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Traffic Simulation and Calibration of Heterogeneous Traffic by VISSIM

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Abstract—*The paper demonstrates the efficiency of PTV VISSIM software to replicate the traffic conditions of a rotary intersection in the city of Silchar, Assam. VISSIM is microscopic traffic simulation software, which helps to create a realistic situation of the heterogeneous field conditions. Traffic data from the intersection has collected, traffic volume and cumulative vehicle arrived/departed have determined from the software. The volume given from software is compared with field set of values. Calibration has done for driving parameters CC0 and CC1.Standstill distance (CC0) in meters and time headway (CC1) in seconds were keep on changing till a good match between simulated and field is reached.*

Keywords: *Microscopic traffic simulation, PTV VISSIM, heterogeneous, CC0, CC1.*

1. INTRODUCTION

Traffic simulation generally defined as the process of creating a realistic situation inside the software from the actual field conditions. A wide variety of softwares are available in the market for the purpose of traffic simulation.PTV VISSIM is one among them , which can replicate complex traffic situations, such as roundabouts and intersections, where numerous conflicts between modes of transport exist.

In the city of Silchar, where the numbers of vehicle owners are increasing day by day traffic congestions are predominant, an ambulance in the middle of heavy traffic, heavy traffic jam, long queue of vehicles etc. are common phenomenon here. The road conditions remains the same whatever be the increase in traffic, so its high time to do vehicle performance analysis and thus find a way to improve traffic efficiency. The intersections present in silchar are mostly unsignalised, traffic lights are absent in the city. 'T' intersections are common followed by rotary. For the purpose of analysis a rotary intersection at *Ranghirkari* has taken.

Traffic survey had done over the study area and required datas were collected. The data includes traffic volume, vehicle speed, geometry of road, types of vehicle plying, type of road. As per the data from field a model has been created on the software, PTV VISSIM.

2. FIELD DATA

Field data for the study was collected by a video graphic survey. The video was later replayed and the data regarding volume count was collected. The vehicles found was classified as Car, two wheelers (2W), three wheelers (3W), heavy vehicles (HV).

Traffic speed data was collected using radar gun. Speed of individual vehicles have noted and distribution profiles were created

Table 1 Vehicular data

Vehicle	Length(m)	Breadth(m)	Height(m)
Swift	3.85	1.69	1.53
Wagonr	3.59	1.47	1.67
Dzire	3.95	1.69	1.55
Sumo	4.25	1.7	1.925
Alto	3.50	1.28	1.72
Auto	2.65	1.6	1.47
Van	5.53	2.47	2.50
HGV	9.74	2.43	11
Bikes	2.05	0.75	1.17

Table 2. Mode Split

Vehicles	Percentage (%)
Car	14.94
Bike	40.11
Auto	34.49
Truck	1.39
Cycle	8.20
Van	0.85

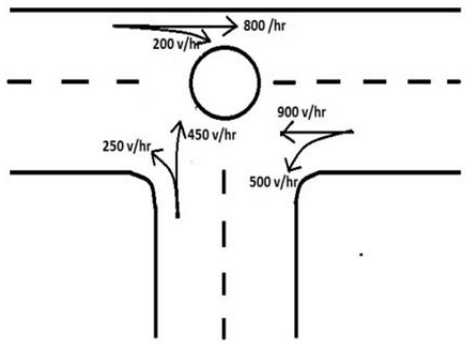

Fig. 1. Traffic volume

Table 3. Speed values adopted

Vehicle	Speed(Km/hr)
Car	20
HGV	15
Bike	20
Auto	25

3. TRAFFIC SIMULATION

3.1 Simulation parameters

Before a simulation starts, a number of parameters can be setup to define the framework of the simulation. Some of the options available and relevant are,

- *Period* which defines the period of time to be simulated. In the simulation a time period of 10minutes (i.e. 600 seconds) are simulated to allow for all vehicles to flow.20 simulations for a period of 10minutes have done with different combination of vehicles and the average value of each has taken as inference.
- *Start time* states at which time at the day the simulation start.
- *Simulation resolution* which describes the number of times a vehicles position will be calculated within one second of the simulation. Basically, having more calculation steps per simulated second generates a more accurate representation of the vehicles position in the model. On the other hand, having more calculation steps leads to a higher demand on computing capacity. In order to obtain accurate results while not putting too high demand on computing power, a simulation resolution of 10 time steps per simulation second is used in this simulation.
- The *Random seed* initialises the random number generator where a change in this number changes the profile of the traffic arriving and therefore the simulation result changes, even with identical input files.

3.2 Simulation steps

Fig. 2 shows the ranghirkari intersection, traffic survey was conducted on the same and various data's, including traffic volume vehicle speed , geometry of road etc. has collected, which is shown in fig1 and table 3. Speed data has collected using radar gun. Fig 3 shows the simulation ,it's a combination of links and connecters which will be getting after applying the data obtained from traffic survey. Vehicle compositions, vehicle types & classes also to be assigned for getting desired results.

Fig. 2. Intersection (Ranghirkari)

Fig. 3. Simulation of Ranghirkari

3.3 Traffic flow from field data

Traffic flow is expressed in terms of vehicle per hour. Field data is calculated by taking vehicle count for 10 minutes, likewise 2hr data was formulated i.e. twelve 10 minutes segments. The average of these 12 segments were taken as the volume for 10 minutes and its been converted for per hour duration. The traffic volume was found out to be 3100veh/hr.

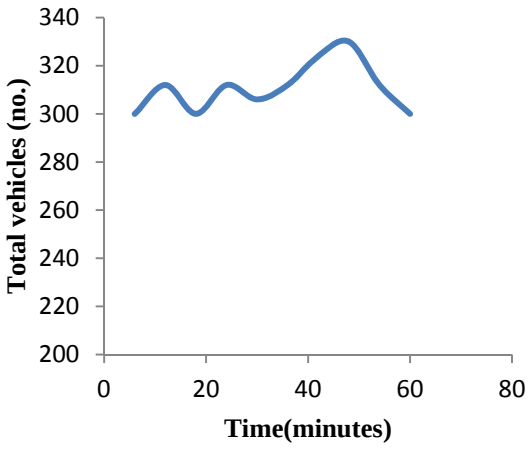

Fig. 4: Traffic flow curve from field data

3.4 Simulation of field data by VISSIM

The algorithm behind the software is car following method, according to which 10parameters(CC0 – CC9) serve the backbone of simulation. The basic input data for VISSIM is road geometry, traffic volume & speed data's. The simulation initially run with the default CC parameters.The acceleration characteristics of different vehicles were estimated on Indian highway by Shukla and Chandra (2011),the same values were adopted for the present study.

On doing initial simulation wit default parameters mentioned in table4 the flow capacity was found out to be 3018veh/hr. An error of 4% was accumulated by running the simulation. Calibration has to be done to reduce the error. Fig. 5 shows the variation of traffic flow between field & simulated

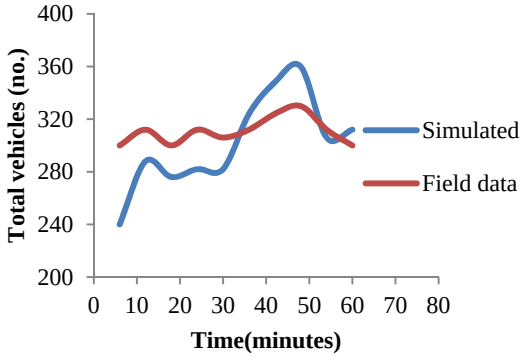

Fig. 5. Comparison between field & simulated flows

Table 4. Default CC parameters

CC parameters	Default values
CC0	1.5m
CC1	0.9s
CC2	4m
CC3	-8.00
CC4	-0.35
CC5	0.35
CC6	11.44
CC7	0.25 m/s2
CC8	3.5 m/s2
CC9	1.5 m/s2

4. CALIBRATION OF FIELD DATA

From the sensitivity analysis it came to know that CC0 & CC1 are the most sensitive parameters, hence calibration of those two will helps to improve the result. As an initial step CC0 & CC1 for homogenous condition has to be analysed. Table 5 shows the simulated results for homogenous traffic conditions

Table 5. Simulated results for homogenous traffic conditions

Homogenous type	Field volume (veh/hr)	Simulated volume (veh/hr)	CC0(m)	CC1(sec)
Car	4680	4380	1.1	0.45
2W	12775	12540	1	0.5
3W	10428	10200	0.9	0.48
HV	749	768	7	5

After getting the CC parameters for homogeneous conditions, its converted to heterogeneous condition by weighted average method .

- $CCO_{mixed}=CC0_{car}*P_{car}+CC0_{auto}*p_{auto}+CC0_{2W}*p_{2W}+CC0_{HGV}*p_{HGV}$
- $CC1_{mixed}=CC1_{car}*P_{car}+CC1_{auto}*p_{auto}+CC1_{2W}*p_{2W}+CC1_{HGV}*p_{HGV}$

Default CC parameters CC0 = 1.5m, CC1 = 0.90s

Calibrated CC parameters CC0 = 1.13m, CC1 = 0.58s

Fig. 6 shows the comparison of calibrated, simulated & field data, the calibrated volume was found out to be 3090 veh/hr

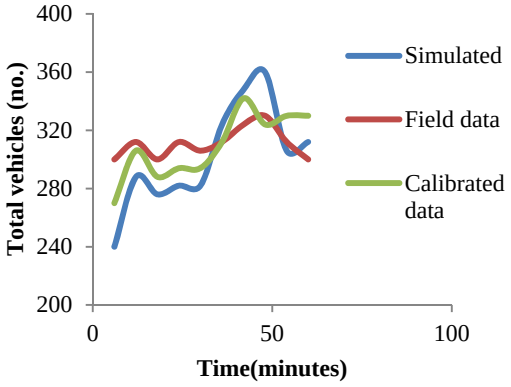

Fig. 6. Calibrated traffic flow

5. CONCLUSION

The traffic simulation and the calibration for the heterogeneous traffic was done, CC parameters were determined for heterogeneous conditions, it is found that an error of only less than two percentage in between field and calibrated traffic flow. The result hence found reliable. Further studies can be done by checking sensitivity of other Wiedemann parameters.

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