Microsimulation Modelling in Vissim for Longterm Improvement of Cement Junction, Nattakom

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***Abstract*: - Travel efficiency and traffic safety of nonsignalized intersections are two main objectives considered in traffic management and control. Traffic analysis at nonsignalized intersections has always been a difficult process to carry out with the ever- increasing volume of vehicles. Cement junction is a three-legged intersection situated at Kottayam district in Kerala. The ineffective signalling and lack of space leads to long queues in the intersection and improper positioning of bus bays in the influence zone of the junction cause heavy traffic congestion during peak hours. The focus of the study is to investigate the current situation and to developing a signalized intersection model of intersections to reduce the traffic congestion and smooth movement of traffic flow. Seeking appropriate control mechanisms with the help of traffic simulation software is an effective way to solve the problem. By using VISSIM micro simulation software we created the model and ran simulations with signals fitted to model and compared the queue length and suggest that model for long-term solution for the trip makers at Cement junction.**

Keywords: VISSIM, Intersection, Traffic simulation, Queue Length

I. INTRODUCTION

The increasing traffic congestion has become a major problem in many of the developing metropolitan areas across the globe. Peak hour traffic congestion has become something everyone has to face due to the way in which the current society operates. The timings which are in place in different parts of the world has led to the inevitable overloading of the existing roads every day. The alarming issue is that in spite of many of the remedies that are tested out to reduce the traffic congestion, there has not been any major improvement in this aspect. The traffic is only getting worse with every passing year.

II. SCOPE AND OBJECTIVES

The main objective of this study is to elucidate traffic congestion Pala Civil Station, Kottayam, Kerala by proposing a suitable traffic improvement proposal for long term solution. This is done on the basis of the data and conclusions obtained from the traffic studies conducted on the considered area.

For achieving this, the objectives of the study are as follows:

(1) To find traffic improvement proposal for long term span.
(2) To carry out surveys in the study area including traffic volume survey, topographic survey.
(3) To analyse and evaluate intersections performance and recommend enhancing measures.
(4) To establish relative importance of any route or road facility.
(5) To minimize the number of potential conflicts and their severity.
(6) To identify the various factors governing the traffic congestion.
(7) To design the intersection on the basis of outcomes of traffic volume survey.

III. AREA OF STUDY

Cement Junction is situated in the district of Kottayam, Kerala. For the research purpose, we are focusing on the 3- legged intersection in that area. One road is in the direction of Kottayam and the opposite to Nattakom and the third one istowards Kumarakom.

Figure 1: Survey Site (Map)

IV. METHODOLOGY

(1) Traffic Volume Study

Traffic volume is the number of vehicles crossing a section of a road at any selected period of time. Traffic volume studies were conducted at the intersection of the cement junction. There were six routes Kottayam to Nattakom, Nattakom to Kottayam, Nattakom to Kumarakom, Kottayam to Kumarakom, Kumarakom to Kottayam and Kumarakom to Nattakom.

Routes	PCU
Kottayam to Nattakom	2335
Nattakom to Kottayam	2918
Nattakom to Kumarakom	665
Kottayam to Kumarakom	394
Kumarakom to Kottayam	741
Kumarakom to Nattakom	747

Table 1: PCU through each route

(2) Survey Methods

Traffic survey is the important part of any intersection design. Nowadays there are several methods of conducting traffic volume surveys. The most well-known technique involves employing personnel at the vantage points in the junction and manually noting down the traffic volume with respect to the various vehicle classifications include 2 wheeler, 4 wheeler, heavy, etc. in terms of Passenger Car Units (PCU). Here we recorded the intersection from a nearby tall building having a visibility to intersection & 3 roads.

(3) PCU

Vehicles of different classes of are found to use the common road way facilities. To estimate the traffic flow the different vehicle classes they are converted, i.e. to one common standard vehicle unit. The common practice is to consider the passenger car as a standard vehicle unit to convert the other vehicle classes. The unit is called PCU.

Table 2: IRC: 70-1977 Recommended PCU Factors for Various types of Vehicles in Urban Roads

Sl. no	Vehicle type	Equivalent PCU factors: Percentage composition of vehicle type in traffic stream	
	Fast vehicles	5%	10 %
1	Two wheelers – motor cycle, scooter, etc...	0.5	0.8
2	Passenger car, pick-up van	1	1
3	Auto-rickshaw	1.2	2
4	Light Commercial vehicle	1.4	2
5	Truck or bus	2.2	3.7
6	Agricultural Tractor – trailer	4	5

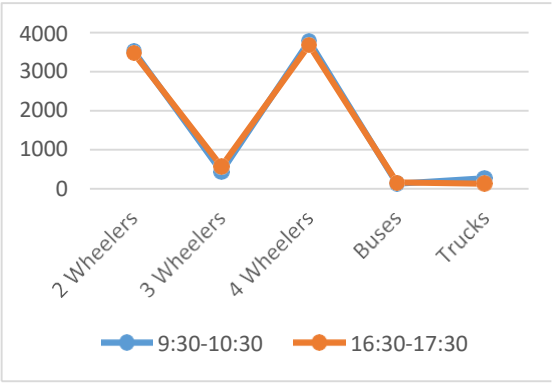

Fig 2: Graphical Representation of the type of vehicles passing through the intersection at peak hours.

V. SIMULATION

A. DESIGN OF INTERSECTION MODEL

VISSIM has various features, such as traffic flow, modelling, traffic light engineering, vehicle queue length analysis, pedestrian simulation, and also script-based modelling. Simulation provides us the advantage of being able to study how the created model behaves dynamically over time or after a certain span of time. A traffic characteristic on roads as a system varies with time and with a considerable amount of randomness and simultaneous interactions.

At first we have to make the intersection model as a satellite image of the selected section of roads. On the basis of scale in the image, the map is scaled to match the model's measurements to the actual intersection measurements. The modelling procedure begins by sketching straight roads and joining them directly to the intersection map. In places where roads crossing conflict areas appear where the priority of vehicles in the event of an uncontrolled intersection needs to be defined.

Figure 3: Formation of Routes in Software

After the model has been made, all the components have been added to the model. First is vehicle inputting, which is adding the vehicle volume to the model. The total vehicle flow through each entrance is added to the table shown in the fig-5 and assigned vehicle routes.

Vehicle volumes by

Count: 3	No	Name	Link	Volume(0-MAX)	VehComp(0-MAX)
1	1		4: Nattakom to Kumarakom	1488.0	1: Default
2	2		6: Kottayam to Nattakom	2729.0	1: Default
3	3		2: Nattakom to Kottayam	3583.0	1: Default

Figure 4: Screenshot of Vehicle Input

B. SIMULATION RESULT

The simulation is basically a real-time traffic flow according to the inputted data. The simulation was run in 3600 seconds and we gotgood results. At some point the vehicles had tobe stopped due to the conflict zones. The signal timing also affected the queueing of the vehicles. After performing the simulation we get a set of results which includes:

- Queue length
- Vehicle delay
- Stops

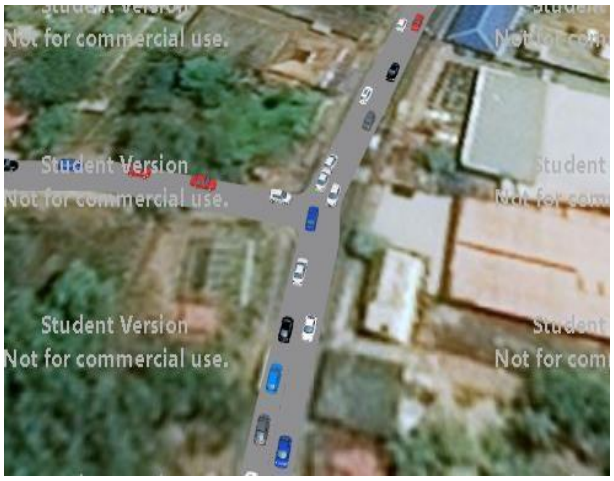

Figure 5: Simulation at the intersection

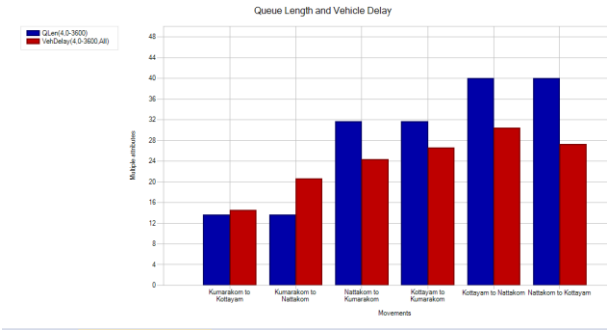

Figure 6: Final Simulation Result

VI. CONCLUSION

The present study focuses on suggesting long- term improvements at Cement junction. A traffic survey is conducted and determines the vehicle flow through each entrance. Optimum signal cycle time corresponding to minimum total delay to all the vehicles at the approach roads of the intersection is determined. . The performance evaluation of the junction was done with the several parameters taken during the course of the study. Based on the performance evaluation which was done at the junction, several improvement measures were suggested, out of which the most feasible alternatives have been suggested as a further step in improving the existing traffic scenario. Owing to the growing financial capacities of the common man, more and more vehicles are coming out on the roads. And thus, there is a need to increase the transport and road infrastructure to cater to the needs and demands. This is an important step in the same direction. When properly designed, traffic signals and flyovers can increase the traffic handling capacity of an intersection, and when installed under conditions that justify its use, it will be a valuable device for improving the safety and efficiency of both pedestrian and vehicular flow.

REFERENCES

[1] Parameters Influencing Lane Flow Distribution on Multilane Freeways in PTV Vissim; Claude Marie Weylanda, Marvin V. Baumanna, H. Sebastian Bucka, Peter Vortischa (2021)
[2] Micro-simulation Modelling in VISSIM on Short-term and Long-term Improvements for Mangalore City Road Network; Marsh M. Bandi, Varghese George (2020)
[3] Design and evaluation of a new intersection model to minimize congestions using VISSIM software; Jana Fabianova, Peter Michalik, Jaroslava Janekova, Michal Fabian (2020)
[4] Traffic Flow Simulation using VISSIM Software; Manoj Kumara, Praveen Aggarwal (2019)
[5] Traffic Management in the city of Port Blair; Madhu Errampalli, Ravinder Kayitha (2018)
[6] VISSIM simulation-based analysis for improving traffic conditions in Bandung Indonesia; Eko Wahyu Utomo, Fadillah Ramadhan, Arif Imran (2020)
[7] Modelling traffic flow emissions at signalized intersection with PTV Vissim; Kudrat Kutlimuratov, Shaukat Khakimov, Akmal Mukhitdinov, Rustam Samatov (2021)
[8] Simulation of Rotary Intersection at K.R. Hospital Junction; Dayananda H S,Manoj P, Ram Kumar P, Gagana D (2019)
[9] Traffic Queuing Analysis on Chord Road, Vijayanagar, Bengaluru using PTV Vissim Software; Ramkrishna P Jagali, Rahul L Kadam (2016)

[10] Vissim as a Simulation Tool for Analyzing Over-Saturated Signalized Urban Intersections with Heterogeneous Traffic; S. Pradeep Reddy, P. R. Bhanu Murthy (2021)
[11] MICRO SIMULATION MODELLING OF AN URBAN CORRIDOR IN PTV VISSIM; Swati Goyal, Sonal Bhugra (2021)
[12] Analysis of traffic density on three-way junction in Jalan Sukabangun 2 using Vissim simulations model; ErnyAgusri, , Muhammad Arfan (2021)
[13] PERFORMANCE EVALUATION AND IMPROVEMENTS TO PALA CIVIL STATION JUNCTION; Adithya Abhayalal, Arya Mohanan,Dinoy P Jose, Agaja G(2021)
[14] Microsimulation Modelling in VISSIM for Long-Term Improvements in Kuruppanthara Junction; Alvin Jose James, Amal Prasad, Brinda P Ashok, Reshma Ramachandran, Arun Issac Varghese (2021)
[15] Optimization Model of Unsignalized Intersection to Signalized Intersection Using PTV. VISSIM: Study Case in Imogiri Barat and Tritunggal Intersection, Yogyakarta, Indonesia; Muchlisin, Ikhsan Tajudin, Wahyu Widodo (2019)