Travel Time and Congestion Analysis under Heterogeneous Traffic Condition

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Abstract: -- Now a day's vehicle population growth keeps on increasing, due to this there is more congestion among the traffic. The sudden development of economic status of people urges them to buy more vehicles, beyond their demand and this leads to congestion. This congestion causes time delay during their travel. In this study, the main objective is to reduce the congestion and travel time among the intersection using the modern simulation software technology (VISSIM 7). The traffic data among the intersection are observed manually, then the readings are given as the input for the VISSIM software and it is simulated. The simulation results were analyzed to give the perfect solution and then the solution is again simulated in that VISSIM software to know the consequence of the solution. By using this software we can able to give a solution that effectively reduces the congestion and travel time. In this project, the study area taken under consideration was Periyar Bus Stand in Madurai. The study area is a four-arm intersection with a high number of vehicular traffic.

Index Terms: - Modelling, Simulation, VISSIM 7 Software, Congestion and travel time analysis.

I. INTRODUCTION

Tamil Nadu is one of the most vehicle using states in India, here there is more congestion due to heavy traffic volume and density. The number of vehicles registered from 2016-2017 was 1,905,618 till September. Total number of vehicles registered from 2004-2017 was 17,444,263. According to the survey transportation department collects more revenue than other department. These problems of congestion and travel time exceedance can be solved by using either microscopic simulation tool [1]. And also can be reduced by using analytical and mathematical formulae the congestion of traffic flow and volume of the traffic was mitigated [2].So in this study our project is to simulate a heterogeneous traffic model and to give a better solution to reduce the congestion as well as the travel time of the traffic flow. And to reduce the pollution caused due to the mass density of the traffic flow which produces harmful pollutants such as CO_2, NO_2, etc., The main reason behind selecting this area for the study is, it is the hotspot of Madurai which connects the various important places in Madurai such as Madurai junction Railway station, Madurai Meenakshi Amman temple, Bypass Road (Through 70feet Road), Madurai Periyar Bus stand.

NEED FOR THE STUDY:
- There is need for mitigate the congestion due to the excess of the traffic flow.
- More fuel consumption affects the economical expenditure for the transportation needs.
- More congestion registers the carbon foot print over the area and leads to the emission of harmful pollutants like NO_2, Etc.,
- Congestion of traffic makes stress over the people through the noise pollution.
- Delay in travel time.

OBJECTIVES
- To reduce the travel time and congestion among the traffic flow.
- To analyze the Signal timings and traffic volume.
- To simulate the heterogeneous traffic model for the peak value of the traffic data.

METHODOLOGY:
The methodology which is adopted for the present study is to simulate the data analyzed by VISSIM 7 software and to provide a better solution.
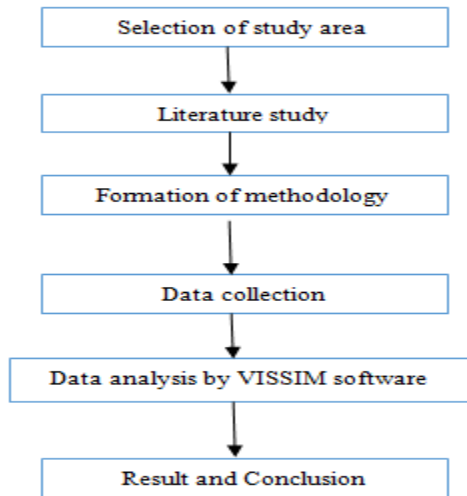

Fig. Methodology Chart

DATA COLLECTION

The traffic data was collected during morning and evening for six days on 22.07.2017 to 27.07.2017. The data was collected from 9:00 am to 11:00am and in the evening 5:00 pm to 7:00 pm. According to our survey these timings consumes more traffic than other time at the Periyar bus stand intersection.

Traffic volume and type of vehicles are noted for each cycle.

LOCATION OF THE STUDY AREA:

The area of the study was Madurai Periyar Bus stand intersection which is the hotspot of the madurai which was located nearer to the bus stand, south to the madurai junction railway station, West to the Madurai meenakshi amman temple, East to the Bye pass road which was connected by the 70 feet road from the Ellis nagar.

R1-West veli street (Near bus stand)
R2-70 feet road

R3-West veli street (Railway junction)
SIGNAL TIMINGS:

SIGNAL	ROAD 1	ROAD 2	ROAD 3
RED	66	60	74
GREEN	27	32	18
AMBER	5	5	5

VEHICULAR COMPOSITION IN PERCENTAGE AT THE ROADS R1, R2, R3 WERE GIVEN AS FOLLOWS:

| Road	2W	4W	3W	Bus/Truck/ LCV
R1	70.45	11.36	13.63	4.54
R2	68.47	10.86	14.13	6.52
R3	55.55	22.22	13.88	8.33

2W- Two wheeler, 4W- LMV/SUV, 3W- AUTO/APE.

INFERENCE FROM THE TRAFFIC DATA

By analyzing the traffic data we can able to state that the two wheeler consumption in the intersection area is more than any other type of vehicles. And the least count of the traffic data is Bus/truck/lcv.

THE GRAPHICAL REPRESENTATION OF COMPOSITION OF VEHICLES AMONG THESE THREE ROADS R1, R2, R3 ARE GIVEN AS FOLLOWS:
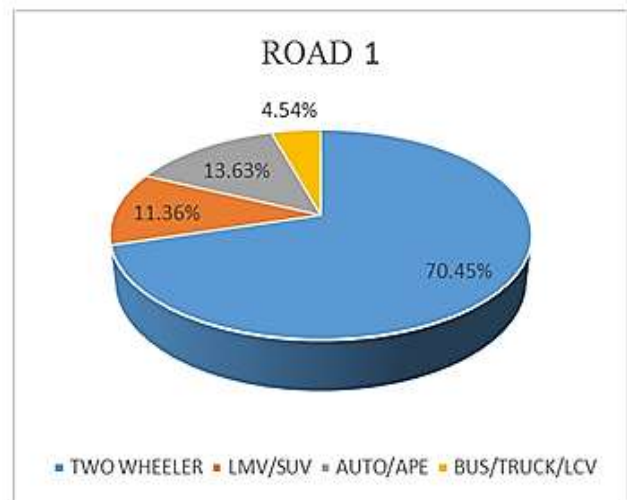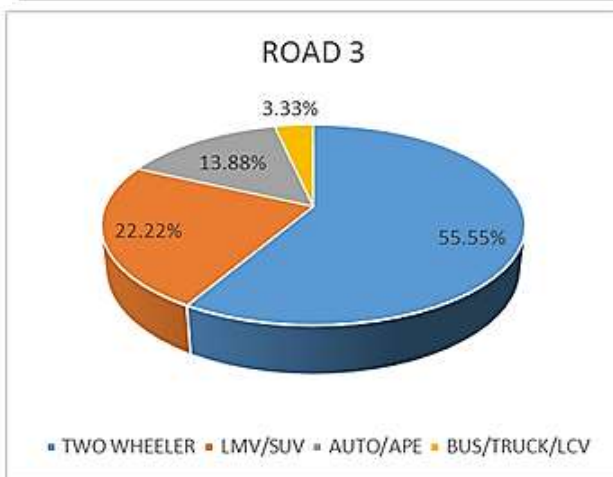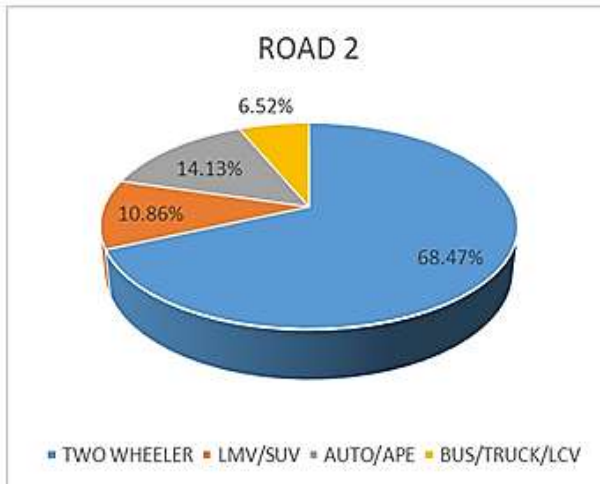
SIMULATION AND FINALIZATION:

After all inputs were given to the project, now it's the time to simulate the software.

- ➢ After the simulation process gets over the project software gives the output of the simulation at RSR file format, you can see the results using notepad.
- ➢ Other than that the results were easily understand by the lists that shown below the simulation work space.
- ➢ 3d view of the simulation

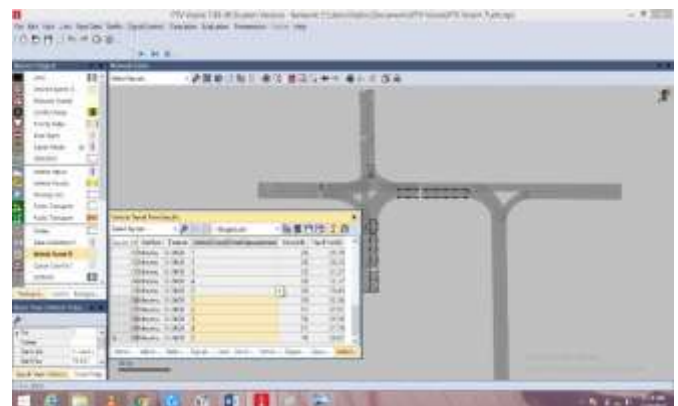| ROADS	QUEUE LENGTH
R1	45.23m
R1(2nd lane)	12.66m
R2	49.62m
R3	15.53m

SIMULATION RESULTS

The readings that were obtained by manual calculation that are noted for the each roads by signal to signal were made as input to the software according to the steps described above and the simulation was made to know the time travel and queue length that was obtained normally.

RESULTS OBTAINED FOR NORMAL TRAFFIC CONDITIONS:

MAXIMUM TRAVEL TIME OBTAINED FOR THE VEHICLES ACCORDING TO SIMULATION:

ROUTES	TRAVEL TIME
R1 to R3	74s
R1 to R2	51s
R2 to Nethaji road	39s
R2 to R3	51s
R3 to R1	74s
R3 to R2	39s
R1 to Nethaji road	51s

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MAXIMUM QUEUE LENGTH OBSERVED FOR THE VEHICLE ACCORDING TO THE SIMULATION:

THE SOLUTION: The solution that is recommended by our project for solve the problem of excess queue and maximum travel time is about constructing a roundabout at the centre of the intersection. Roundabout is an element used to reduce the travel time and the congestion of the traffic flow. The main use of this software is to make trial run and to analyze the consequences and the effect of the changes. So a simulation is made to run according to the new change that is constructing a roundabout within the intersection with the same peak traffic flow readings as the input to the simulation. Then the results were observed and gives the feasible solution for this problem of congestion and travel time.

MAXIMUM TRAVEL TIME OBTAINED ACCORDING TO NEW SIMULATION:

ROUTES	TRAVEL TIME
R1 to R3	8.78s
R1 to R2	6.46s
R2 to Nethaji road	6.86s
R2 to R3	6.46s
R3 to R1	8.56s
R3 to R2	6.86s
R1 to Nethaji road	8.56s

MAXIMUM QUEUE LENGTH OBSERVED FOR THE VEHICLE ACCORDING TO THE NEW SIMULATION:
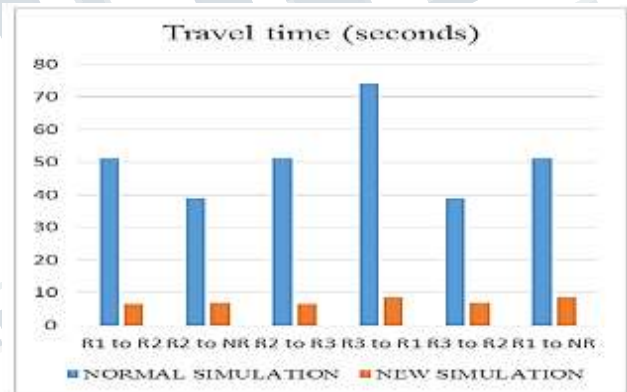
| ROADS	QUEUE LENGTH
R1	0m
R1(2nd lane)	0m
R2	0m
R3	0m

COMPARISION BETWEEN NORMAL SIMULATION AND NEW SIMULATION MAXIMUM TRAVEL TIME COMPARISION:

ROUTES	NORMAL SIMULATION RESULTS	NEW SIMULATION RESULTS
R1 to R3	74s	8.78s
R1 to R2	51s	6.46s
R2 to Nethaji road	39s	6.86s
R2 to R3	51s	6.46s
R3 to R1	74s	8.56s
R3 to R2	39s	6.86s
R1 to Nethaji road	51s	8.56s

GRAPHICAL REPRESENTATION:

MAXIMUM QUEUE LENGTH COMPARISION: GRAPHICAL REPRESENTATION:
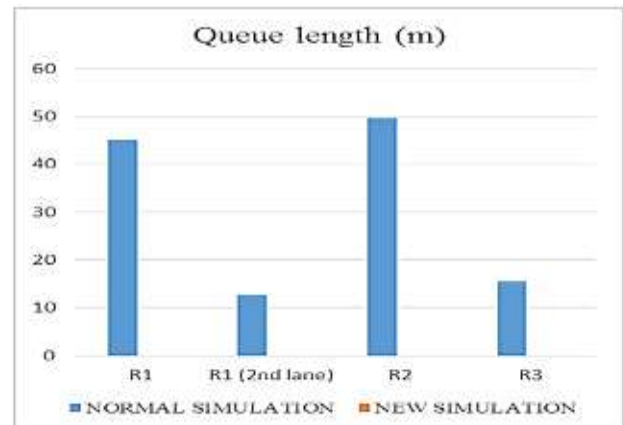
II. CONCLUSION

According to the simulation results we are able to conclude that the congestion and travel time of the traffic flow at the Madurai periyar bus stand intersection can be minimized by the Roundabout at the intersection. From our simulation we are sure that the maximum queue length of 49.62m can be reduced to 0m and the travel time can be reduced up to 80% of the signalized intersection travel time. By simulating the vehicle inputs and the vehicle routing decision at our initial simulation we can state that there is a queue formation over the roads R1, R2 and R3 and there is also some time delay during their travel. After the simulation of the roundabout in that intersection area we came to conclude that there is maximum reduction of travel time and the maximum queue length was reduced up to 0m. Hence the simulation model of this roundabout gives us the perfect view for mitigate the travel time and the congestion among the traffic flow.

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