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Evaluation of Traffic Signal at Nagawara Intersection, Bangalore

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Abstract

Bangalore being an International City is having the maximum number of wheels giving rise to an immense traffic congestion in which people are expected to spend an average of 71% extra travel time being stuck in traffic according to studies conducted by the Tom-Tom traffic index dated Jan 30 (2020) precisely at signalized intersection and especially during peak hours. The objective of this paper is to improve the flow of vehicles paving the way for reduced congestion using VISSIM software. The study area selected for the project is Nagawara junction. Since the intersection is crowded during peak hours and intersection gets jammed due to buses stopping near the signal for passengers to board. Traffic volume analysis is being conducted in order to obtain the various parameters required for the feasibility check of the proposed simulation. The various parameters considered for the study are traffic volume data, road dimensions, delay factor & queue counter, these are analyzed which helps in designing the control signal at junction. The project focuses on redesigning the signal at intersection to facilitate the better movement of traffic.

Keywords: *VISSIM Software, intersection, traffic volume data, delay, queue counter*

Introduction

As most of the metropolitan cities in India Bangalore is having heterogeneous traffic moment and hence it is not only needed but also mandatory that traffic system should be designed as for needs of basic and also projected traffic. Intersection is the point where it can hold up the traffic and smooth moment of the vehicles in transportation network [1]. Bangalore traffic keeps on increasing if designed for lesser then the traffic expected. During the peak period it leads to vigorous problems to smooth traffic especially in intersections, which leads to traffic congestion and delays. In the administrations and governments is very hectic and very serious issue nowadays.

At convergences where there are an enormous number of intersection and right-turn traffic, there is plausibility of a few mishaps as there can't be efficient developments. On go across streets with two-path two-route traffic, there are 16 intersection clashes [2]. The issue of such clashes at the crossing

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point acquires noteworthiness as the traffic volume increments. In this way traffic signals are made at convergence. The limit of a signalized convergence relies upon physical elements of streets, for example, roadway width, number of paths, geometric plan highlights of crossing point and further more the green and red periods of traffic signal.

Collection of traffic volume data is a essential requirements for organizing the road advancement with the present requirement [3]. Traffic information diagrams vital part in the examination of clear national financial issues and such information is chief in drawing up a commonsense vehicle approach for development of explorers and things by both government and the private divisions. Considering this guideline the way that traffic flow information is colossal in planning of a specific region of the street form and for its resulting upkeep. Traffic stream design shows up, evidently, to be emotional in dispersing, as it mirrors individuals' inspiration as for varying relationship of vehicles on various sorts of paths under fluctuating ordinary conditions. It follows then that information being collected is a methodological encounters, since traffic stream arrangement follows an abstract spread [4]. Not withstanding such complexities, it follows reasonably and plainly depicted plans that are conceivable to ask for and independent. Thusly, traffic information assortment and appraisal follows changing models and acknowledge a significant action in the assessment and the main gathering of street engineer plans [5]. While taking consideration regarding the recently referenced, traffic stream information is required for various purposes by various Ministries similarly as Organizations in Botswana. The regions for which the data is required are:

- Prioritization of planning.
- Structure of project.
- Planning upkeep.
- Transport of National Statistics.
- Safety Measures for road.
- Controlling of traffic.

Understanding the importance of the size of traffic information which is required to be gathered, at that point to decide the quality and also sort the vehicle grouping to be considered. Traffic which includes falls in two primary classifications, to be precise; manual calculations and software checks. There is no indisputable differentiation between the two methodologies in any case, the money related use or decision of a fitting procedure for traffic checking is the segment of traffic level and quality of fundamental data.

Manual Counts: Most broadly used type of collecting traffic volume data is the manual count method, which contain assigning a person to record traffic as it passes. This procedure for data grouping can be exorbitant to the extent work, yet it is regardless significant generally speaking where vehicles are to be masterminded with different advancements recorded autonomously, for instance, at intersection focuses. At intersection point areas, the traffic on each arm should be counted and recorded autonomously for each improvement. It is of principal hugeness that traffic on avenues with more than one way are counted and requested by direction of traffic stream. Constant traffic-checking bunches are regularly set up to do the counting at the various territories all through the road organize at set between time. The length of the check is settled going before commencement of traffic counting and it is coordinated by the end use of data. The gatherings are administered and guided by the specific staff to ensure capable and fitting combination of data.

Programmed checks: Area of the vehicular proximity and road occupants has for the most part been performed on a very basic level on or near the outside of the road. The abuse of new electromagnetic spectra and remote correspondence media in continuous year, has allowed traffic acknowledgment to occur in a non-nosy structure, at territories above or to the side of the roadway. Black-top based traffic area right now reasonably modest, will be met with wild competition in the coming quite a while from pointers that are liberated from the road surface [6].

The types of detectors are:

- Pneumatic tubes
- Inductive loops
- Weigh-in-Motion Sensor types

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- Micro-millimeter wave Radar detectors
- Video Cameras

By using HCM manual the relevant data obtained from the field, is used to calculate delays, level of service, capacity of the intersection and relevant measures are calculated using HCM manual and results compared to obtained results after simulation.
After data obtained we can develop a micro simulation base model of exact field condition and delay model in VISSIM Software.
We can also picture the recreation model not only we get the proper outcomes from VISSIM software. The exact current circumstances can be effortlessly comprehended. The VISSIM simulation model is widely accepted software as it gives significantly same yield as got information.

Objectives

The following aspects are mainly concentrated, in this study:

- Collection of field traffic data to analyze and forecasting the present and future traffic trend.
- Analysis of predicted data using VISSIM software to identify delay at intersections.
- Suggestion for improvement of transport facility to meet the future growth of traffic.
- The field data and estimation of delay has to analyz
- The output from the simulation and compare with field data has to be analyzed.

Methodology and Analysis

The various steps involved in the methodology are as follows:

- The very first step is selection of intersection for the study.
- Once the selection of intersection is done the next step is to gather the geometrical information of site manually.
- After which the traffic volume count as per IS regulations is carried in the prescribed manner.
- Next by making use of HCM manual after collecting basic data from the field delays and queue length id calculated.
- By using output obtained from the calculations after the validation it is subjected to various suggestions and mitigation measures and can be implemented.

DETAILS OF THE STUDY AREA

BASIC INFORAMATION

Nagawara intersection

Due to heavy traffic or capacity of the road this junction is selected since high saturation value and delay in that particular section. The delay leads to present traffic conditions. The following are the reasons for selection of location Nagawara Junction.

- In all days heavy traffic can be seen especially on week days because it is situated at the centre which connects to IT sector like Manyata Tech park, K.R Puram, Silk board, White field.
- Especially in peak hours there will be maximum delay due to heterogeneous traffic.
- Through volumes expected at the intersection because it is a signalized intersection operating 4 phases and having heavy turning.
- Number of BMTC buses are more since during peak hours number of bus users are more.

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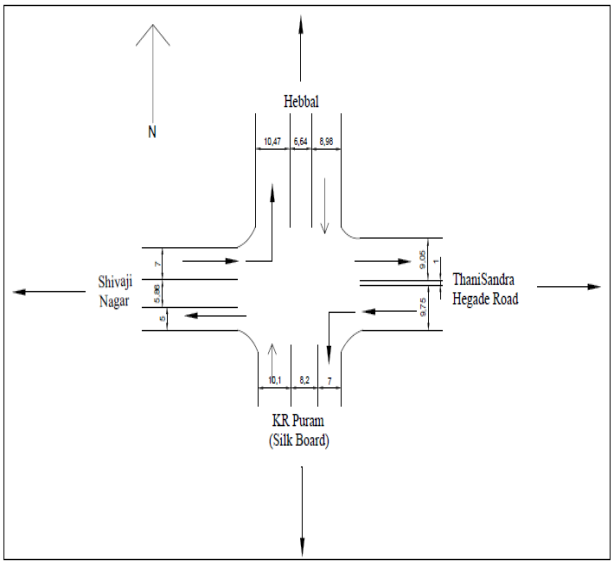
Google map of Nagawara intersection

Data Collection (Site measurements)

Nagawara Intersection

The manual measurements are done and the results are:



Top view of Nagawara intersection

Traffic volume data collection

- Traffic data were collected during morning peak period (7:00AM-11:00AM) and evening peak period (4:00PM to 8:00PM) on two weekdays and two weekends. Monday, Tuesday, Saturday and Sunday.
- Conducted the classified traffic volume count to determine the average delay at the intersection.
- All the data converted to PCU values.

SOFTWARE DESCRIPTION

MICROSCOPIC SIMULATION PROGRAM

Basic Principle

There are two types of simulation models, they are microscopic and macroscopic simulation models. The Microscopic simulation takes indusial entities and their interaction, in microscopic simulation is based upon the volume, depends on the demand-based operation, considering the traffic as a whole.
Microscopic collects more data than macroscopic simulation, and HCM type analysis. Only the level of effort is required by the problem being studied.
If average performance of the highway system is sufficient for the problem then the analytic approach contained in HCM are being studied.

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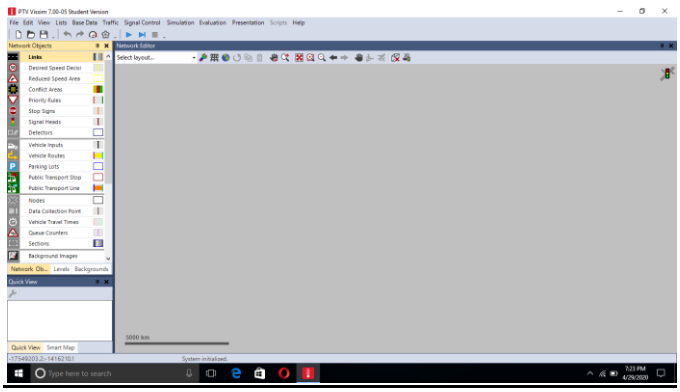
Micro simulation will be required if conditions are very close to breakdown, to be precise . For situation where the projected demand is greater than capacity, there may be the need of micro simulation for the better performance statistics.

Micro simulation analysis steps:
Basically the steps involved in a Micro simulation are:

1. Identifications of purpose, scope and approach:
   For determining the ultimate cost and schedule for the micro simulation this scoping step is critical.
2. Data collection:
   The collection of input data for the micro simulation model as well as selected output data for calibrate the model involved in this step.
3. Coding:
   This step is where the analysts convert the field data into inputs for the Micro simulation model
4. Error checking:
   For the coded input it verifies the accuracy in this step.
5. Calibration:
   Where the analysts adjust the default parameters in the standard behavioral model contained in the Micro simulation software to local conditions.
6. Alternative testing:
   This step is the purpose for which the micro simulation models were developed.
7. Documentation:
   The results of the alternative analysis, the validity of the model, information on the inputs to the models is provided by the documentation.
8. Presentation of the results:
   This step is where the analysts present the micro simulation results to the decision maker and for the public.

VISSIM
The software package VISSIM is part the PTV vision software suite as well and provides microscopic simulation methods for assessing and solving a wide range of transportation problems. The heart of VISSIM includes scientifically approved models for car-following, lane changing and pedestrian moments. Simulation includes road users, public transport, pedestrians, and their intersections with each other. All is based on an integrated network model of roads and trails along with their control methods as well as pedestrians infrastructure to control with them. .The multi-model network is then used by the cars, HGVs , buses ,LCVs and trams as well as cyclists and pedestrians- only to name a few. During the simulation a wide selection of evaluations are available for online and offline analysis. Another characteristic is an animated visualization in 2D and 3D, which offers an instant comprehension of the simulated traffic simulation and fills the gap between the technical expertise and non-technical audience.



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VISSIM Background Image

Areas of Application for PTV Vissim

- Traffic Flow Simulation.
- Advanced Traffic Management Systems.
- Multimodal Systems.
- Autonomous Vehicles and New Mobility.
- VR Traffic Simulation.

SIMULATION RESULTS

By using VISSIM, software simulation results were obtained for intersection and compared input delay value or in other words, simulation had been done with the parameters of VISSIM and with input of field data. Whether software considered is valid or not if the first objective of the simulation run has to be checked. To validate the software, field delays are compared with the first simulation run i.e. using default parameters of the software and the obtained results holds good if converge up to 85% or more. The default parameters of the VISSIM are shown in the below table 5.1 in the table shown below by using simulation software are calculated and tabulated the results of the appropriate proposal is given to optimize the traffic signals by varying signal timings and partial grade separated intersection results in decrease in delays and various traffic parameters.

Defaults parameters of VISSIM

Link Data	No. of lanes on each link=2 Behavior type= urban(Motorized) Lane width= 3.5m
Vehicle types	Cars, bike, auto, Govt.bus, LCV, HCV
Signal control	Amber= 3sec
Car following Model	Weidam 174
Driving Behavior	Look ahead distance= 250m Look back distance= 150m Min headway= 0.25m Behavior at Amber= Go as green

Field Delay Results

In the below table by using field data collected with the help of HCM manual field delay values are calculated and results are tabulated.

Nagawara intersection

The signal timings details are directly taken from the junction

Input Parameter		**Towards Thanisa-ndra Hegade Road**	**Towards KR Puram Road**	**Towards Shivaji Nagar Road**	**Towards Hebbal Road**
Cycle length, C (s)	**C**	360	360	360	360
Effective green-	**g/**	0.272	0.219	0.247	0.208

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to-cycle-length ratio, g/C	**C**				
v/c ratio for lane group, X	**X**	0.281	0.258	0.278	0.261
Capacity of lane group, c (Veh/h)	**C**	6000	6000	6000	6000
Arrival type, AT	**AT**	3	3	1	1
Length of segment, L (km)	**L**	0.4	0.8	0.6	0.4
Initial queue, Qb (Veh)	**Qb**	0	0	50	50
Urban street class, SC (Exhibit 10-4)	**SC**	III	III	III	III
Free-flow speed, FFS (km/h) (Exhibit 15-2)	**FFS**	55	55	55	55
Delay Computation					
Uniform delay, d l (s)	**d1**	180.47	181.622	181.71	182.095
Signal control adjustment factor, k(Exhibit 15-6)	**k**	0.5	0.5	0.5	0.5
Analysis period, hr	**T**	1	1	1	1
Upstream filtering/metering adjustment factor, I(Exhibit 15-7)	**I**	1	1	1	1
Incremental delay, d2 (s)	**d2**	0.0468	0.0834	0.06930	0.04238
Initial queue delay, d3 (s)	**d3**	0	0	37.5	37.5
Progression adjustment Factor, PF(Exhibit 15-5)	**PF**	1	1	1.58	1.25
Control delay, d (s)	**d**	180.516	181.705	324.286	265.16

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LOS Determination					
Segment travel speed, ST (s)	**S T**	24.31	22.54	24.67	23.69
Segment LOS		F	F	F	F

Conclusion

1) The road width provided and the traffic signal provided is sufficient for the traffic volume of the intersection.
2) The delay found to be more, hence further improvement in present signal is required.
3) It is observed that BMTC buses are stopping near the intersection itself which is blocking the traffic at the intersection. As per IRC guidelines for the bus stops should be 75m away fro the intersection. It is suggested to relocate the bus stops further or any other point.
4) The pedestrian movement is high during the peak hours, pedestrian signal must be provided for the safe movement of traffic.
5) It is also observed that vehicles from the service road enter from the opposite direction, due to which possibility of collision of vehicles is more.
6) The optimization process is very time consuming for a larger complicated networks, improvement of the performance of the software frame work is highly recommended.

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