Analysis of Traffic Congestion for a Corridor in Visakhapatnam

R. Srikanth [1], D.Preethi[2]

[1]PG Student, Gayatri Vidya Parishad College of Engineering (A), Madhurawada, Visakhapatnam, Andhra Pradesh, India

[2]Assistant Professor, Department of Civil Engineering, Gayatri Vidya Parishad College of Engineering (A), Madhurawada, Visakhapatnam, Andhra Pradesh, India.

Abstract:

Traffic congestion is the primary cause that has an impact on the community's economy, climate and quality of life. In this study, an approach is developed to the analyse the [1]traffic conditions at different junctions in Visakhapatnam. It is necessary to identify the reason for traffic congestion and to evaluate traffic patterns in order to take the most suitable steps for each location to minimise traffic congestion and effectively and efficiently implement countermeasures. In this study, five areas were identified: Kommadi junction, Car shed, Yendada junction, Hanumanthawaka, Maddilapalem, and studies of traffic volume and spot speed were conducted. The degree of service is calculated by using the free flow velocity equation in the Highway Capacity Manual based on different variables such as lane width and peak hour variables at these junctions. The standard of service and was obtained in some roads in all the junctions due to geometric problems and heavy traffic on different occasions such as weekends and festivals. Based on current conditions in the area, potential interventions have been suggested.

Keywords:

Delay, traffic volume, VISSIM software, fuel consumption, PCU, Level of service.

Background study:

Miao Yu, Wei (David) Fan: - In order to calibrate a microscopic traffic simulation model, this paper introduces several metaheuristic algorithms. It introduces and compares the genetic

---

R. Srikanth [1], D.Preethi [2]

[1] PG Student, Gayatri Vidya Parishad College of Engineering (A), Madhurawada, Visakhapatnam, Andhra Pradesh, India.

[2] Assistant Professor, Department of Civil Engineering, Gayatri Vidya Parishad College of Engineering (A), Madhurawada, Visakhapatnam, Andhra Pradesh, India.

algorithm (GA), Tabu Search (TS), and a mixture of GA and TS (i.e., warmed GA and warmed TS). A collection of traffic data obtained from the Los Angles, California, I-5 Freeway is used. In order to minimise the difference between simulated and field traffic data based on flow and speed, objective functions are described. To calibrate, multiple car-following parameters are selected in VISSIM that can significantly affect simulation outputs. As opposed to that, only using the default parameters in VISSIM, a better fit to the field measurements is achieved with the GA, TS, and warmed GA and TS. Overall, TS performs very well and can be used for parameter calibration. The combination of metaheuristic algorithms obviously performs better and is therefore strongly recommended for microscopic traffic simulation model calibration.

Geetimukta Mahapatra, Akhilesh Kumar Maurya: - The abreast manoeuvre of vehicles depends on the driver's actions, vehicle type and, most importantly, the traffic parameters such as vehicle speed and acceleration, on heterogeneous and no lane disciplined traffic. Therefore, when driving, drivers have two fundamental duties, firstly to monitor the position of the vehicle along the longitudinal direction of motion and secondly to monitor the position of the vehicle along the lateral direction, i.e. the width of the roadway. The relationship between the dynamic parameters (speed and lateral / longitudinal acceleration) can very well reflect the driving behaviour of vehicles with low or no disciplined lane traffic in combination. The study of longitudinal and lateral vehicle control in a systematic way is therefore important. In this paper, vehicle driving behaviour is analysed by evaluating longitudinal and lateral acceleration / deceleration (A / D) with operational acceleration. Speed of vehicles on various straight parts of road. Data is collected using a GPS-based instrument (Video-V BOX) mounted on five different types of vehicles from five major cities in India. Longitudinal A / D probability distribution and lateral acceleration are evaluated and their relationship with the operating speed of vehicles on roads with a lateral acceleration is studied.

The different number of lanes for various types of vehicles. For lateral and longitudinal A / D, respectively, a two-term exponential and linear relation to operating speed is observed.

Eric M. Laflamme a, Paul J. Ossenbruggen: - To examine two characteristics of recurrent congestion, this study uses regression models: breakdown, the transition from free-flowing conditions to a congested state, and length, the time between the onset and clearance of recurrent congestion. Second, we apply a binary logistic regression model where the likelihood of breakdown is predicted using a continuous calculation of traffic flow and a dichotomous categorical time-of-day variable (AM or PM rush hours). Second, we apply an ordinary regression model of the least squares where categorical variables are used to estimate recurring congestion period for time-of-day (AM or PM rush hours) and day-of-the-week (Monday or Friday). The models are equipped with data collected over a span of 9 months from a bottleneck on I-93 in Salem, NH**.**

The breakdown model findings estimate the probability of repeated congestion, are consistent with observed traffic, and demonstrate a change in the probabilities of breakdown between the AM and PM rush periods. Results from the congestion period regression model show the existence of substantial time-of-day and day-of-week interaction. Thus, the impact of the time of day on the length of congestion depends on the day of the week. This work offers a simplification of persistent, very noisy processes of congestion and recovery. Simplification is a realistic and effective method for traffic managers to use in the decision-making process, conveying complicated relationships with simple statistical summaries of facts**.**

Arpan Mehar, Satish Chandra, and S. Velmurugan: - The current study demonstrates the applicability of the VISSIM programme to assess, under mixed traffic flow conditions, the capability of multilane highways. The speed-flow curve is built using traffic flow data obtained on a segment of a four-lane split highway. In VISSIM, the same set of field data is used and the virtual velocity-flow curve is compared to the field curve. In its original form, VISSIM was found to overestimate both the speed and the capability of the highway. For homogeneous traffic conditions with only one of the four types of vehicles in the stream, driver behaviour parameters CC0 and CC1 are first calculated and then the results are aggregated to get the values of these parameters for a mixed traffic stream**.**

Further analysis of field data with calibrated CC0 and CC1 values showed that there was a good match between the field and the simulated power. On another segment of four-lane divided highway with paved shoulders, where the simulated capacity was 5329 pcu / hr against the field capacity of 5277 pcu / hr., the technique is shown to work**.**

Praveen Vayalamkuzhi, Veeraragavan Amirthalingam: - This paper focuses on the study of the effect on traffic safety of geometric design features using bi-directional data on divided roadways operated in India under heterogeneous traffic conditions. The analysis was conducted in plain and rolling terrain on a four lane split inter-city highway. The Poisson regression and Negative binomial regression statistical modelling methodology are used to test the safety output as crash accidents are random events and to define the effect on the crash frequency of the geometric design variables.

It was found that the negative binomial regression model was more fitting for

Identify the factors that contribute to road crashes. The research made it possible to better understand the factors related to road geometrics that affect the frequency of road crashes. The analysis also found that operating speed contributes significantly to the overall number of accidents. Negative binomial models are found to be acceptable under heterogeneous traffic conditions to predict road accidents on divided roadways.

Soheil Sajjadi, Alexandra Kondyli: - Agencies tend to use controlled lanes on their highway networks as congestion increases in metropolitan areas. There are many types and names of maintained lanes, such as high-occupancy vehicle (HOV) lanes, high-occupancy toll (HOT) lanes, express lanes, and lanes for buses only. While controlled lanes received considerable attention because, without adding more lanes, they increased overall throughput and improved mobility, little was known about their operational capabilities. Furthermore, it can be difficult to calibrate controlled lane facilities because with general purpose freeway lanes they do not always follow the same actions.

An operational review of two HOT lane segments located in South Florida is provided in this report. The sites are segments of one lane and two lanes divided by flexible pylons (FPs). A macroscopic capability study and a microscopic calibration of the two sites using micro simulation with VISSIM are included in the paper. The results of the research help to evaluate the capability and speed-flow relationship of these segments, and also provide practitioners with guidance for micro simulation model calibration.

The study results show that the percentage drop in capacity for the one-lane FP site is 7.6 percent, while after the breakdown at the two-lane FP site, the flow did not change significantly. The research results also provide recommendations for the simulation of breakdown events and the calibration of VISSIM micro simulation software for one-lane and two-lane controlled lane facilities. For the one-lane FP site, the Wiedemann car-following parameters (CC0 1⁄4 3.9 ft., CC1 1⁄4 1.9 s, CC2 1⁄4 26.25 ft., CC4 1⁄4 ?? 0.35, and CC5 1⁄4 0.35) offered the best fit, while the one-lane FP site was the best fit.

S.M. Sohel Mahmud, Luis Ferreira, Md. Shamsul Hoque, and Ahmad Tavassoli:- This paper critically discusses micro-simulation modelling applications for road safety assessment with regard to the use of different simulation methods, the use of surrogate safety measures in various aspects of road safety assessment.

Environments and considerations in collisions. The paper discusses general input variables used to build the models; key parameters for crash prediction; and approaches to calibration and validation. The strengths and limitations of the simulation packages used for the assessment of traffic safety are also noted. In addition, recent advances have also been addressed in the development and implementation of a traffic safety micro-simulation model for safety evaluation.

While there are a number of studies, there is still a substantial gap in the development and implementation of the simulation model to assess the protection of non-lane-based heterogeneous traffic environments that predominate in traffic safety.

In many countries in progress. The paper examined the possible use in heterogeneous traffic environments of the traffic safety micro-simulation model. Finally, a variety of perhaps promising future avenues for study are highlighted.

Manraj Singh Bainsa et al: - As motorcycles, two-wheelers, three-wheelers and bullock carts are not permitted to travel on these facilities and the traffic basically consists of cars and trucks, expressways in India are dramatically different from other roads in the country.

However, there is not much research literature related to these road categories. Via evaluating the Passenger Car Unit (PCU) or Passenger Car Equivalents (PCE) of different vehicle categories at different volume levels in a level terrain using the micro-simulation model, VISSIM, this work is therefore intended to model traffic flow on Indian Expressways. The goal of this work is also to evaluate expressway ability and to research the impact of vehicle composition on PCU values. Regardless of the vehicle category, the PCU has been found to decrease with an increase in volume-capacity ratio. The analysis also showed that the PCU of a given type of vehicle decreases at a given volume level as its own proportion in the stream increases.

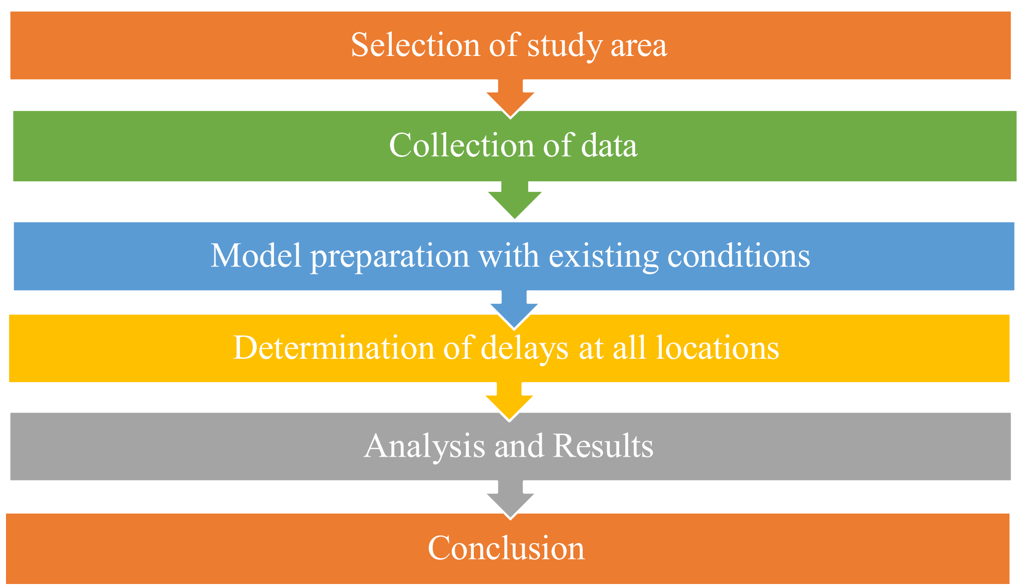
Caleb Ronald Munigety: - In developing economies, such as India, China, Bangladesh, etc., mixed traffic conditions are often prevalent and are characterised by the presence of several types of vehicles. The existence of several types of vehicles with differing dynamic and static features results in dependent driving behaviours of the vehicle type. For example, drivers of small-sized vehicles such as motorbikes accelerate and decelerate at will, maintain shorter safe gaps with the lead vehicles, and accept smaller lateral clearances to break the lane discipline by lateral movements inside and across lanes. Drivers of large vehicles such as trucks, on the other hand, have less versatility in accelerating / decelerating and lateral movement operations. The representation of mixed traffic systems therefore includes modelling of vehicle-type based driving behaviours**.**

This paper first discusses the impact of the type of vehicle on the longitudinal and lateral movement actions of drivers using trajectory data collected in India and then presents the proposed dependent driver behavioural vehicle-type models based on the same dataset. The performance of the proposed models is evaluated in a simulation environment that is consistent with non-lane-based vehicle movements and is cross-validated by field data. The findings show a greater predictability of the actions of the driver and hence a more accurate representation of mixed traffic systems. In addition, the simulator, based on the proposed behavioural models, would be useful in assessing alternative initiatives to boost traffic and will help transport planners build transport networks in developed countries in an effective and sustainable way.

Sai Kiran M. Ashish Verma: - In developing economies, the traffic scenario differs fundamentally from that of advanced economies. The latter consists primarily of passenger cars and can be appropriately referred to as "homogeneous" traffic, while the former consists of vehicle types with a broad range of static and dynamic features, which share the same right of way, leading to the vehicles being unsynchronized. The lack of lane-discipline is another distinctive feature of this traffic, arising from the large variance in the vehicles' sizes and manoeuvring abilities.

These variations result in some phenomena that are absent in homogeneous traffic, such as vehicle slippage. It is also possible to refer to this form of traffic as "heterogeneous disordered" or "mixed" traffic. An analysis of the literature has shown that the methods and principles developed for homogeneous traffic are used in most studies of such traffic. Very few studies have attempted to capture the distinctive features of mixed traffic and recognise them. The main aim of this paper is to review studies on different mixed traffic characteristics in developed economies, to define their constraints and to provide guidance for future research. A comprehensive simulation process methodology is also provided for the mixed traffic, representing the "gap-filling" rather than the traditional "car-following" action. There is also a comparison of the previous modelling methods and the quality of their implementation is discussed.

Methodology:



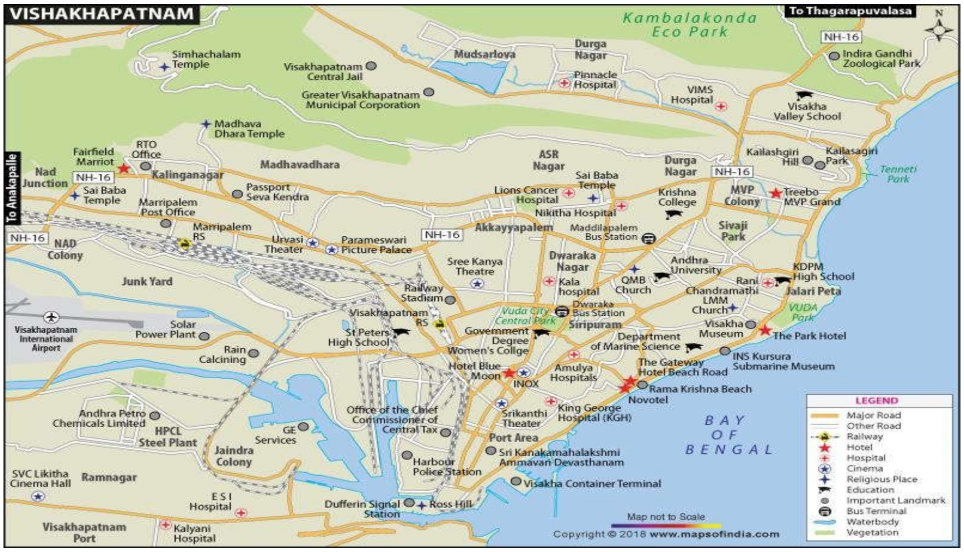


Fig 1: Visakhapatnam Road Network Map

SELECTED ROAD NETWORK FOR STUDY

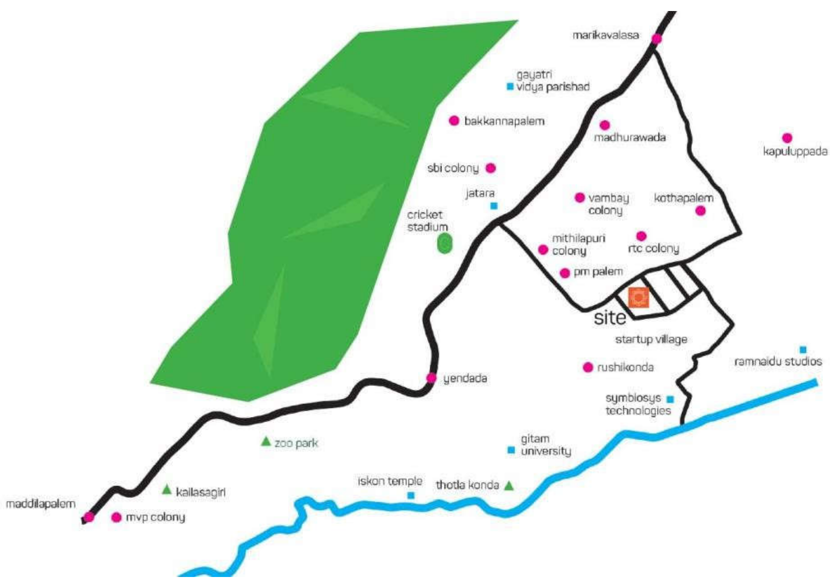


Fig 2: Selected Road Network

STUDY AREA

Traffic volume study conducted at following areas.

- Maddilapalem
- Hanumanthawaka

- Yen dada
- Car shed
- Kommadi junction

Traffic Volume Study

The term traffic volume study can be termed as traffic flow survey or simply the traffic survey. It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time.

Volumes of a day or an hour can vary greatly, depending on the different day of the week or different time period of a day. Traffic volume survey is the determination of the number, movement and classifications of roadway vehicles at a given location.

Table 1: Traffic volume in PCU/hr and Percentage of composition at Maddilapalem in Morning

Location	Time	Vehicle type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Maddilapalem towards Kommadi junction Total: -16413	7:00AM - 10:00AM	Two-wheeler	10672	65.04	0.75	8004
		Four-wheeler	1388	8.45	1.0	1388
		Buses	488	2.97	2.2	1073.6
		Three-wheeler	3677	22.40	2.0	7354
		Heavy vehicles	188	1.14	2.2	413.6
Maddilapalem towards complex Total: -16188	7:00AM - 10:00AM	Two-wheeler	10547	65.18	0.75	7910.25
		Four-wheeler	1392	8.59	1.0	1392
		Buses	473	2.92	2.2	1040.6
		Three-wheeler	3594	22.20	2.0	7188
		Heavy vehicles	182	1.12	2.2	400.4

Table 2: Traffic volume in PCU/hr and Percentage of composition at Maddilapalem in Evening

Location	Time	Vehicle type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Maddilapalem towards Kommadi junction Total: -16238	5:00PM - 8:00PM	Two-wheeler	10493	64.64	0.75	7869.75
		Four-wheeler	1342	8.26	1.0	1342
		Buses	477	2.93	2.2	1049.4
		Three-wheeler	3749	23.08	2.0	7498
		Heavy vehicles	177	1.09	2.2	389.4
Maddilapalem towards complex Total: - 16249	5:00PM - 8:00PM	Two-wheeler	10577	65.09	0.75	7932.75
		Four-wheeler	1368	8.41	1.0	1368
		Buses	458	2.81	2.2	1007.6
		Three-wheeler	3659	22.54	2.0	7318
		Heavy vehicles	187	1.15	2.2	411.4

Table 3: Traffic volume in PCU/hr and Percentage of composition at Hanumanthawaka in Morning

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Hanumanthawaka towards Kommadi junction Total: -16154	7:00AM - 10:00AM	Two-wheeler	10692	66.18	0.75	8019
		Four-wheeler	1392	8.64	1.0	1392
		Buses	454	2.81	2.2	998.8
		Three-wheeler	3425	21.20	2.0	6850
		Heavy vehicles	191	1.18	2.2	420.2

Hanumanthawaka towards complex Total: -16281	7:00AM - 10:00AM	Two-wheeler	10547	64.78	0.75	7910.2
		Four-wheeler	1374	8.43	1.0	1374
		Buses	482	2.96	2.2	1060.4
		Three-wheeler	3692	22.67	2.0	7384
		Heavy vehicles	186	1.16	2.2	409.2

Table 4: Traffic volume in PCU/hr and Percentage of composition at Hanumanthawaka in Evening

Location	**Time**	**Vehicle type**	**Number of vehicles**	**% of composition**	**PCU Factor**	**PCU/ Hour**
Hanumanthawaka towards Kommadi junction Total: -15974	5:00PM - 8:00PM	Two-wheeler	10627	66.54	0.75	7970.2
		Four-wheeler	1339	8.38	1.0	1339
		Buses	477	2.98	2.2	1049.4
		Three-wheeler	3342	20.93	2.0	6684
		Heavy vehicles	189	1.18	2.2	415.8
Hanumanthawaka towards complex Total: -16037	5:00PM - 8:00PM	Two-wheeler	10547	65.78	0.75	7910.2
		Four-wheeler	1349	8.42	1.0	1349
		Buses	472	2.94	2.2	1038.4
		Three-wheeler	3491	21.77	2.0	6982
		Heavy vehicles	178	1.10	2.2	391.6

Table 5: Traffic volume in PCU/hr and Percentage of composition at Yendada (Morning)

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Yendada towards Kommadi junction Total:13676	7:00AM - 10:00AM	Two-wheeler	9324	68.19	0.75	6993
		Four-wheeler	1215	8.88	1.0	1215
		Buses	534	3.90	2.2	1174.8
		Three-wheeler	2451	17.93	2.0	4902
		Heavy vehicles	152	1.11	2.2	334.4
Yendada towards complex Total: -13764	7:00AM - 10:00AM	Two-wheeler	9439	68.57	0.75	7079.2
		Four-wheeler	1239	9.03	1.0	1239
		Buses	549	3.98	2.2	1207.8
		Three-wheeler	2393	17.38	2.0	4786
		Heavy vehicles	144	1.04	2.2	316.8

Table 6: Traffic volume in PCU/hr and Percentage of composition at Yendada in Evening

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Yen dada towards Kommadi junction Total: -13872	5:00PM - 8:00PM	Two-wheeler	9594	69.18	0.75	7195.5
		Four-wheeler	1259	9.07	1.0	1259
		Buses	459	3.30	2.2	1009.8
		Three-wheeler	2421	17.45	2.0	4842
		Heavy vehicles	139	1.00	2.2	305.8

Yen dada towards complex Total: -14254	5:00PM - 8:00PM	Two-wheeler	9739	68.34	0.75	7304.25
		Four-wheeler	1294	9.07	1.0	1294
		Buses	528	3.70	2.2	1161.6
		Three-wheeler	2539	17.82	2.0	5078
		Heavy vehicles	154	1.08	2.2	338.8

Table 7: Traffic volume in PCU/hr and Percentage of composition at Car Shed junction in Morning

Location	**Time**	**Vehicle's type**	**Number of vehicles**	**% of composition**	**PCU Factor**	**PCU/ Hour**
Car Shed towards Kommadi junction Total: -13532	7:00AM - 10:00AM	Two-wheeler	9232	68.24	0.75	6924
		Four-wheeler	1237	9.14	1.0	1237
		Buses	457	3.37	2.2	1005.4
		Three-wheeler	2447	18.08	2.0	4894
		Heavy vehicles	159	1.17	2.2	349.8
Car Shed towards complex Total: -14194	7:00AM - 10:00AM	Two-wheeler	9693	68.28	0.75	7269.75
		Four-wheeler	1233	8.68	1.0	1233
		Buses	458	3.22	2.2	1007.6
		Three-wheeler	2638	18.58	2.0	5276
		Heavy vehicles	172	1.24	2.2	378.4

Table 8: Traffic volume in PCU/hr and Percentage of composition at Car Shed junction in Evening

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Car Shed towards Kommadi junction Total: -13724	5:00PM - 8:00PM	Two-wheeler	9453	68.89	0.75	7089.75
		Four-wheeler	1279	9.31	1.0	1279
		Buses	491	3.57	2.2	1080.2
		Three-wheeler	2349	17.11	2.0	4698
		Heavy vehicles	152	1.10	2.2	334.4
Car Shed towards complex Total: -14291	5:00PM - 8:00PM	Two-wheeler	9759	68.28	0.75	7319.25
		Four-wheeler	1213	8.48	1.0	1213
		Buses	448	3.16	2.2	985.6
		Three-wheeler	2719	19.02	2.0	5438
		Heavy vehicles	152	1.06	2.2	334.4

Table 9: Traffic volume in PCU/hr and Percentage of composition at Kommadi Junction in Morning

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Kommadi junction towards Marikavalasa Total: - 13929	7:00AM - 10:00AM	Two-wheeler	9579	68.77	0.75	7184.25
		Four-wheeler	1190	8.54	1.0	1190
		Buses	527	3.78	2.2	1159.4
		Three-wheeler	2446	17.57	2.0	4892
		Heavy vehicles	187	1.34	2.2	411.4

Kommadi junction towards complex Total: - 13167	7:00AM - 10:00AM	Two-wheeler	9068	68.86	0.75	6801
		Four-wheeler	1238	9.42	1.0	1238
		Buses	533	4.05	2.2	1172.6
		Three-wheeler	2158	16.39	2.0	4316
		Heavy vehicles	170	1.29	2.2	374

Table 10: Traffic volume in PCU/hr and Percentage of composition at Kommadi Junction in Evening

Location	Time	Vehicle's type	Number of vehicles	% of composition	PCU Factor	PCU/ Hour
Kommadi junction towards Marikavalasa Total: - 14220	5:00PM - 8:00PM	Two-wheeler	9626	67.69	0.75	7219.5
		Four-wheeler	1292	9.08	1.0	1292
		Buses	501	3.54	2.2	1102.2
		Three-wheeler	2609	18.34	2.0	5218
		Heavy vehicles	192	1.35	2.2	422.4
Kommadi junction towards complex Total: - 14438	5:00PM - 8:00PM	Two-wheeler	9765	67.65	0.75	7323.75
		Four-wheeler	1298	8.99	1.0	1298
		Buses	551	3.81	2.2	1212.2
		Three-wheeler	2615	18.11	2.0	5230
		Heavy vehicles	209	1.44	2.2	459.8

VISSIM software is used to analyse the delay at all the selection locations. The Traffic volume, geometry of the road sections is given as input for the software.

Results and Discussion:

Maddilapalem junction:

- From the data collected, the total vehicles at Maddilapalem in the direction to Kommadi is 16413 in morning and 16238 in the evening.
- In the location, the values are converted into PCU’s for all vehicles and it is calculated as18233 PCU/hr in the morning and 18149 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 75.02 seconds and stopped delay as 61.78 seconds.
- The queue length for the stretch is 355.53m. The average fuel consumption in the location in morning time is observed as 9.208km/L.
- The total vehicles at Maddilapalem in the direction to Complex is 16188 in morning and 16249 hr in the evening.
- The values are converted into PCU’s for all vehicles and it is calculated as17930 PCU/hr in the morning and 18029 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 161.79 seconds and stopped delay as 143.17 seconds.
- The queue length for the stretch is 347.88m. The average fuel consumption in the location in evening time is observed as 3.870km/L.
- The Level of service obtained as “E”.

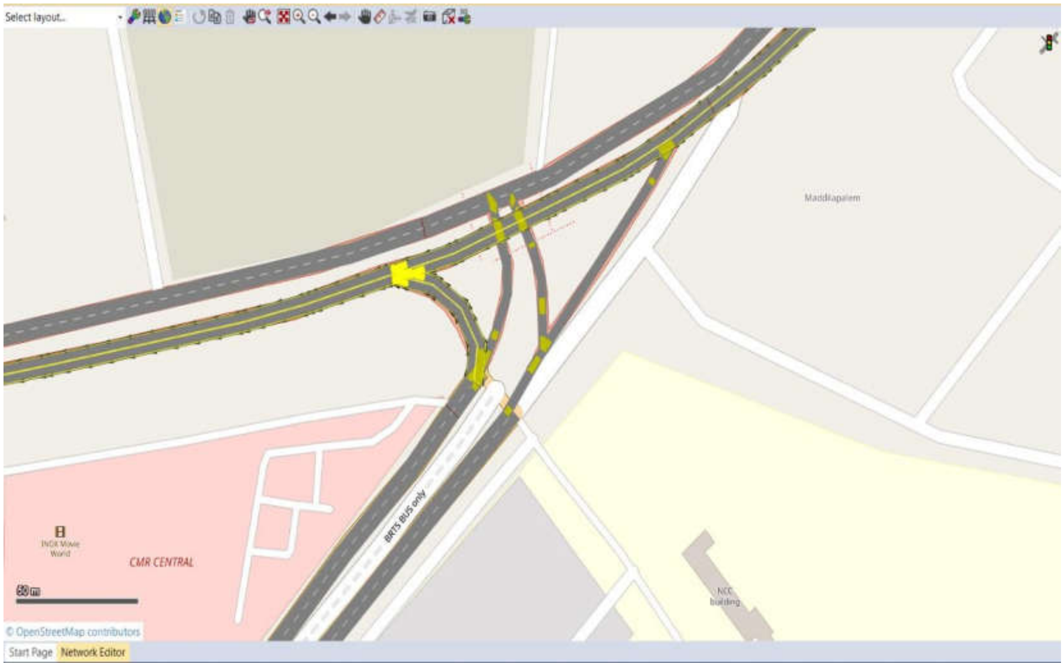


Fig 3: Map from VISSIM Software for Maddilapalem Junction

Hanumanthawaka junction

- The total vehicles at Hanumanthawaka in the direction to Kommadi is 16154 in morning and 15974 in the evening.
- The values are converted into PCU's for all vehicles and it is calculated as17679 PCU/hr in the morning and 17458 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 134.57seconds and stopped delay as 117.39 seconds.
- The queue length for the stretch is 274.02m. The average fuel consumption in the location in morning time is observed as 33.929km/L.
- The total vehicles at Hanumanthawaka in the direction to Complex is 16281 in morning and 16037 in the evening.
- The PCU converted values are 18137 PCU/hr in the morning and 17670 PCU/hr in evening.

- For a length of 500m, the vehicle delay in morning time is observed as 117.15 seconds and stopped delay as 102.86 seconds.
- The queue length for the stretch is 272.87m. The average fuel consumption in the location in evening time is observed as 25.331km/L.
- The Level of service obtained as “F”.

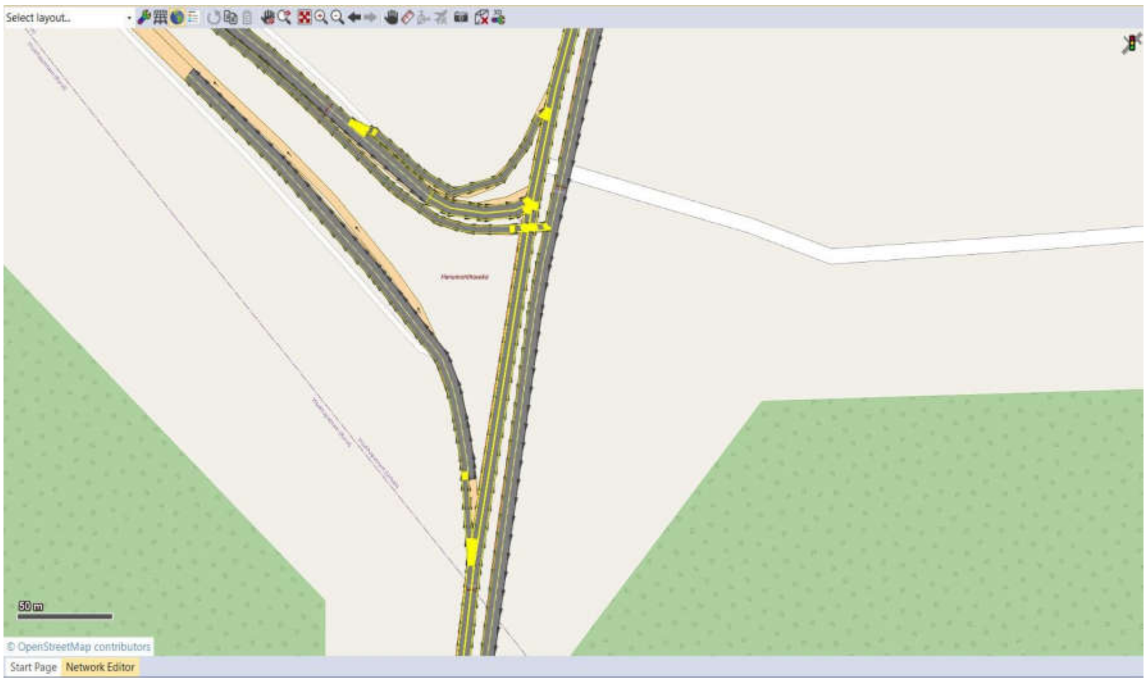


Fig 2: Map from VISSIM Software with node points at Hanumanthawaka Junction

Yendada junction

- The total vehicles at Yendada in the direction to Kommadi is 13676 in morning and 13872 in the evening.
- The values are converted into PCU’s for all vehicles and it is calculated as14618 PCU/hr in the morning and 14610 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 136.66seconds and stopped delay as 117.99 seconds.

- The queue length for the stretch is 462.38m. The average fuel consumption in the location in morning time is observed as 21.174km/L.
- The total vehicles at Yendada in the direction to Complex is 13764 in morning and 14254 in the evening.
- The PCU converted values are 14627 PCU/hr in the morning and 15176 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 117.15 seconds and stopped delay as 102.86 seconds.
- The queue length for the stretch is 462.37m. The average fuel consumption in the location in evening time is observed as 12.579km/L.
- The Level of service obtained as “F”.

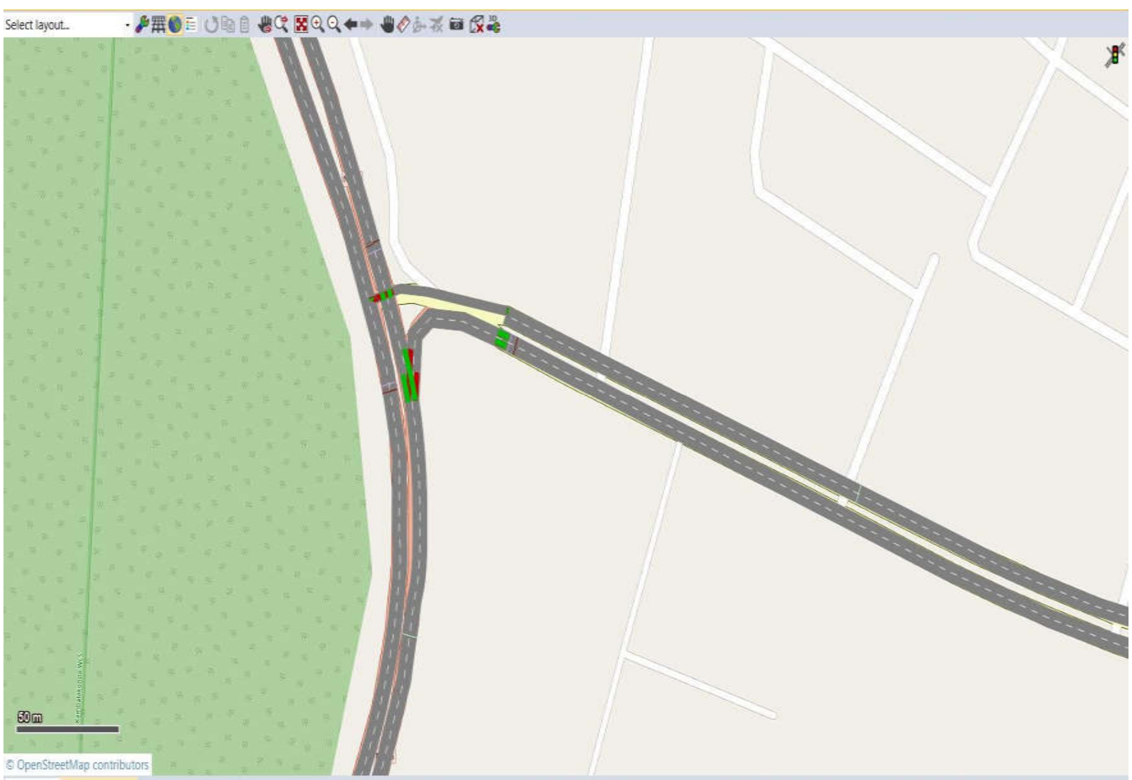


Fig 3: Node points at Yendada Junction

Car shed junction:

- The total vehicles at Car shed junction in the direction to Kommadi is 13532 in morning and 13724 in the evening.
- The values are converted into PCU's for all vehicles and it is calculated as 14409 PCU/hr in the morning and 14561 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 177.15seconds and stopped delay as 161.71 seconds.
- The queue length for the stretch is 309.88 m. The average fuel consumption in the location in morning time is observed as 30.626km/L.
- The total vehicles at Car shed junction in the direction to Complex is 14194 in morning and 14291 in the evening.
- The values are converted into PCU's for all vehicles and it is calculated as 15615 PCU/hr in the morning and 15289 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 337.58 seconds and stopped delay as 331.79 seconds.
- The queue length for the stretch is 340.47m. The average fuel consumption in the location in evening time is observed as 27.995km/L.
- The Level of service obtained as "F".

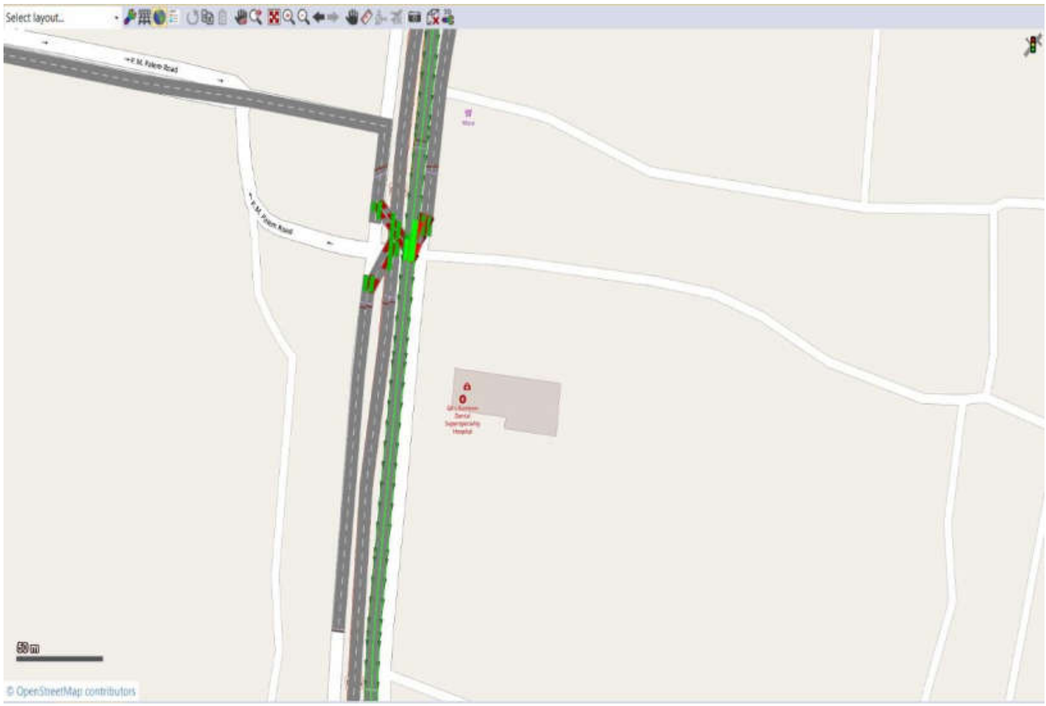


Fig 4: Map representing the road network at Carshed Junction

Kommadi junction

- The total vehicles at Kommadi junction in the direction of Marikavalasa is 13929 in morning and 14220 in the evening.
- The values are converted into PCU's for all vehicles and it is calculated as 14836 PCU/hr in the morning and 15253 PCU/hr in evening.
- For a length of 500m, the vehicle delay in morning time is observed as 131.40seconds and stopped delay as 113.54 seconds.
- The queue length for the stretch is 466.80m. The average fuel consumption in the location in morning time is observed as 18.558km/L.
- The total vehicles at Kommadi junction in the direction to Complex is 13167 in morning and 14438 in the evening.
- The values are converted into PCU's for all vehicles and it is calculated as 13901 PCU/hr in the morning and 15522 PCU/hr in evening.

- For a length of 500m, the vehicle delay in morning time is observed as 105.92seconds and stopped delay as 122.57 seconds.
- The queue length for the stretch is 488m. The average fuel consumption in the location in evening time is observed as 22.003km/L.
- The Level of service obtained as “F”.

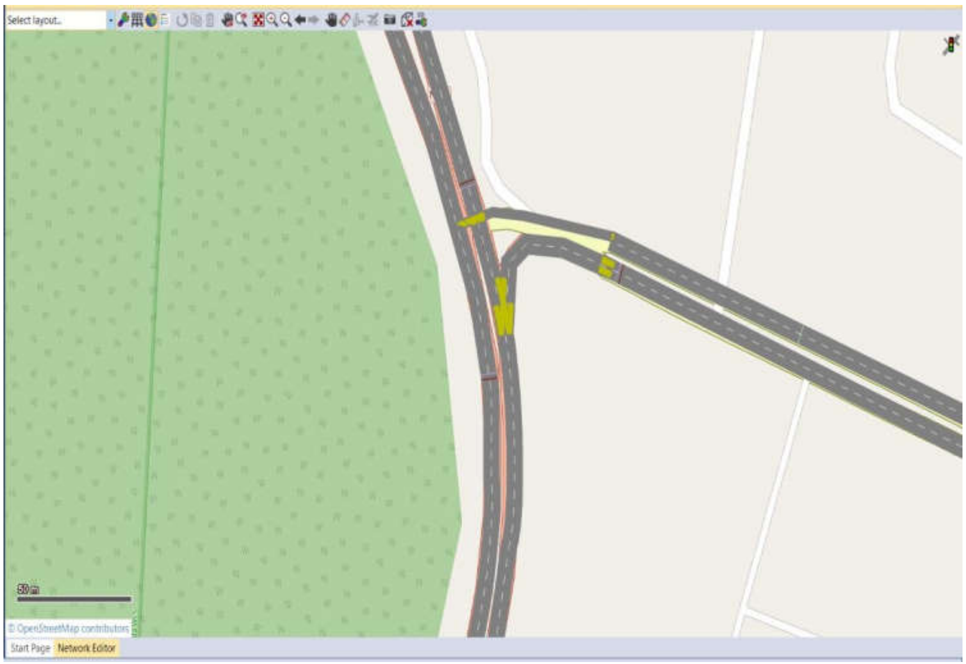


Fig 5: Road network at Kommadi Junction

Conclusions

- The number of vehicles at Maddilapalem towards Kommadi is reduced to 16238 in the evening compared to morning i.e., 16413, whereas it is Maddilapalem towards RTC complex is increased to 16188 in the morning compared to evening 18038.
- The delay is more at Maddilapalem towards complex compared to Maddilapalem to Kommadi junction. As it will have a traffic merging from 3 locations. i.e., from highway to complex (right turn traffic) highway to complex crossing Andhra university and from Andhra university.

- The queue length is less at Hanumanthawaka junction compared to Maddilapalem junction as it consists of a vehicle activated signal system which helps in control of delay at that locations.
- The flow is high in morning and less in the evening towards to Kommadi junction and also in direction towards complex.
- As the queue length is increasing the fuel consumption is also increasing.
- At Hanumanthawaka junction with less queue length, the fuel consumption is high because of the waiting time at signal.
- At yendada junction due to the curve in geometry, the queue length is more and consumption of fuel is also more. In the evening towards complex, for the same queue length the fuel consumption is reduced almost half.
- In all the remaining junctions i.e., car shed and Kommadi junction the delay is very high.
- At Kommadi junction the queue length is 466.8m which is almost the length considered in the analysis.
- For all the locations, the level of service is obtained as ‘F’ except Maddilapalem which has an LOS of ‘E’
- It concludes that the delay can be measured using the traffic volume considered and the geometric features.
- The delay is depended on the geometrics like curves at some locations.
- Among various options considered for improvement of this corridor, the option of constructing flyover and two vehicular under passes one at Maddilapalem and other at kommadi junctions is proposed which will relieve the traffic congestion at 5 major junctions.

- As some part of the traffic use the grade separator, road users experience savings in travel time due to uninterrupted movement at flyover and at the grade separator thereby improving running speeds on the approach roads.

References:

[1] B. Yao, C. Chen, Q. Cao, L. Jin, M. Zhang, H. Zhu, and B. Yu, "*Short-Term Traffic Speed Prediction for an Urban Corridor,*" Computer-Aided Civil and Infrastructure Engineering, vol. 32, no. 2, pp. 154–169, Jul. 2016.

[2] G. Asaithambi, V. Kanagaraj, K. K. Srinivasan, and R. Sivanandan, "*Study of traffic flow characteristics using different vehicle-following models under mixed traffic conditions*," Transportation Letters, vol. 10, no. 2, pp. 92–103, Jun. 2016.

[3] V. Kanagaraj, G. Asaithambi, C. H. N. Kumar, K. K. Srinivasan, and R. Sivanandan, "*Evaluation of Different Vehicle Following Models Under Mixed Traffic Conditions*", Procedia - Social and Behavioral Sciences, vol. 104, pp. 390–401, Dec. 2013.

[4] Miao Yu, Wei (David) Fan, **"***Calibration of microscopic traffic simulation models using metaheuristic algorithms***"***,* International Journal of Transportation Science and Technology 6 (2017) 63–77.

[5] Geetimukta Mahapatra, Akhilesh Kumar Maurya, **"***Dynamic parameters of vehicles under heterogeneous traffic stream with non-lane discipline: An experimental study,***"**Journal of Traffic and Transportation Engineering (English Edition) 2018; 5(5): 386 – 405

[6] Eric M. Laflamme, Paul J. Ossenbuggen, "*Effect of time-of-day and day-of-the-week on congestion duration and breakdown: A case study at a bottleneck in Salem, NH,"* Journal of Traffic and Transportation Engineering (English Edition) 2017; 4(1): 31 – 40.

[7] Arpan Mehar, Satish Chandra, and S. Velmurugan, "*Highway Capacity Through Vissim Calibrated for Mixed Traffic Conditions,"* KSCE Journal of Civil Engineering (2014) 18(2):639-645.

[8] Praveen Vayalamkuzhi, Veeraragavan Amirthalingam, "*Influence of geometric design characteristics on Safety under heterogeneous traffic flow,"* Journal of Traffic and Transportation Engineering (English Edition) 2016; 3 (6): 559 – 570.

[9] Soheil Sajjadi , Alexandra Kondyli, "*Macroscopic and microscopic analyses of managed lanes on freeway facilities in South Florida,"* Journal of Traffic and Transportation Engineering (English Edition) 2017 ; 4(1) : 61-70.

[10] S.M. Sohel Mahmud , Luis Ferreira, Md. Shamsul Hoque, Ahmad Tavassoli, "*Micro-simulation modelling for traffic safety: A review and potential application to heterogeneous traffic environment,"* IATSS Research (2018) : IATSSR-00180; No of Pages 10.

[11] Manraj Singh Bainsa, Balaji Ponnua, Shriniwas S Arkatkar, "*Modelling of Traffic Flow on Indian Expressways using Simulation Technique,"* Procedia - Social and Behavioral Sciences 43 (2012) 475 -493.

[12] Caleb Ronald Munigety, "*Modelling behavioural interactions of drivers' in mixed traffic conditions,"* Journal of Traffic and Transportation Engineering (English Edition) 2018; 5(4): 284-295.

[13] Sai Kiran M. Ashish Verma," *Review of Studies on Mixed Traffic Flow: Perspective of Developing Economies,"* Transp. In Dev. Econ. (2016) 2:5 DOI 10.1007/s40890-016-0010-0.