MODELLING OF AN UNSIGNALIZED INTERSECTION IN VISAKHAPATNAM USING VISSIM

[1]Majji Gowri, [2]Matta Ganesh
[1]Asst. Professor, [2] PG Student
[1,2] Department Civil Engineering
Sanketika Vidya Parishad Engineering College, Andhra Pradesh

Abstract: Intersections, particularly in a metropolitan region, are the most potentially crowded than other road networks. In Visakhapatnam, some intersections have no signal. One of them is at the crossroads between the Beach road and MVP main road (Appughar jn.) in Visakhapatnam. This study aims to create the model of an existing condition (unsignalized T intersection) with a signalized intersection. The software that used in this study is PTV.VISSIM 2021.00-07. VISSIM is one of the micro-simulation programs from PTV Group. One of the advantages of PTV.VISSIM is the model results from the dynamic simulation. The results of this study obtained a average queue length of 70.45 m and a level of service of LOS (Level of Service) "E" for unsignalized intersection. The best result indicates a signalized intersection with a average queue length of 37.15 m and a service level of LOS "C."

Index Terms –Intersections, Road networks, Simulation, VISSIM, and Unsignalized Intersection

1. INTRODUCTION

Vehicle traffic has increased significantly as a result of rapid industrialization, population growth, and economic growth. India is undergoing rapid development, which has resulted in an increase in vehicular traffic flow. Road transportation, which is India's primary mode of transportation, is likely to face severe strain as a result of these transportation demands. Because of the mixed traffic conditions and poor traffic regulation, traffic management is a major challenge in India. Because of the mixed nature of traffic, many developing countries face varying degrees of difficulty in providing well-organized vehicular traffic operations. Rapid increases in mixed traffic conditions, poor lane control, and traffic volume on roads in developing countries necessitate careful data interpretation and traffic flow analysis. The availability of traffic flow data from the field has a significant impact on roadway structure and operational analysis. The time span over which a traffic count data set is recorded is an important factor in determining traffic volume in terms of traffic flow rate.

Different vehicle types are permitted to coexist along the length of the road, as long as they share the same road space. Different types of vehicles complicate capacity analysis when compared to homogeneous traffic conditions. Field data in such situations are generally insufficient for studying the effect of traffic volume and vehicle composition on stream speed and capacity. Traffic flow simulation has proven to be a very useful tool in such situations. Various traffic simulation programmers have been developed in various countries based on homogeneous traffic conditions. VISSIM, a microscopic traffic simulation software, was developed in Germany by the continuous work of Wiedermann on car following behavior in the 1970s. Microscopic traffic simulation has become more popular in recent years for studying traffic operations at unsignalized intersections. For conducting traffic engineering studies and operational analysis, traffic simulation models are among the most analytical tools available to traffic engineers. To model traffic conditions for a given set of geometry, traffic demand, vehicle routing, and driver behavior inputs, traffic simulation models employ random processes. Calibration and validation are the primary reasons for doing simulation modelling.

Calibration is a comparison of a known measurement and the measurement made with our instrument, which is essentially for simulation software. Calibration, in our terms, is defined as the adjustment of computer simulation model parameters to precisely reflect the prevailing conditions of roadway networks. Validation is the process of ensuring that a software system meets specifications and fulfills its intended purpose. It is also defined as the process of comparing simulated model results with field measurements in order to regulate the precision of the simulation model. The primary goal of the validation stage is to identify parameters settings in the simulation model that produce outputs that closely match the measured field results. Since the validated parameter settings have been identified, they are maintained as baseline settings that reflect the overall driving behavior and operational characteristics of the freeway section being modelled.
Once a model has been validated, it can be used with acceptance to examine future scenarios that may involve changes to trip distribution, travel demand, or changes in roadway geometry. When analyzing future scenarios, it is critical to keep the baseline settings in mind. If significant changes in roadway geometry or classification occur in future forecast models, the baseline parameter settings may no longer be valid for forecast models.

Roads are a vital mode of transportation in India. Until March 2021, India has a road network of over 62 lakh kilometers. This is the world's second largest road network. Today, the road is the most common mode of transportation in India. They transport nearly 85 percent of the country's passengers and 65 percent of its freight. As of today, 23.24 crore vehicles are registered in India, with 2.05 core vehicles registered in 2019. Road travel appeared to be the preferred mode of transportation in India, with more than 60% of the population using personal or shared vehicles for commuting. People preferred to travel in their own vehicles, which has resulted in a rapid increase in vehicle growth in India. Due to the increase in two-wheelers and cars over the last decade, there has also been an increase in three-wheeler vehicles, which has resulted in a rapid increase in vehicle growth. With continuous urbanization, the consumer sector continues to grow, and theautomobile industry's development and sales were expected to grow indefinitely. With different vehicle sales and composition, as shown in table 1.1, passenger vehicles (PVs), commercial vehicles (CVs), three wheelers (3W), and two wheelers (2W).

PTV VISSIM is a multi-model microscopic traffic flow simulation tool. Whether comparing junction geometries, analysing public transportation priority schemes, or examining the effects of specific signalling. VISSIM allows you to precisely simulate traffic patterns. Nowadays, traffic planners and engineers commonly use traffic simulation, which has become an indispensable tool. VISSIM is completed with extensive analysis options, resulting in a powerful tool for evaluating and planning urban and extra-urban transportation infrastructure. Planung Transport Verkehr AG (PTV) in Karlsruhe, Germany, created the VISSIM software package. This software can be used to generate detailed computational results or eye-catching 3D animations for a variety of scenarios. It is one of the most recent micro-simulation software programmes available, with notable improvements in terms of driver behaviour, multi-model transit operations, and integration with planning/forecasting.

OBJECTIVE OF STUDY

The proposed thesis uses simulation model calibration guidelines in general and intensifies them so that they can be applied specifically to three way intersection models using the VISSIM software package. Among the important goals of this research project are the following:

i. To design a traffic signal using a simulation tool.
ii. To determine the optimal signal cycle length in vissim. **iii.** Calibration of the simulation model.
iv. Validation of the simulation model.
v. Simulation results of the calibrated VISSIM signalized model and the unsignalized model are compared.

2. LITERATURE REVIEW

A literature review was conducted to determine research efforts related to the calibration and validation on freeway, expressway, intersection and arteries models using VISSIM. Generally micro-simulation modeling are done by the VISSIM software. Additional research is needed for general traffic simulations which is applicable specific to VISSIM software. From the last 20 years many traffic simulation models have been developed. The traffic simulation models are used by traffic engineers and transportation planners for the planning, operations, and design of transportation facilities.

Buck, H. S., Mallig, N., & Vortisch, P. (2017) This study demonstrated how Vissim could be calibrated for that purpose. Vissim models of four signalized intersections for which data had been collected were built. From these data, information that was extracted on headways, time to pass the intersection, and arrival distribution was used for calibration. Calibration of the headways resulted in car following parameters for these intersections that differed substantially from the Vissim default values. The resulting data were used to calibrate Vissim models of these intersections. Three measures that are relevant for realistic behavior at intersections were identified: the time to pass the intersection, the average headway, and the arrival distribution of the vehicles. Calibrating the time to pass the intersection is equivalent to calibrating the geometric delay. The average headway influences how fast a queue at the intersection dissolves and hence influences control delay.
Gaye, D., Faye, R. M., & Mampassi, B. (2016) In this paper, we present a microscopic car following model based on the consideration of the driving behavior on a single-lane road. With this model, we propose an approach which permits to take into account the phenomenon of anticipation in driver behavior. A comparative study with the optimal velocity model is done. The proposed modeling approach is validated by simulation. Numerical results confirm that this proposed approach can well describe car-followers models. From this approach this paper has contributed to the improvement of some existing car-followers models.

Gautham raj B. R(2020) The study aims at developing a micro-simulation model for signalized intersection to reduce the travel time by improving the signal program. The data collection includes Classified Turning Volume count at the Intersection, Geometry of the Intersection, Signal Timing and Phasing and Delay and Travel Time across the intersection. The model is developed in PTV (VISSIM) "Verkehr In Städten - SIMulationsmodell" and is calibrated using Genetic Algorithm (GA) through the Component Object Model (COM), Application Programming Interface (API) enabled through MATLAB, also by manual systematic adjustments of parameters, which is then validated with a different dataset with a Mean Absolute Percentage Error (MAPE) within the limit of 15%. Results from the Simulation after signal program optimization indicated a reduction in the travel time upto 25% to the users. Muchlisin and Ikhsan Tajudin (2019) The study aims to create the optimization of model of an existing condition (without signal) and with a signalized intersection. The parameters that can be used in the analysis of this study are the fewer number of conflict points, due to signaling that can regulate movement, greater intersection capacity, because more vehicles can be accommodated, level of service (LOS) from the value of the delay is getting smaller. Thus, efforts to increase safety with the application of signalized intersections can be easy with the existence of micro simulation programs using PTV. VISSIM. Nadika Jayasooriya, and Saman Bandara (2018) The aim of the research is to develop a calibration procedure and identify representative values for parameters required for VISSIM micro simulation software to suit the local Condition. The research focuses on developing values for calibration parameters for VISSIM microscopic traffic simulation software, using the accepted practices referring to calibration procedures conducted for neighbouring countries.

3. SIMULATION MODEL

VISSIM is a commercial software tool that has sold approximately 7000 licenses over the last 15 years. One-third of users are in consultancies and industry, one-third are in government agencies, and the remaining third are in academic institutions for teaching and research. The software is primarily intended for traffic engineers. However, as transportation planning becomes more detailed, an increasing number of transportation planners use microsimulation. Applications are assembled by traffic engineers and transportation planners by selecting appropriate objects from a set of primary building blocks. Technical features of pedestrians, bicyclists, motorcycles, cars, trucks, buses, trams, light (LRT), and heavy rail are provided with customization options in order to simulate multi-modal traffic flows. The following are examples of common applications:

i. Advanced motorway studies, such as contra-flow systems, variable speed limits, ramp metering, and route guidance, mainline operation, and operational impacts during construction phases.

ii. Corridor studies on arterials with and without signalized intersections. Corridor studies on heavily travelled highways to identify system performance, bottlenecks, and improvement opportunities.

iii. Development and analysis of highway management strategies, including signal priority schemes for public transportation as part of multi-modal studies. Traffic circulation, public transportation operations, pedestrian crossings, and bicycle facilities are modelled for various street network layouts and vehicle detection options.

iv. Alignment of public transportation lines with various types of vehicles such as

Light Rail Transit (LRT), trams, and buses, with design and operational strategy refinements. This includes tram and bus terminal operation and capacity analysis.

v. Traffic calming scheme investigations, including detailed studies on speeds during manoeuvres with limited visibility.

Internally, the simulation package VISSIM is divided into two parts that communicate via an interface about detector calls and signal status. The simulation generates an online visualization of traffic operations as well as offline output files containing statistical data such as travel times and queue lengths. The traffic simulator is a microscopic traffic flow simulation model that includes lane change and car following logic. The signal state generator is a piece of signal control software that polls detector data from the traffic simulator on a discrete time step. It then determines the signal status for the next time step and sends it to the traffic simulator. For the following reasons, computer simulation is more practical than field experimentation:

i. It is less expensive.

ii. Quick results, The data generated by simulation includes several measures of effectiveness that are difficult to obtain from field studies.

iii. Traffic disruption, which is often associated with field experiments, is completely avoided.

iv. Many schemes necessitate significant physical changes to the facility, which are in compatible with experimental purposes.

Traffic simulation models enable the creation of new and innovative transportation system management concepts and designs. Planners and engineers now have the ability to test ideas prior to field demonstrations. Because these models enable the designer to identify flaws in concepts and designs, they serve as a foundation for determining the best candidate approach. Finally, because the model's results can be used to select the most effective candidate among competing concepts and designs, the eventual field demonstration will have a higher chance of success.

Model building principles

The following definitions will be provided for clarity. A microscopic traffic flow simulator, such as VISSIM, includes software and mathematical models for running traffic flow models. The simulator itself contains no application-specific data or additional tools required for additional modelling and data analysis tasks. Additional software tools, such as statistical packages, proprietary external traffic control software, or post-processing, such as emission calculations, are sometimes required for data analysis. These extra tools are not included with the simulator. Without the simulator, a microscopic traffic modelling application contains all of the data required to run a VISSIM model. A modelling system is required in order to run an application. The microscopic modelling system includes the simulator, all additional tools required to run an application, and the data for that application.

The VISSIM software is written in C++ and adheres to object-oriented programming principles (OOP). Actually, ship simulation was the first to introduce the OOP concept. The academic implementation and predecessor of VISSIM, Mission of the University of Karlsruhe, was built with SIMULA-67 and included object classes and virtual methods. VISSIM includes object classes such as vehicles. Within a class, each object's properties are defined by attribute values and methods that describe the functions that each object can manage.

4. FIELD WORK-DATA COLLECTION

Data required in this study are collected from unsignalized intersection in visakhapatnam. Data is collected manually. The data is collected for varying times of the day, especially during peak hours of morning and evening. The data set comprises of flow data, speed data, vehicular data, area occupancy is done manually, and travel time data. The location is selected on the State Highway (SH144) Appughar junction. These road form an unsignalized intersection which connect RK beach, Bheemili beach, MVP main road with each other.

The state highway (SH 144) 4-lane divided road having 4.5 m width of each lane. The major district road from the other side is 4- lane divided road having 4 m width of each lane. The overall roadway condition has also been depicted in the form of the Google map in figure.1

Figure.1: Google image of the study intersection (Appughar junction)

Figure.2: Traffic conjunction of the study intersection (Appughar junction)

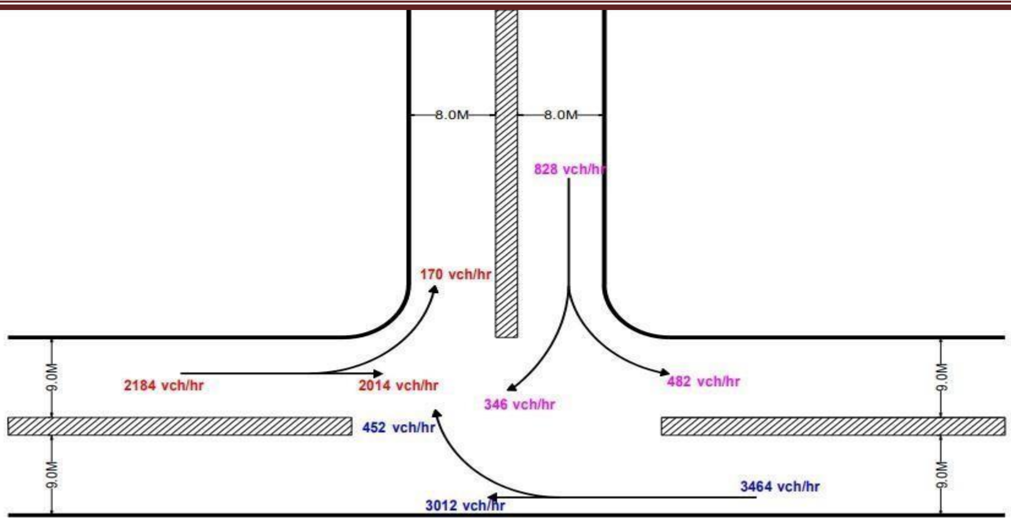

Figure.3: Traffic flow of the study intersection (Appughar junction)

VOLUME COUNT

The data has been taken out through manual method collect field data to validate the developed model. The traffic volume observed for 8 hours in which 3hrs during peak morning from 8:00 am to 11:00 am represented in table 4.2, 2hrs during afternoon from 1:00 pm to 3:00 pm represented in table 4.3, and 3hrs during peak evening from 5 pm to 8 pm represented in table 4.4. After that, this data is used to the model for calibration and validation. The field data input required for the model was collected at the above location.

Dimensions and proportions of these vehicles in traffic stream are given in Table 4.1. The speed of a vehicle was determined by noting the time taken by the vehicle to cross the longitudinal trap of 30 m using a stop watch of 0.01 s accuracy. Speeds of individual categories of vehicles are analyzed and the distribution profiles have been created.

All vehicles are divided into five classes like Bicycle, motorised two-wheeler (2W), motorised three-wheeler (3W), Light motor vehicle (LMV) and heavy motor vehicle (HMV). LMV includes motorcars, jeeps, taxis, delivery vans, etc… and HMV includes truck, bus, van, etc…

Table.1: Vehicle Dimension and there proportion in traffic

Vehicle types	Length (m)	Width (m)	Projected area	Proportion in traffic (%)
HMV	10.5	2.5	26.5	3.45
LMV	4.8	1.85	8.88	37.73
3W	2.5	1.3	3.25	14.7
2W	1.8	0.8	1.44	43.93
Bicycle	1.3	0.5	0.65	0.19

Table.2: hours traffic flow data from RK beach road to Left turn & Through direction

Name of Road : RK Beach to Bheemili					Direction : Left turn & Through			
S.no	Time period		Traffic volume					Total volume
	From	To	Bicycle	2W	3W	LMV	HMV	
1	08:00	08:30	0	356	67	179	1	603
2	08:30	09:00	1	480	114	252	3	849
3	09:00	09:30	1	559	135	278	8	980
4	09:30	10:00	0	630	156	294	12	**1092**
5	10:00	10:30	0	534	144	186	5	869
6	10:30	11:00	0	502	113	143	4	762

7	13:00	13:30	0	492	60	252	6	810
8	13:30	14:00	0	534	126	300	8	968
9	14:00	14:30	0	450	78	240	6	774
10	14:30	15:00	0	335	46	181	3	565
11	17:00	17:30	2	403	88	254	5	750
12	17:30	18:00	4	498	102	306	7	913
13	18:00	18:30	0	613	114	345	8	1080
14	18:30	19:00	0	625	112	302	8	1047
15	19:00	19:30	0	660	144	250	5	1059
16	19:30	20:00	0	597	126	212	3	938
		Total	8	8268	1725	3974	92	14059

Peak Traffic Volume = 1092 x 2 = **2184 veh/hr**

Table.3:8 hours traffic flow data from MVP main road to Left turn & Through direction

Name of Road : MVP Double Road					**Direction : Left turn & Through**			
S.no	**Time period**		**Traffic volume**					**Total volume**
	From	**To**	**Bicycle**	**2W**	**3W**	**LMV**	**HM V**	
1	08:00	08:30	0	137	52	41	2	232
2	08:30	09:00	1	252	90	66	6	**414**
3	09:00	09:30	2	275	78	34	5	392
4	09:30	10:00	0	198	96	18	3	315
5	10:00	10:30	0	210	94	54	2	360
6	10:30	11:00	0	172	67	72	3	314
7	13:00	13:30	5	210	72	54	4	340
8	13:30	14:00	0	174	90	90	12	366
9	14:00	14:30	0	258	48	66	3	375
10	14:30	15:00	0	199	53	51	2	305
11	17:00	17:30	3	183	48	45	5	281
12	17:30	18:00	5	216	60	42	6	324
13	18:00	18:30	9	237	69	73	5	384
14	18:30	19:00	6	258	42	90	4	394
15	19:00	19:30	0	252	60	54	3	369
16	19:30	20:00	0	196	33	41	2	272
Total			31	3427	1052	891	67	5437

Peak Traffic Volume = 414 x 2 = **828 veh/hr**

Table.4: 8 hours traffic flow data from Bheemili beach road to Right turn &Through direction

Name of Road : Bheemili to RK Beach					Direction : Right turn & Through			
S.no	**Time period**		**Traffic volume**					**Total volume**
	From	**To**	**Bicycle**	**2W**	**3W**	**LMV**	**HMV**	
1	08:00	08:30	6	876	83	297	4	1266
2	08:30	09:00	2	1146	108	420	12	1688
3	09:00	09:30	10	1131	125	439	9	1714
4	09:30	10:00	7	1122	132	463	8	**1732**
5	10:00	10:30	3	816	156	384	10	1369
6	10:30	11:00	0	709	127	263	7	1106
7	13:00	13:30	0	833	80	294	13	1220
8	13:30	14:00	0	816	84	306	18	1224
9	14:00	14:30	0	780	96	462	15	1353
10	14:30	15:00	0	732	93	384	12	1221
11	17:00	17:30	2	629	77	480	9	1197
12	17:30	18:00	1	660	90	522	13	1286
13	18:00	18:30	4	798	105	499	11	1417
14	18:30	19:00	0	834	108	390	18	1350
15	19:00	19:30	0	720	110	498	5	1333
16	19:30	20:00	0	683	59	382	2	1126
Total			35	13285	1633	6483	166	21602

Peak Traffic Volume = 1732 x 2 = **3464 veh/hr**

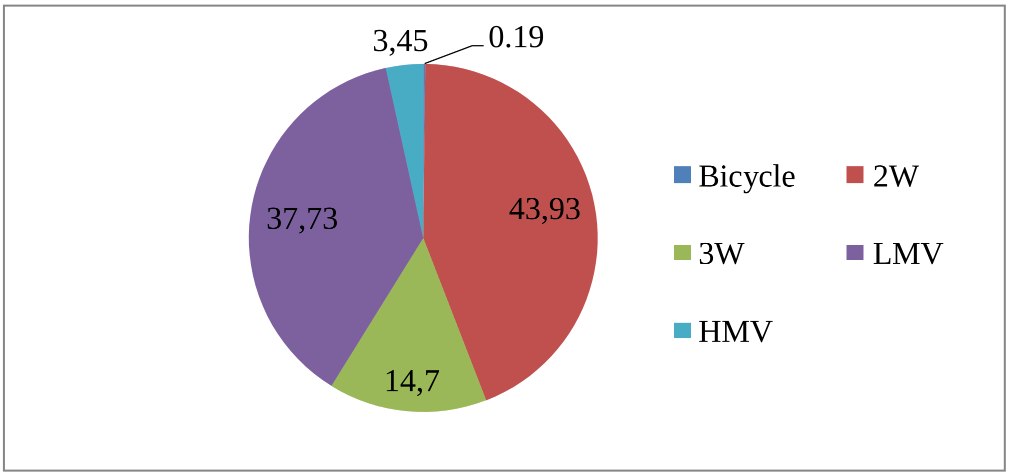

Figure.4: Traffic composition of the study intersection(Appughar junction)

Table.5: Speed parameters from the field data

Vehicle	Min speed (kmph)	Max speed (kmph)
HMV	13.41	39.26
LMV	30.04	54.63
3W	19.72	42.53
2W	23.44	59.2

5. RESULTS AD DISCUSSIONS

This section presents the results and discussions of the simulation studies carried out. The results and outputs of the VISSIM model are presented first, followed by the results and discussion.

VISSIM MODEL UNSIGNALIZED INTERSECTION OUTPUT

Result of evaluation of delay measurements

Table 6. Delay evaluation result attributes

Simulation run	Time interval	Delay measurement	Average stopped delay per vehicle [s]	Average delayof all vehicles [s]
AVG	0-3600	1: RK Beach road	9.92	22.92
AVG	0-3600	2: MVP Main road	91.23	121.08
AVG	0-3600	3: Bheemili beachroad	50.29	67.64

Result of evaluation of Queue Measurement

Table 7. Queue evaluation result attributes

Simulation run	Time interval	Queue counter	Average queue length [m]	Queue length (maximum)[m]
AVG	0-3600	1: RK Beach road	61.68	96.03
AVG	0-3600	2: MVP Main road	72.93	140.18
AVG	0-3600	3: Bheemili beach road	76.75	109.25

Result of evaluation of Node measurements

Table 8. Node evaluation result attributes

Simulat ion run	Time inter val	Move ment	Level of service	Vehicle delay[s]	Emissions carbon monoxide [grams]	Emissions nitrogen oxides [grams]	Emissi ons volatile organic compo unds [grams]	Fuel consum ption [US liquid gallon]
AVG	0-3600	1	D	34.14	19.736	3.84	4.574	0.282
AVG	0-3600	2	E	39.62	258.889	50.37	60	3.704

AVG	0-3600	3	F	127.37	81.078	15.775	18.791	1.16
AVG	0-3600	4	E	43.88	78.946	15.36	18.297	1.129
AVG	0-3600	5	E	44.59	222.294	43.25	51.519	3.18
AVG	0-3600	6	F	80.95	60.805	11.83	14.092	0.87
AVG	0-3600	Total	E	48.54	722.915	140.653	167.542	10.342

Here 1: RK Beach to MVP Main road

2: RK Beach road to Bheemili beach road3: MVP Main road to RK Beach road
4: MVP Main road to Bheemili beach road5: Bheemili beach road to RK Beach road 6: Bheemili beach road to MVP Main road Total: Total intersection movement

VISSIM MODEL SIGNALIZED INTERSECTION OUTPUT
Result of evaluation of delay measurements

Table 9. Delay evaluation result attributes

Simulation run	**Time interval**	**Delay measurement**	**Average stopped delay per vehicle [s]**	**Average delayof all vehicles [s]**
AVG	0-3600	1: RK Beach road	13.29	17.56
AVG	0-3600	2: MVP Main road	22.71	30.19
AVG	0-3600	3: Bheemili beachroad	24.75	36.52

Result of evaluation of Queue Measurement

Table 10. Queue evaluation result attributes

Simulation run	Time interval	Queue counter	Average queue length [m]	Queue length (maximum)[m]
AVG	0-3600	1: RK Beach road	27.01	70.69
AVG	0-3600	2: MVP Main road	13.06	57.87
AVG	0-3600	3: Bheemili beach road	31.4	86.58

Result of evaluation of Node measurements

Table 11. Node evaluation result attributes

Simulat ion run	Time interval	Move ment	Level of service	Vehicle delay[s]	Emissions carbon monoxide [grams]	Emissions nitrogen oxides [grams]	Emissi ons volatile organic compo unds [grams]	Fuel consum ption [US liquid gallon]
AVG	0-3600	1	C	24.45	20.888	4.064	4.841	0.299
AVG	0-3600	2	C	30.31	239.091	46.518	55.412	3.42
AVG	0-3600	3	C	31.06	59.51	11.579	13.792	0.851
AVG	0-3600	4	A	9.53	47.032	9.151	10.9	0.673

AVG	0-3600	5	C	23.74	269.117	52.36	62.371	3.85
AVG	0-3600	6	D	51.08	72.267	14.061	16.749	1.034
AVG	0-3600	Total	C	26.66	708.449	137.838	164.19	10.135

Here 1: RK Beach to MVP Main road

2: RK Beach road to Bheemili beach road3: MVP Main road to RK Beach road
4: MVP Main road to Bheemili beach road
5: Bheemili beach road to RK Beach road
6: Bheemili beach road to MVP Main road
Total: Total intersection movement

Delay results

The delay of a vehicle is obtained by subtracting the theoretical (ideal) travel time from the actual travel time. The theoretical travel time is the travel time which could be achieved if there were no other vehicles or no signal controls or other reasons for stops. The actual travel time does not include any passenger service times of PT (public transport) vehicles at stops and no parking time in real parking lots. As shown in figure 5.

Here, 1: RK Beach road
2: MVP Main road
3: Bheemili beach road

According to the data presented above, the delay time of the VISSIM model signalized intersection is lesser than the delay time of the VISSIM model of the existing condition at an unsignalized intersection. This indicates that the observed and simulated traffic differ significantly.

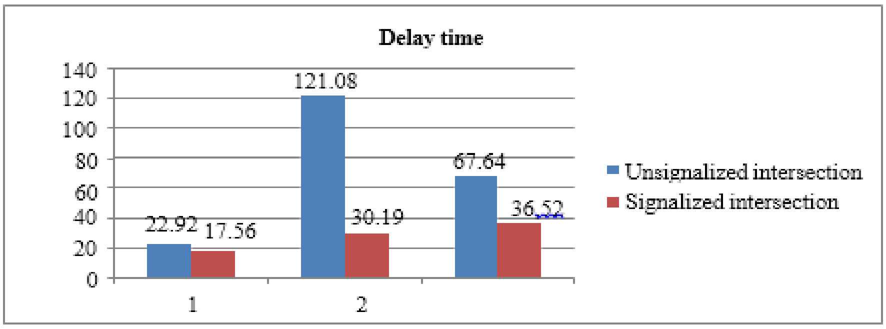

Figure 5: Delay time graphical comparison

Queue length results

Queue lengths can be determined with queue counters at any point in the Vissim network and evaluated for any time interval. The maximum distance between the traffic counter and the vehicle that meets the queue conditions. If there is no vehicle that meets the queue condition, this includes zero values. As shown in figure 6.

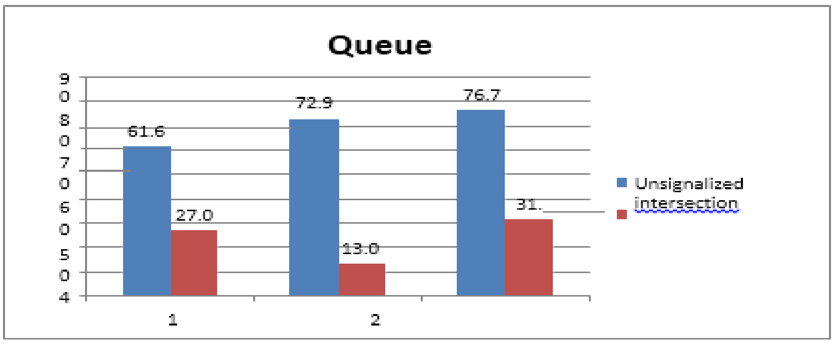

Figure 6: Queue length graphical comparison

Here 1: RK Beach road 2: MVP Main road 3: Bheemili beach road

According to the statistics shown above, the Queue length of the VISSIM model signalised intersection is smaller than the Queue length of the VISSIM model of the existing condition at an unsignalized intersection. This shows that the observed and simulated traffic differ significantly.

Vehicle travel time results

A vehicle travel time measure between start section and destination section. The mean travel time between start section and destination section is calculated, including the waiting time and/or stop time on all lanes. As shown in figure 7.

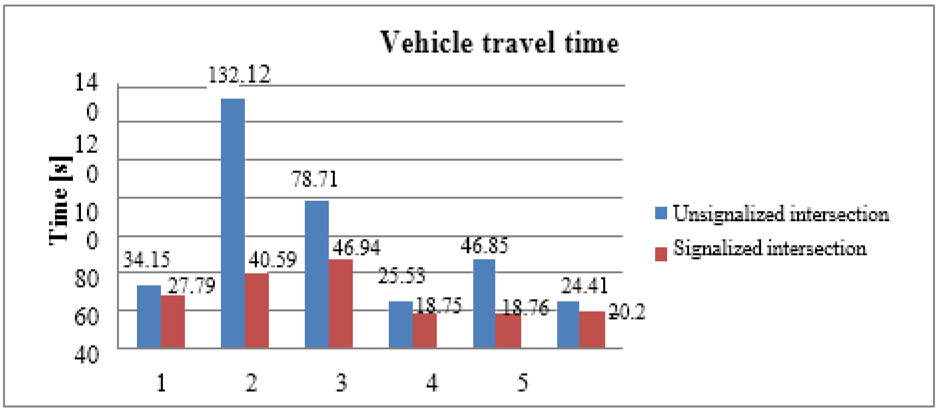

Figure 7: Vehicle travel time graphical comparison

Node results

Level of service (LOS) is a qualitative measure used to relate the quality of motor vehicle traffic service. LOS is used to analyze roadways and intersections by categorizing traffic flow and assigning quality levels. The levels of transport quality Ato F. It is based on the result attribute Vehicle delay (average). The current value range of vehicle delay depends on the Level of service scheme type of the node Signalized or Non-signalized. As shown in table 12.

Table 12: Level of service range

	Signalized intersection	**Non-signalized intersection**	**Quality**
LOS_A	Delay < 10 s or no volume, as no vehicle is moving, also due to traffic jam		Free flow
LOS_B	> 10 s to 20 s	> 10 s to 15 s	Reasonable free flow
LOS_C	> 20 s to 35 s	> 15 s to 25 s	Near free flow
LOS_D	> 35 s to 55 s	> 25 s to 35 s	Medium flow
LOS_E	> 55 s to 80 s	> 35 s to 50 s	At capacity flow
LOS_F	> 80 s	> 50 s	Congested flow

The level of service for an unsignalized intersection in the Vissim model is LOS E, whereas the level of service for a signalized intersection in the Vissim model is LOS C. Because of the signal controller, the traffic quality has improved from at capacity flow to near free flow. Emissions of carbon monoxide, nitrogen oxides, and volatile organic compounds are also reduced as a result of the vissim model signalised.

6. CONCLUSIONS

Following conclusion can be drawn out from this dissertation:

- Modelling Signal Controllers model developed in the VISSIM environment show a lot of promise in terms of incorporating different vehicle types and testing different scenarios.

- Optimal signal cycle length determined by VISSIM is 70 sec.
- The proposed procedure appears to be effective in the calibration and validation for vissim for existing condition intersection.
- The delay time results generated using the simulation model show that the delay time for the vissim unsignalized intersection model is more than the delay time for the vissim signalized intersection model.
- The queue length results from the simulation model indicate that the queue length for the vissim unsignalized intersection model is longer than the queue length for the vissim signalized intersection model.
- The simulation model's vehicle travel time results show that the vehicle travel time for the vissim unsignalized intersection model is higher than the vehicle travel time for the vissim signalized intersection model.
- In the Vissim model, the level of service for an unsignalized intersection is LOS E, whereas the level of service for a signalized intersection is LOS C. Traffic quality has improved from at capacity flow to near free flow as a result of the signal controller.
- Carbon monoxide, nitrogen oxide, and volatile organic compound emissions are also reduced as a result of the vissim model signalized junction.

Based on the results, it can be stated that the vissim model signalized intersection outperforms the present vissim model intersection. As a result, a signal controller can be added to the existing unsignalized intersection to improve traffic flow.

Future scope

- In addition, VISSIM results can be compared using other simulation programmes such as SiM-TriM, SUMO, and CORISM.
- The effect of geometric parameters, such as curvature, is not explored in this study but may be in future works.
- The influence of a public transportation bus stop is not considered inthis study and may be considered in future works.

REFERENCES

1. Buck, H. S., Mallig, N., & Vortisch, P. (2017). Calibrating VISSIM to analyze delay at signalized intersections. Transportation Research Record, 2615(1), 73-81.
2. Cunto, F., & Saccomanno, F. F. (2008). Calibration and validation of simulated vehicle safetyperformance at signalized intersections. Accident analysis & prevention,40(3), 1171-1179.
3. Fellendorf, M., & Vortisch, P. (2001, January). Validation of the microscopic traffic flow model VISSIM in different real-world situations. In transportation research board 80th annualmeeting (Vol. 11).
4. GAYE, D., FAYE, R. M., & MAMPASSI, B. (2016). A car following model for traffic flow simulation.
5. Illahi, U., Burhan-Ul-Wafa, D. Z. W., & Khan, R. N. (2016). Traffic Flow Analysis & Efficiency of Geometric Design of A T-Intersection, A Case Study. International Journal of Civil Engineering and Technology, 7(1).
6. Jayasooriya, N., & Bandara, S. (2018, May). Calibrating and validating VISSIM microscopic simulation software for the context of Sri Lanka. In 2018 Moratuwa Engineering Research Conference (MERCon) (pp. 494-499). IEEE.
7. Mukhtyarali, S. S., Zala, L. B., & Amin, A. A. (2017). Capacities and LOS Measures of Intersections. Kalpa Publications in Civil Engineering, 1, 209-218.