the lateral movements generated by Wiedemann 74. VISSIM encourages to define the particular desired speed of each and every types of vehicle which are entering the network. The approach speeds on each leg of the roundabout is derived by the empirical speed curves that has been created by the users.

The results mainly indicate the correlations that exist between the driving behavior parameters, stop line, delays and geometric variables of simulation. Thus this paper guides the users using simulation models to understand the sensitivity models of different input driving behavior parameters. (Gallelli & Vaiana, 2008) [4].

Siddharth S M P, Gitakrishnan Ramadurai (2013): The paper describes the methods as well as results on the sensitive analysis and automated calibration of the VISSIM models using the data acquired from one of the intersection in Chennai. Parameters that affect the driving behavior in Indian heterogeneous conditions were generated using sensitivity analysis.

Heterogeneous traffic data such as speed, traffic volume, composition, and signal timing along with its geometric data were been collected. The parameters of VISSIM that affects the behavior of the network constructed were adjusted during the calibration process so that the models will replicate the present field conditions. Desired speed distributions acceleration and deceleration distributions and Driving Behavior Parameters were identified as the main parameters governing the calibration and modified to desired values. The sensitivity analysis was performed to obtain the parameter that affects the driving behavior in significant way.

The parameters that had been calibrated through VISSIM were acceleration, lane change distance, desired speed, and clearance distance, standstill distance, emergency stopping distance, waiting time before diffusion, minimum headway and Wiedemann parameters. Desired numbers of trials were carried out.

The parameters minimum headway, additive part of safety distance, average standstill distance, minimum lateral distance and multiplicative part of safety distance between bikes at 0 kmph showed high level of elementary effect in all the trials and those 5 parameters were considered as sensitive. Look ahead distance-minimum, look back distance, minimum and desired acceleration of Bike at 0 kmph showed little effect. Desired acceleration LMV at 0 kmph and desired acceleration HMV at 0 kmph showed no effect in the trials. (Siddharth & Ramadurai, 2013) [5].

Nicholas E. Lownes and Randy B. Machemehl (2006): This paper describes the sensitivity analysis of VISSIM's simulation capacity on output under different values of driving behavior parameters. For every driver behavior parameters such as look-back distance etc. and their variations on simulated capacity were noted for every parameter that has been modified.

Total of Eleven parameters were investigated in sensitivity analysis. The first 10 are included in the Wiedemann 99 car-following model used for freeway segments in VISSIM, CC0 through CC9. The last parameter investigated was the look-back distance associated with the VISSIM connector. This parameter in particular was found to have the large impact on the capacity. Therefore this parameter was subjected to the sensitivity analysis similarly to that of the driver behavior parameters. The analysis is done starting from CC0 to CC9 i.e. CC1 Headway Time, CC2 Following Variation, CC3 Threshold for Entering Following, CC4 and CC5 Following Thresholds, CC6 Speed Dependency of Oscillation, CC7 Oscillation Acceleration, CC8 Stopped Condition Acceleration, CC9 Acceleration.

VISSIM allows the modeler to enhance the flexibility and control in developing, calibrating and interpreting the simulation accurately. The results indicates that driving behavior parameters can be used to full extent to develop an optimization model that offers flexibility and control in traffic conditions. A better understanding of highly influential VISSIM parameters will make any traffic situation manageable. (Lownes & Machemehl, 2006) [6].

Matthias Richter and Jan Paszkowski (2018): The main aim of this paper was to investigate driving behavior parameter in the view to develop a particular method for improving micro-simulation traffic model that focuses on traffic solutions. Thus a speed profile was calculated and PTV VISSIM model was developed and attempt was made to estimate the volume-delay functions. Driver behavior model was developed on the basis of data received on traffic conditions. With the PTV VISSIM tests were conducted on various traffic volumes along with the various traffic compositions so that it can identify the relationships between the traffic flow and travel time.

Driver behavior was divided into 4 states namely free driving, following, approaching and braking. Further, detailed description is done with wiedemann model. For every type of vehicle, accelerations and decelerations were identified. Once the identification is completed, the simulation was done for the same traffic flows that was observed during surveys. The results obtained from the simulation were exported and generated as the average speed profiles for all the vehicles so that comparing them with the measurements was possible.

Results of microscopic model done using PTV VISSIM resulted in estimating suitable network characteristic of VISSIM. This model consisted of two main parts i.e. demand and supply. Demand represents the origin and destination matrix between the traffic areas with homogenous transport functions, whereas Supply is the transport network which consists of various transport modes both in private and public. (Richter & Paszkowski, 2018) [7].

Emelie Fransson (2016): The main aim of this research was to investigate on how complex was driving behavior on ramps and merging areas through micro simulation model.
Field observations were obtained and simulation study was made. The data was recorded using video cameras; the data collected included traffic volumes, merging behavior, how frequent was lane changing, turning moments, vehicle composition, and speed and travel time along with road geometry. With the help of VISSIM, parameters that were available such as car-following and lane changing models were adjusted in order to reflect the driving behavior observed from the video recorded. In addition to this lateral driver behavior parameter and parameters that are related to the conflict areas were modified. Then the model was calibrated using the traffic flow and travel time data obtained from field observations. Data on how frequent was lane changing and their locations were used for calibration of the merging behavior.

The results suggested that the vehicles on the on-ramp tend to prefer driving as far to the left as possible, leaving the rightmost on-ramp lane relatively unoccupied. This lane is hence targeted by the mainline traffic. (Fransson, 16 Feb 2018) [8].

Craig D. Yannes and Nicholas E. Lownes (2010): This paper describes the results of an investigation into the reliability and consistency of capacity estimated from VISSIM when the driver behavior are changed and for better understanding the impacts on changing driver behavior parameter and road capacity. This paper describes the relevant parameters of the VISSIM driver behavior model used in pair combinations evaluation. The interactive analyses was done to obtain relationships between the pairs of driver behavior parameters and roadway capacity.

Each parameter, described, excluding headway acceleration was found to have considerable impact on the roadway capacity. Headway acceleration is included in the combinations because it has capability to interact with other parameters which influence the capacity. The combinations were CC1: Headway Time, CC2: Following Variation, CC3: Threshold for Entering Following, CC4 and CC5: Following Thresholds, CC6: Speed Dependency of Oscillation, CC7: Oscillation Acceleration, CC8: Stopped Condition Acceleration, CC9: Acceleration at 80 km/h.

This research was intended to help the simulation modelers in better understanding the impact of changing driver behavior parameters on calibration .The results generated was helpful in identifying 4 significant interaction between the different combinations of driving behavior parameters and roadway capacity. (Yannes & Lownes, 2010) [9].

Palak Maheshwarya, Kinjal Bhattacharyya, Bhargab Maitra, and Manfred Boltze (July 2016): This paper demonstrates the methodology for calibration of vehicle class driver behavior at an intersection in Kolkata. The data from the study area was replicated using VISSIM microscopic simulation. The sensitive parameters that are affecting the driver behavior were identified.

The proposed procedure for the calibration of microscopic traffic flow simulation models broadly includes 4 stages namely Pre-Modelling i.e. definition of study objectives, selection of study area, determination of MOEs, field data collection and extraction, Initial Modelling i.e. Network coding, comparison of simulation with default values and field results, Calibration i.e. identifying calibration parameters and ranges, experimental design for calibration and finally optimization, and Validation and Visualization using a different set of flow data for validating the calibrated model, visualization check for realistic animations to identify the best parameter set. The car following model in VISSIM has been developed based on the works of Wiedemann 74 and 99 with the assumption that a driver may be in one of the four driving modes such as Free Driving, Approaching, Following, and Braking. Wiedemann99 model is used in the present study given that it offers more flexibility over Wiedemann-74 model.

The calibrated parameter provided much better results when compared to the initial simulation with the default parameter values. (Maheshwarya, et al., 15 July 2016) [10].

Narayana Raju, Shriniwas Arkatkar and Gaurang Joshi (2019): In this paper, calibration of driving behavior parameters was done using high quality vehicular trajectories. In this, the key element was studying the driver behavior in the identification of leader-follower pairs in different traffic conditions. Wiedemann 99 model is the car-following model in which the following behavior is expressed by means of ten parameters in which each parameter has its own significance.

Calibrated parameters of Wiedemann99 car-following model were CC1: Headway Time, CC2: Following Variation, CC3: Threshold for Entering Following, CC4 and CC5: Following

Thresholds, CC6: Speed Dependency of Oscillation, CC7: Oscillation Acceleration, CC8: Stopped Condition Acceleration, CC9: Acceleration. Level of Service indicates the operational conditions within a traffic stream generally in terms of speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience and safety.

The results suggest that the high speed road characteristics should not be analyzed with the empirical observations because variations in traffic flow will be slightly lesser than urban roads. The validated simulation results describe the level of service of thresholds for the selected study area. It was also observed that vehicular trajectory data was an indispensable source for simulating the road section effectively. (Raju, et al., 2019) [11].

Zhengyang Lu, Ting Fu; Liping Fu, Sajad Shiravi, Chaozhe Jiang (2016): The objective of this paper was to develop a reliable and practical method for calibrating car following parameters in micro simulation software called VISSIM.

The data was collected from the video footages, which was used to identify the measure of effectiveness. On completion of data collection, calibration was done in VISSIM. In this, 3 main categories of parameters were used namely, safe following distance, Acceleration or Deceleration and desired speed. Once the parameters were calibrated, evaluation was conducted to assess the credibility for the model.

The calibration results when compared to the traditional results suggested that the results obtained using VISSIM were much more relevant and resemble the driving behavior characteristics. But this paper focused on only calibrating car-following model parameter, further calibration can be extended by using other simulation parameter such as lane changing behavior and route choices. (Lu, et al., 17 May 2016) [12].

Arpan Mehar, Satish Chandra and S. Velmurugan (2013): The objective of this research was to examine the applicability of VISSIM to mixed traffic condition and thereby to calibrate driving behavior parameters of the model to suit mixed traffic condition. Traffic volume data was collected and used to develop a speed and flow curve. The identical set of data is used for simulation to generate speed flow curve and the generated curve is compared with the field curve. Thus, Driver behavior parameters were determined first for the homogeneous traffic conditions having any one of the types of vehicle in the flow and then the results were aggregated to get the values of these parameters for a mixed traffic stream. The field data with the calibrated values of driving behavior parameters indicated a good match between field and simulated capacity.

The car-following driver behavior contains ten different parameters ranging from CC0 to CC9 with their default values. The values of these parameters have been investigated in different scenarios by researchers and checked the sensitivity of these parameters on simulated results. The Validation was performed using another set of field data collected.

It was observed that VISSIM with its default values over estimates the speed as well as capacity of the Roadway. The driver behavior parameters CC0 and CC1 were determined for homogeneous traffic stream. From the curves, the difference in simulated capacity and the field capacity was less than one percent. It indicates that the calibrated parameters are suitable for simulating any traffic conditions. (Mehar, et al., 2014) [13].

Viti, Francesco, Hoogendoorn Serge, Arem Bart van (2010): This paper describes how data was been collected and processing of microscopic data using the image processing or clustering techniques. They generated the first results of the study of the driving behavior at the signalized junctions from the data obtained. Speed and acceleration distributions was been generated along with dynamic process for stop and go at signals. From the distributions analysis it was observed that the speed variability increases considerably nearer to the stop sign. Moreover it can be visualized on how the car following behavior parameters are influenced by the presence of traffic signals. The data has enormous potentials for achieving intuition into the traffic process at the signal controls. This unique data can be used to study the variability of driver behavior at any signals and also to gain insight into the factors which determine their actual trajectories. (Viti, et al., July 2010) [14].

Praveen Edara & Indrajit Chatterjee (2013): In this paper, multivariate regression models were developed to express the relationship between the critical driving behavior parameters of the VISSIM model, truck percentages, work zone capacity and work zone lane configuration. The values for driving behavior parameter were identified by visualizing the simulation runs for all the different parameters value.

Threshold value for both lower bound as well as upper bound were kept under unsafe driving behavior conditions and unrealistic from occurring. CC1 parameter was varied from 0.9 s and 1.8 s, CC2 parameter was varied from 10ft and 55ft, and SRF was varied from 0.15 and 0.6. The main goal of this paper was to generate a parameter values that results in different simulated capacities.

The validation results pointed out that the model generated values were capable of producing the accurate estimations of traffic capacity and maximum queue lengths. (Edara & Chatterjee, 7 Sept 2013) [15].

Chen Chen, Hao Liu and Xiaoming Liu (2019): This paper presents the combination of traffic simulation and driving simulator that have been used to measure the effects of weather on traffic flow characteristics. Firstly combination of frame work was established establishing then the verification experiment was conducted which includes the driving simulation experiment as well as series of traffic simulations and the effects of weather on the traffic flow characteristics were identified and measured.

Due to its complexity it has been simplified into three categories of car-following situations that were designed for driving simulation experiments. The three car-following situations were accelerating and decelerating car-following situation and cruising according to the front car motion. Repetitive tests were conducted and after the tests, car-following situations were well designed in the driving simulator and can provide drivers similar driving experiences as the real experience.

Based on the results of the verification experiment it has been observed that the proposed method was proved to analyze the influence of weather on the traffic flow characteristics. A bridge between driving behavior and traffic flow was established. (Chen, et al., 5 Feb 2019) [16].

Higgs, Abbas, and Medina (2014): This paper analyzes the Wiedemann car following model by using car following periods that occur at various speeds. The model uses the thresholds to define the different regimes in the car following. Few of these thresholds use the speed parameter but most of them rely solely on the difference in the speed between the subject vehicles and the lead vehicles.

The equation was been developed and implemented into the calibrated framework that uses a genetic algorithm to calculate all the optimal values of these parameters. A genetic algorithm was been used because of its ability to precisely find the optimal solution which can meet certain criteria when numerous parameters are present. The framework consists of expressing the logic of Wiedemann model as the series of the state transitions. The states are defined by the different thresholds and each state has an equation and parameter for their acceleration. The optimization function was to minimize the error between the velocity values that calculated in the Wiedemann model and the velocity values which are directly from the data.

The results indicate that the threshold were not constant but was varying over various speeds. These variances in the speed were driver independent. The results show that the drivers exhibit different behaviors depending upon the speed which can imply an increase in aggression at particular speed. (Higgs, et al., 2014) [17].

Michaa Niezgoda, Mikoaaj Kruszewski (2012): This paper presents the different methods used for measuring the driver behavior and objective behavioral indicator that were commonly used for traffic safety measures such as lane deviations, time to collision, time headway, post-encroachment-time, deceleration rate, gap acceptance, red-light violations, and others. This paper also provides a general framework for finding the valid and reliable variables in traffic safety studies.

There were no straight relationship between the measures and the ideal condition of traffic safety. In addition there were no common standards for these indicators and their cut-off values can vary from one to even few seconds. Furthermore safety was always a set of parameters and single indicators with their limitations. These variables are been calculated in the relation to other indicator and general traffic conditions such as traffic density, number of lanes, weather and other moderators. However the present traffic variables can be precisely valid and reliable behavioral indicators for traffic to determine whether the person is a safe driver or not. (Niezgoda, et al., 2012) [18].

Athul Suresh and Pabitra Rajbongsh (2016): This paper describes the efficiency of VISSIM software that replicates the traffic conditions of the rotary intersection in Assam. VISSIM is microscopic traffic simulation software that helps to construct the realistic circumstances of heterogeneous field condition. Field data was been collected by a video graphic survey, traffic volume and cumulative vehicle arrived or departed has been determined by the software. The volume given from software is compared with field set of values. Calibration was been done for driving parameters CC0 and CC1.Standstill distance i.e.CC0 in meter and time headway i.e. CC1 in second were kept on changing up to a good match between simulated and field was been reached.

The traffic simulation as well as calibration was done for heterogeneous traffic. Car following parameters of wiedemann 99 parameters were determined for the heterogeneous conditions and was found that the error were only less than two percentage in between field and calibrated traffic flow. The result was found to be reliable and further studies was done by checking the sensitivity of reaming Wiedemann parameters. (Suresh & Rajbongshi, January-March 2016) [19].

Wenwen Liu, Yong Qin, Honghui Dong and Yanfang Yang (2014): This paper makes an effort to find the sensitivity parameters for selected roundabouts by using travel time and queue length as evaluation index. Sensitivity an analysis was done for the calibrated parameters using microscopic simulation software called VISSIM. While analyzing the model parameters, other parameters default values are kept unchanged. The values are adjusted by applying equidistant values and analyzed.

This paper adopts three sensitivity analysis methods namely poor analysis line chart method, and sensitivity coefficients methods. Line chart indicates the trend between the dependent variables and independent variables. Sensitive parameters are obtained by analyzing correlation between the evaluation and the parameters. Range analysis indicates the difference in between the maximum values and minimum value in every level. Sensitivity co-efficient is a comprehensive function that evaluates all the factors of all levels together on sensitivity analysis.

After the testing, simulated parameters values were found for different levels. It also resulted that sensitivity parameter were not same for roundabout and intersections, thus it requires separate analysis. The minimum headway, additional safety distances were found more sensitive on travel time and queue length and those parameters were corrected. (Liu, et al., 2014-09-02) [20].

Columbia Project Team (2006): This paper describes the components of the VISSIM that was been developed and calibrated. Couple of models were been developed, one representing the existing condition other representing the calibrated values.

Geometric data traffic volume data and traffic flow data was been collected. VISSIM model was built according to the data collected. It was found that all the default values represented the study area, thus few parameters were adjusted to replicate the original field conditions. The driver behavior was modelled in VISSIM using car following and lane changing parameters. The driving behavior was linked to every link. Different driving parameters were defined to different vehicle types. The driver behavior parameters were modified based on position of vehicle or the driver. But there was no correlation defines between the driver and the vehicle. Thus car following parameters consisted of two types freeway drivers and urban drivers. Freeway driver was the best suited and was used, the parameters were CC0 to CC9 and these parameters was been modified from the default values.

VISSIM calibrated output was compared against the field data to determine that the output was within the acceptable level. (Project team , August 28, 2006) [21].

Bawan Mahmood and Jalil Kianfar (2019): This paper describes the need to provide separate driver behavior parameters for multi axle vehicles as well as passenger vehicles to replicate its existing condition in VISSIM. The work zone driver behavior model parameter was calibrated so that the both flow and speed values were replicated.

The work zone for driver behavior parameters was been determined by a stepwise implementation of the proposed PSO optimized method. The first step described 10 sets of driver behavior parameter generated randomly and was simulated for three days of the data with a simulation random seeds. Ten lowest functions value were used as initial swarm of next optimization process. In second step parameters were evaluated using all the three days of work zoned traffic data and the simulation of each day was repeated for three various random seeds.

This paper results indicated that heavy vehicle as well as passenger car driver behavior parameters were different in the same work zones. (Mahmood & Kianfar, 29 October 2019) [22].

Varun Ramanujam (2007): This paper dealt on studying the driver behavior models and focused on generating an enhanced lane changing models. Lane selection and gap acceptance decision were the parameters governing the lane changing behavior. But this gap acceptance had been considered as inadequate since it ignored the magnitude of the lane change duration, which resulted in time lagging between actual lane changing and actual acceptable gap. Lane changing duration was influenced by two predominant factors which was characterizing the lane change and other was characterizing the speed.

This resulted that the drivers tends change the lane completely when they experience the adjacent gaps are significantly greater than minimum threshold that was required for a safe lane changing and Drivers moving at a higher speed are likely to complete the lane changing quicker than others. (Ramanujam, June 2007) [23].

Jian Rong, Kejun Mao, and Jianming Ma (2011): This paper describes the effects of the individual difference on traffic flow characteristics and driving behavior. Driving behavior was considered to be an important approach in determining the solutions to reduce roadway traffic crashes, improve vehicle designs, develop in-vehicle safety devices and level of service of a roadway gets increased. The drivers were categorized into three types namely aggressive, moderate and conservative. For these three types of drivers, driving behavior parameters were calibrated using the data collected from the driving simulator.

Two groups of indicators was been analyzed completely to capture the driver behavior while driving. A cluster analysis was been done. Therefore, driving simulator data was used to calibrate t car-following and lane change parameters for those three types of drivers. Parameters include reaction time of acceleration, the coefficients of Motors, expected speed and critical gap for the lane changing. From these, the reaction time as well as expected speed of three types of drivers was estimated based on the driving simulator data. Furthermore, effects of the driving behavior on the traffic flow were been analyzed.

The results suggest that the traffic flow with aggressive drivers were more unstable. The disturbance in the traffic flow such as the speed reduction was the one of the reason to make the aggressive drivers change lanes frequently and thus causing less stable traffic flow that further results in reduction of roadway capacity and causing safety issues. The results also shows that the roadway with more aggressive drivers have the highest traffic flow rate yet results in least stability in traffic flow. (Rong, et al., 2011) [24].

Christopher S. Russo (2007): This research focused on the developing and calibrating two vastly different micro simulation models. The two models utilized were, SHAKER, a deterministic queuing model for the vehicles utilizing the toll collection facilities, and VISSIM for driving behavior analysis.

Extensive field survey generated valuable processing time as well as demand data that was been used to establish the capacities based on the lane and payment type, payment amount, and type of vehicle. The resolved capacities were used as a primary measure for calibration and validation. The driver behavior parameters was been found from the following behavior, lane change behavior, lateral behavior and signal control behavior. Two models were built namely Wiedemann 74 and the Wiedemann 99. The Wiedemann 74 model was suitable for urban traffic. The Wiedemann 99 model was suitable for interurban traffic and each model was evaluated.

The results suggested that each simulation model possessed benefits over other in terms of set up time, analysis reporting time, practicality of results and potential for adapting to variation. (RUSSO, 2007) [25].

4. Major Findings from the Literature Review

1) Not all the driver behavior parameters have impact, only CC0 and CC1 have major impact than other parameters when calibrated. [2, 6, 13, 15, 19]
2) The ability to change the parameter values with respect to the speed of the vehicles was possible which increased accuracy in the simulations. [5, 17, 23]
3) The values generated by the calibrated models was capable of generating accurate estimations of queue lengths and capacity.[4, 15, 23]
4) The combinations of driving simulator as well as traffic simulation were used to measure the effect of weather on the traffic flow characteristics. [16]
5) The conflict points at intersection were reduced by signals that can regulate the moments. [7, 14]
6) The driver behavior parameter values were able to calibrate with respect to different vehicle combinations. [7, 8, 9, 10, 24]
7) Four significant combinations of driver behavior parameter and roadway capacity was identified as CC0-CC8, CC2-CC1, CC4/5-CC1 and CCC7-CC8. [10, 12]
8) VISSIM default values were incapable of replicating the traffic condition and resulted in larger queue lengths and higher speeds, but on calibration it was capable to replicate the field condition.[3, 6, 20, 21]
9) CC1 and CC2 were found the most influential parameters of VISSIM car following model for both safety as well as operational aspects. Parameters CC4 and CC5 had moderate impact on safety as well as operations of the simulated vehicles. The CC3 parameter affected the safety of simulated vehicle without any impact on operations. [3, 9, 11, 20, 22]
10) Lane changing was the most important parameters of VISSIM that governs the maximum deceleration and reduce the rate of acceleration of the trailing vehicles. [1, 2, 25]

5. Conclusion

After the study of literature it is been observed that the driving behavior mainly is governed by two parameters namely wiedemenn 99 and wiedemenn 74. Wiedemenn 99 works on sensitivity analysis for total 21 driving behavior parameter in VISSIM which includes 10 for the car following and 11 for the lane changing model. Whereas wiedemenn 74 works on three main categories of parameters namely, safe following distance Acceleration or Deceleration and desired speed. These parameters were adjusted over a specified number of iterations within the specified range until the optimized performance measure i.e. travel speed, queue length and travel time agreed with their specifications. Driving behavior parameters were compared with the field data.

The results indicated that a correlation between driving behavior parameters and stop line, delay, geometric variables has a greater impact. VISSIM driving behavior parameter which impact the safety as well as operations of simulation models were identified. The findings of this literature papers was that it can act as guide for the microscopic traffic simulation for calibrating the VISSIM model for safety and operational analysis of the transportation facilities.

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