VISSIM Based Traffic Flow Simulation Analysis on Road Network

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Abstract. The urban transport system is a heterogeneous system and is in serious trouble. Traffic congestion has become a major socio-economic problem in both urban and rural areas. Traffic congestion is managed through signage, interchanges, and road widening. Traffic analysis remains a difficult task, especially in countries like India where the number of vehicles is constantly increasing and the roads are increasingly busy, because it is difficult to generate alternatives. Traffic simulation systems such as PTV VISSIM are tools dedicated to the analysis of traffic problems. VISSIM is a simulation software that is widely used to create simulations in dynamic traffic situations before evaluating traffic conditions and creating a realistic plan. Dynamic simulation of traffic flow using VISSIM and appropriate techniques to reduce traffic congestion. The main objective is to examine the study area and prepare a sample for it to find out the root causes of the traffic problem and give the necessary suggestions to solve the problem.

Keywords: PTV VISSIM, Heterogeneous, Traffic congestion, Signalization, Widening, Interchanges, Intersections

1 Introduction

Traffic management is a way to provide better traffic conditions. Proper traffic management starts with the right situation design. Traffic congestion is a major problem in many cities, especially large cities. Overcoming traffic congestion and improving service levels, road capacity and efficient urban transport systems, as well as effective traffic management and management practices, are normal ways. The assessment of traffic congestion in road networks is important for flow, control, and management. This allows the company to have an accurate and clear view of the status of network marketing activities. Microsimulation modelling of transport and infrastructure has evolved over time to a safer, simpler, and cheaper way to assess the impact of changes in weather conditions on cars. PTV VISSIM is

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one such tool and is being studied extensively in many studies. PTV VISSIM is a new multi-model simulation tool developed by the German group PTV. VISSIM is a simulation tool for modelling urban and rural traffic and pedestrian flows. It was developed at the University of Karlsruhe and its first version was released in 1994. In addition to private vehicles, it is also possible to try public transport on the train and road to VISSIM. Compare traffic flow and consider route planning, traffic configuration, signal control and special traffic detection and transit. VISSIM can be applied to many traffic and traffic engineering problems, such as reconstructing intersections and comparing their advantages, choosing the best part for roads and highways, building capacity analysis, transportation development planning, transportation management, traffic planning and human resources, and public transport. The same goes for modelling. The core of VISSIM is the Wiedemann National Model. The version used in this study is PTV VISSIM 2022 (Sample Edition) published by PTV Group. PTV VISSIM 2022 (model version) consists of two parts, the first part is the traffic flow model, and the other part is a signal controller (signal scheduler), which is always connected to other models. Signal programs are developed separately, imported into the traffic flow model, and used where necessary.

2 Literature Review

Basic idea about Analysis and compared improved alternatives to reorganize the existing traffic control elements in areas with high traffic flow through implementing microscopic traffic simulation models. Paper [1] proposed a PTV-VISSIM software simulation model for, installation of an additional bus stop for public transport in the study area, the restriction of the use of some stops by taxis, help reduce the traffic congestion, delays, and travel times. Specifically, the improvements proposed would result in reductions of 32.9% in total aggregate travel times and of 49.5% in total aggregate delay times. Micro simulation modelling of an over saturated congested urban corridor in Wipro Avenue and Infosys Avenue roads in Electronic City Phase-1 Bangalore by using PTV VISSIM [2]. It is advisable for widening of existing road widths to provide much needed space for the vehicular traffic, this will result in lesser travel time on corridor and the reduction in travel time is also achieved by creating freeway corridor and limit the number of intersections on it [3]. It also suggested proper turns in lane discipline to be followed strictly on road which reduces unnecessary delays in traffic signage. Improved road markings to reduce accidents. Calibration and validation process of Takashi's VISSIM model where Data were collected, including volume counts, geometric data, and duration of symptoms [4]. The survey was conducted in manually selected areas. Data were collected over two hours, from 9:00 AM to 11:00 AM, the morning rush hour, and from 5:00 PM to 7:00 PM, the evening rush hour. Model optimization is performed using optimization tools such as genetic algorithms. The model is validated using GHG calculations. The GEH value of the sample is 2.863, which indicates that the sample is well prepared. Data recorded measured and averaged data for 10 simulation runs after calibration, two simulation tests were designed to develop the small left-side index to large, and the large left-side road was performed using the VISSI M tool [5]. This study may be useful for municipal and regional highway engineers to better assess the need for left turn lanes. They concluded that the studied T-section VISSIM cross-sectional model was well adjusted to reflect field flow conditions and no significant differences were found between field and simulation results. Study [6] evaluates intersection dynamics and develops a VISSIM model for traffic volume. Data is collected using video-reflection and is collected for three hours in the morning and evening. Then, after analysing the data, the VISSIM model was developed, calibrated, and validated. It is suggested that the transmission efficiency can be improved by updating the signal timing. It was found that increased traffic volume at our intersections causes problems such as traffic accidents, accidents, and congestion [7]. Traffic
volume is considered to determine traffic volume, development, and traffic patterns in an area. This information is used to identify progress on the path. Consider the impact of heavy traffic and pedestrians on traffic. The duration of the test depends on the type of test being performed. It can be used to get traffic information and can be checked manually at 15-minute intervals. The collected information is converted into PCU units. Webster's strategy is a smart way to build your brand. The structure is original and is entirely based on a model established somewhere around Webster. In this strategy, the model is determined based on the complete location of the signal, minimizing the duration of the signal. Transportation should be safe, fast, efficient, useful, functional, and comfortable [8]. However, traffic consumes many resources such as time. The current stretch of the road is 2.5 km long up to Uppal. The objective of this research is to understand and assess the condition of seismic road sections. After studying the ship design, optimal cycle time and underwater flight time, the green phase section was created, adding the red and gold sections that were built according to Webster's rules and IRC rules. A road model was developed for this analysis using the VISSIM software [9]. Different corporate plans were compared. The aim of this study is to use simulation methods to analyse the traffic control of the CBD area and the surrounding road network under extreme traffic demand conditions. Differences and ratings found in this study include travel speed, queue length, travel time and delays. To get an idea about the level of congestion in CBD areas in 2020, it is important to conduct a traffic simulation study. A comprehensive analysis of travel time index, length, queue length and travel speed showed that single management conditions in key areas were better than dual management. A sensitivity analysis using ANOVA and optimal methods for within-subjects’ effects [10]. Using the genetic algorithm tools of MATLAB, automatic calibration is performed through the VISSIM COM interface. Sensitive parameters include vehicle tracking, lane changing and lateral parameters. A p-value of a parameter less than 0.2 is designated as a sensitive parameter. Model calibration was performed by keeping other parameter values and changing sensitive parameter values. Our study concluded that ANOVA with baseline effects is very useful for finding sensitive parameters that influence the model. Research [11] developed a VISSIM model for the city of Zurich, which was analysed and estimated. In this project, we proposed an improved sensitivity analysis method based on the elementary tolerance method. Using this method, the computational time required for the sensitivity analysis in this special case is reduced from 77 days to 2 days. This demonstrates that the proposed method is accurate and efficient, especially in performing the sensitivity analysis of VISSIM complex networks. A systematic approach to optimize microsimulation models for heterogeneous vehicles [12]. Multivariate sensitivity analysis was used to identify the set parameters, and an optimization tool called genetic algorithm was used to minimize errors in the field and simulation data to obtain accurate values of these parameters. The most influential parameters in this study are CC8, CC1, CC7, CC0, and CC2. Based on the results of this study, future models with different flow patterns, network simulators and modification tools and various facilities can be built. expected method They refer to well-known transportation systems such as AIMSUM, PARAMICS, and VISSIM, which are widely used in transportation design analysis and evaluation. Study [13] presents a variety of microsimulation model structures. This chapter begins with a review of typical applications, followed by modelling principles that describe the general architecture of the simulator. The chapter concludes with a description of VISSIM's interface with other tools. A sensitivity analysis is carried out to evaluate and identify parameters calibration [14]. In this study, optimization tools, namely genetic algorithms, were used to define the values of these parameters while minimizing field errors and simulation delays. This study proposes a two-step process. First, the sensitive parameters are identified by changing the value of each parameter while keeping the other parameters at their default values. Second, the ranges of the sensitivity parameters are changed by the crossover process. The eight vehicles tracking parameters CC0 to CC7 of the
Wiedemann 99 model are selected based on sensitivity analysis for calibration. The proposed GA and heuristic optimization reduce the time and effort required to accurately optimize various simulation parameters.

3 Methodology

3.1 Flow chart of the Research work

![Flow chart]

3.2 Study Area

The proposed study area for this project is an urban ring road connecting the city of Hyderabad with a marked four-bridge bridge at M.J Market, Nampally, Hyderabad, Telangana, India. (Location: [https://maps.app.goo.gl/jaQewF6uK4gNSnKS7](https://maps.app.goo.gl/jaQewF6uK4gNSnKS7) - Fig 1 & 2)
3.3 Preliminary Survey

For the collection of traffic data, it is important to make a proper assessment of the scope of the expected software (the level of data quality required). In this way, it is intended to guarantee the completion of the planned training and guarantee the best possible and fair compensation. The actual number of people and equipment performing a traffic census task depends, among other things, on:

- The location of the station.
- The quality of the data to be collected.
- Traffic flow level.
- Characteristics of the road section where the station belongs and traffic flow.
- Traffic Structure.

Collection of data from two selected point locations at M.J Market intersection, Hyderabad during the peak hours of 9:30 A.M. to 10:30 a.m. and the peak hours of 6:00 p.m. to 7:00 p.m (Refer Table 1 & 2).

**Table 1.** Lane Details and its Widths

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Road</th>
<th>No. of Lanes</th>
<th>Width of Lanes</th>
<th>Total Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Koti</td>
<td>2</td>
<td>8, 3.5</td>
<td>11.5</td>
</tr>
<tr>
<td>2</td>
<td>Afzalgunj</td>
<td>2</td>
<td>7, 7</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Nampally</td>
<td>2</td>
<td>8, 7</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Abids</td>
<td>2</td>
<td>7, 7</td>
<td>14</td>
</tr>
</tbody>
</table>
Traffic Volume Study:

**Table 2.** Vehicles in Surveyed Peak Hour (9.30 to 10.30 am)

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Lane No</th>
<th>Buses</th>
<th>Cars</th>
<th>Autos</th>
<th>Bikes</th>
<th>H. G. V</th>
<th>Total vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>1</td>
<td>212</td>
<td>436</td>
<td>1008</td>
<td>2804</td>
<td>16</td>
<td>4476</td>
</tr>
<tr>
<td>1 hour</td>
<td>2</td>
<td>152</td>
<td>536</td>
<td>720</td>
<td>2556</td>
<td>24</td>
<td>3988</td>
</tr>
<tr>
<td>1 hour</td>
<td>3</td>
<td>20</td>
<td>748</td>
<td>796</td>
<td>3568</td>
<td>12</td>
<td>5144</td>
</tr>
<tr>
<td>1 hour</td>
<td>4</td>
<td>120</td>
<td>392</td>
<td>280</td>
<td>992</td>
<td>02</td>
<td>1786</td>
</tr>
<tr>
<td>1 hour</td>
<td>5</td>
<td>112</td>
<td>532</td>
<td>948</td>
<td>3484</td>
<td>12</td>
<td>5048</td>
</tr>
<tr>
<td>1 hour</td>
<td>6</td>
<td>260</td>
<td>584</td>
<td>1028</td>
<td>1604</td>
<td>28</td>
<td>3504</td>
</tr>
<tr>
<td>1 hour</td>
<td>7</td>
<td>92</td>
<td>232</td>
<td>496</td>
<td>1864</td>
<td>08</td>
<td>2692</td>
</tr>
<tr>
<td>1 hour</td>
<td>8</td>
<td>152</td>
<td>196</td>
<td>568</td>
<td>1076</td>
<td>08</td>
<td>1924</td>
</tr>
</tbody>
</table>

The total length of the cycle combining the green and red periods is shown in the Table 3. The peak time is 9:15 to 10:15 in this section, the cycle length is the same, the green station time and the red time for all changes currently.

**Table 3.** Total Cycle Length of M.J Market in the morning

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Green(sec)</td>
<td>79</td>
</tr>
<tr>
<td>Amber(sec)</td>
<td>3</td>
</tr>
<tr>
<td>Red(sec)</td>
<td>52</td>
</tr>
<tr>
<td>Cycle Length(sec)</td>
<td>134</td>
</tr>
</tbody>
</table>

3.4 Modelling of Network

Modelling was done to facilitate the construction and understanding of the simulation model [15]. This is because there are four major intersections along this length alone that add to the long traffic times that can be seen when evaluating travel time. Left and right turns are drawn using connectors that connect separate lanes of one road to another. The joints have the widest thickness found in the field and are specially designed for both sides of the vehicle's movement [16]. A snapshot of all connections and connections drawn in VISSIM on the Open Street Map (Mapnik) background in VISSIM [17]. Installing vehicles is a very difficult part of VISSIM. Since you enter your vehicle at the terminal, a vehicle ticket is issued at the start of each route. For this example, vehicles entered four locations at the beginning of four road access points leading to the network. Vehicle entry lists and vehicle numbers created in VISSIM are done at 15-minute intervals and combined at 900 second locations in VISSIM [18]. Therefore, 1-hour trading data is presented as hourly trading in 15-minute intervals. Vehicle configurations observed during classified vehicle surveys are entered into the model under Vehicle Configuration. Standard vehicle models in VISSIM have dimensions and other static and dynamic characteristics like European models and are modified to suit Indian vehicle conditions. So, take this model [19,20] a suitable new car model from the extensive list of car models available in VISSIM and create big and small cars on Indian roads depending on the conditions and length of the car as Auto (3 Wheeler). From 3.72m to 4.58m. Vehicle features in Indo HCM have been considered for standard vehicles available on Indian roads [21].
Using PTV VISSIM Software Various steps involved

- Study area network preparation.
- Simulation.
- Evaluation.
- Presentation.

**Link method:**

- Click the link, then Ctrl + right click and drag to send the road link.
- Once the link is closed, give the road a name and set the link behavior type to "Motorized Urban".
- Set the view type to "Grey Road".
- level "Default".
- Number of lanes: for each road. Various ways
- Road width: Based on the initial road survey information, it can be set in meters.

**Connection process:**

- Right-click anyone, that is, create a spline in numbers "N".
- Repeat the process for all paths.
- Then select a path, right-click, hold the spline icon, and drag it to the other paths.
- Connect as many connections as possible. Repeat the link for.

![Fig. 4. Lists of Links & Lanes](#)

- Complete all the links, click on the link and once the list is displayed, right click to see the full list. (Refer Fig 3)

![Fig. 5. Lists of Links & Lanes](#)
• Click on the slow region, Ctrl + right click and drag the required length to the specified/specific route. (Refer Fig 4)
• After naming the slow region for all routes.

Fig. 6. Conflict Zones in the Model

• Click on conflict areas, then it shows the all-possible conflict zones by using software analysis. (Refer Fig 5)

Fig. 7. List of 2D/3D Model Segments

• Click on Base Data and Click 2D/3D Models, it will show the specified vehicle types. (Refer Fig 6)
• Add vehicles such as Bike, Truck and Auto which are not present in the software 2D/3D models.
Fig. 8. List of 2D/3D Model Distribution Elements

- Click on Base Data, click distributions and go to 2D/3D Models. Then show list. (Refer Fig 7)

Fig. 9. Vehicle Inputs

- Click on vehicle inputs, show list. Then we can create time intervals for every lane and inputs can be given accordingly. (Refer Fig 8)
Fig. 10. Vehicle Types

- Click on base data, click vehicle types, show list, add another vehicle types. (Refer Fig 9)
- Then change capacity according to the field.
- Change category to the respective vehicle types and save.

Fig. 11. Vehicle Clauses

- Click on Base Data, click vehicle clauses, show list and add other vehicles to the list and save. (Refer Fig 10)
Click Traffic and click vehicle composition, then add required vehicles for different compositions by giving different names to it. (Refer Fig 11)

Here we can change or give speeds for all vehicles.

Create compositions for all lanes based on routes and vehicles movement. (Refer Fig 12)

Simulation run done for the given vehicle input for different lanes has completed for 10 minutes. (Refer Fig 13 and 14)

It determined the road network has saturated without any errors.
5 Conclusions

- The program has successfully demonstrated the simulation and analysis of shared space.
- If the traffic is congested and more than double the number of vehicles, the smell will be too much, and the width of the roads will not be adequate.
- Public transport systems should be strengthened to reduce traffic congestion by reducing the use of private vehicles.
- Traffic distribution, public transport, pedestrian and bicycle facilities can be modelled according to different layouts of the street network to reduce traffic congestion.
- Minimize turns and improve behavior and deceleration on special routes of traffic Beat the clock.

References


