ISSN 2395-1621

ANALYSIS OF TRAFFIC AT VITHALRAO CHOWK, S.B. ROAD, PUNE

[#1]ADISH THAVARE, [#2]CHINMAY HAWALE, [#3]SUPRIM SASAVE, [#4]YOGESH PAWAR

[1]adishthavare8@gmail.com
[2]chinmayhawale7@gmail.com
[3]sasavesuprim22@gmail.com
[4]yogeshpawar309@gmail.com

[#1234]Student, Department Civil Engineering

PADMABHUSHAN VASANTDADA PATIL INSTITUTE OF TECHNOLOGY, PUNE.

ABSTRACT

Due to rapid urbanization, the increase in population and traffic flow has immense affect on daily commuting on city roads. The main purpose behind the proposal of a new TVC signal at the point is to ease the flow of traffic coming from various directions to the new Mall which is coming up shortly; with the emphasis being on the traffic coming from Pune University on to S.B. Road. As there is no existing signal at present at the proposed point, the people coming from Pune University must take a U-turn from Bhosale square (square just in front of J.W MARRIOTT HOTEL). There are residential societies, commercial towers and a supermarket which would be easy to access from the present moment itself with the installation of the TVC signal at the proposed junction. Considering the future traffic that would accommodate the people coming to the new Mall which also has a big multiple in it (1384 seating capacity) and to a few more commercial complexes coming up in near future; the need for installation of a TVC signal at the proposed junction is justified.

ARTICLE INFO

Article History

Received: 20th May 2019

Received in revised form :

20th May 2019

Accepted: 25th May 2019

Published online :

26th May 2019

I. INTRODUCTION

Traffic engineering is a branch of civil engineering that deals with engineering techniques to achieve the safe and efficient movement of people and goods on roadways. It focuses mainly on research for safe and efficient traffic flow and others such as road geometry, sidewalks and cross walks, cycling infrastructure, traffic sign, road circles making and traffic lights. Typical traffic engineering project involves designing traffic control device installation and modification, including traffic signals, sign and pavement markings. Traffic flow management can be short term (preparing construction traffic control plans, including detour plans for pedestrian and vehicular traffic) or long term (estimating the impacts of proposed commercial/residential developments on traffic patterns). Increasingly, traffic problems are being addressed by developing system for intelligent transport systems, often in conjunction with other engineering disciplines, such as computer engineering and electrical engineering. Various traffic studies are carried out to analyze the traffic characteristic. It helps in geometric design and traffic control, which tends to a safe and efficient traffic movement.

Traffic studies include:

- Traffic volume study
- Speed study
- Origin and destination study
- Traffic flow characteristics study
- Traffic capacity study
- Parking study
- Accident study

Traffic Volume Study

Traffic volume study is the quantity of vehicles crossing a section of road per unit time at any selected period. The uses of traffic studies are planning traffic operation and control, traffic pattern, structural design of pavement and regulatory measures. Traffic volume count can be done either manually or by using automatic counters.

Automatic Counters

Automatic counters are also known as mechanical counters. They can automatically record the total numbers of vehicles crossing a section of the road in desired period of time.

Advantage:

- It can work throughout the day and night for desired period, which is impractical in manual.

Disadvantage:

- It does not give the detail of the traffic like various classes, stream and turning movement.

II. LITERATURE REVIEW

1) Martin G. Buehler (1983) carried out studies on the three growth factor models of the type developed in early transportation planning theory that were applied to the estimation of the individual 1- way traffic movement volumes at 4-leg intersections. The models used as an input the traffic volume on each leg of the intersection and produce a balanced solution to the problem which models in common use do not produce. Historical data were used to test the models for use in making seasonal intersection volume adjustments and for estimating future intersection volumes due to area wide traffic growth. Results for the data studied were found to be superior to two commonly used models. The models are applicable for use in computerized suburban annual traffic counting and operational analysis systems. The basic structure of such a system is described. Such a system would produce information useful as an element in the priority programming of intersection and roadway capacity projects. A new type of traffic counter is described that would be beneficial for data collection.

2) Makigami, Sakamoto and Hayashi (1985) studied the outline and results of an aerial traffic survey of an 800-m section of the Hanshin Expressway. The objectives of the study were to record congested traffic flow and to determine its causes. Traffic in the study section was photographed by two 35-mm still cameras every 5 s for 1 h. All vehicles recorded in the southward traffic flow were numbered and traced in order to project their trajectories in the time and space diagram. Speed and density contour diagrams were based on the theory of three-dimensional representation of traffic flow. The characteristics and causes of traffic congestion were analyzed using these diagrams.

3) Olusegun Adebisi (1987) analyzed the turning traffic volume data gathered manually at four intersections that have been studied to determine if either Fratar, Furness, or Kruith of models could be used to design labor-saving strategies for manual counts of traffic flows at road junctions and to detect observation errors in a given data set. Each model was used to precompute the observed turning volumes by using different abstractions of the original data as model inputs. The standard errors obtained correlate partly with the level of traffic flow and the magnitude of error- inducing features at the observation sites. The results indicate that the models could be applied to obtain an indication of the magnitudes of observation errors in given data sets.

III. METHODOLOGY

Discussion with Infraking Consultancy

The project was proposed to be done in collaboration with Infraking consultancy, Pune for Pune Municipal Corporation. Initially the consultants from Infraking briefed us about the problem statement and the methodology to be followed. Thereafter the progress of the worked was to be conveyed to them.

Inventory Survey

- The major routes belong to arterial roads while the minor ones were sub – arterial and collector roads.
- There is currently one fixed time automatic signal located near JW Marriot Chowk whose green time is 20 seconds.
- This signal has a predefined cycle time like any other general traffic signal.

Traffic Volume Survey

- The supervisor at site explained how the traffic was to be counted and then divided the enumerators accordingly.
- For the purpose of counts, a day was divided into 3 shifts of 8 hours each and separate enumerators with a supervisor were assigned for each shift. Recording was done for each direction of travel separately.
- A data sheet form for the manual recording of hourly flows was given to each enumerator. Before start of enumeration, it was ensured by supervisor that the information in the form at the top is duly filled in by enumerators.
- In each hourly column, the traffic should be recorded by marking tally marks in the five-dash system (vertical strokes for the first four vehicles, followed by an oblique stroke for the fifth vehicle so as to depict a total of five).
- The mixed traffic volume is converted to PCUs using IRC 106.
- The growth factor to find future traffic assumed to be 5%.

IV. DESIGN AND CALCULATION

Webster’s method of traffic signal design (Conventional Design)

It has been found from studies that the average delay and overall delay to the vehicles at a signalized intersection vary with the signal cycle length. The average delay per vehicle is high when the cycle length is very less, as a sizeable proportion of vehicle may not get cleared during the first cycle and may spill over to subsequent cycles. As the signal cycle time is increased, the average delay per vehicle decreases up to a certain minimum value and thereafter the delay starts increasing, indicating that there is an ‘optimum signal cycle time’ corresponding at least overall delay. The optimum cycle time depends on the geometric details of the intersection and the volume of traffic approaching the intersection from all the approach roads during the design hour.

Webster' method of traffic signal design is an analytical approach of determining the optimum signal time, Co corresponding to minimum total delay to all the vehicles at the approach roads of intersections. The field work consists of determining the following two sets of values on each approach road near the intersection:

i. The normal flow, q on each approach during the design hour and

ii. The 'saturation flow', S per unit time

The normal flow values, q1 and q2 on roads 1 and 2 are determined from field studies conducted during the design hour or the traffic during peak 15-minutes period. The saturation flow of vehicles is determined from careful field studies by noting the number of vehicles in the stream of compact flow during the green phases and the corresponding time intervals precisely. In the absence of the data the approximate value of saturation flow is estimated assuming 160 PCU per 0.3-meter width of the approach road.

Based on the selected values of normal flow, the ratio y1=q1/S1 and y2=q2/S2 are determined on the approach roads 1 and 2. In the case of mixed traffic, it is necessary to convert the different vehicle classes in terms if suitable PCU values at signalized intersection; in case these are not available they may be determined separately.

The normal flow of the traffic on the approach roads may also be determined by conducting field studies during off-peak hours to design different sets of signal timings during other periods of the day also, as required so as to provide different signal settings.

The optimum signal cycle is given by the relation:

Co = 1.5L + 5/1-Y

Where,

L = total lost time per cycle, sec = 2n+ R n = is the number of phases

R = all- red time or red-amber time; (all red time may also be provided for pedestrian crossings)

Y = y1+y2

here, y1= q1/s1 and y2= q2/s2

Then, G1 = y1 (Co– L)/Y and G2 = y2 (Co– L)/Y

Similar procedure is followed where there is more number of signal phases.

Design of 3 phase signal using Webster's method

q1 = 966 + 198 = 1164
y1 = q1 / S1 = 1164 / 3600 = 0.32
q2 = 96.7 + 65.83 + 819.66 + 137.25 = 1119.44
y2 = q2 / s2 = 1119.44 / 3600 = 0.31
q3 = 103.58 + 67 = 170.5
y3 = q3 / s3 = 170.5 / 900 = 0.19
Y = y1 + y2 + y3
= 0.32 + 0.31 + 0.19 = 0.82

Optimum cycle time (C0)

$$C_0 = \frac{1.5 * L + 5}{1 - Y}$$

L = Total lost time

L = 2 * n + R

Where,

R = All Red Time.
n = Number of phases.

L = 2 * 3 + 12 = 18

$$C_0 = \frac{1.5 * 15 + 5}{1 - 0.82} = 153.72 \text{ sec} = 154 \text{ sec}$$

G1 = (y1 / Y) * (C0 – L) G1 – Green time for route 1
= (0.32 / 0.82) * (154 – 15)
= 53.85 sec = 54 sec.

G2 = (y2 / Y) * (C0 – L) G2 – Green time for route 2
= (0.321 / 0.82) * (154 – 15)
= 52.17 sec = 53 sec.

G3 = (y3 / Y) * (C0 – L) G3 – Green time for route 3
= (0.19 / 0.82) * (154 – 15)
= 31.97 sec = 32 sec.

Providing amber time of 2 seconds each for clearance, Total cycle time = 54 + 53 + 32 + 6 + 9
= 154 sec.

V. RESULT AND DISCUSSION

Based on the study and analysis done on the current scenario and taking future traffic in consideration, three alternatives are applicable.

Alternative 1: -

- Provision of entrance and exit on the same side of the road which is adjacent to the mall between existing and proposed signal.
- This is the most feasible alternative for the next two years with respect to time and money.

Alternative 2: -

- Provision of a fixed time automatic signal which is designed based on the present traffic count.
- The total cycle time calculated by Webster's method is 154 seconds.
- The green times are as follows. G1 = 54 seconds G2 = 53 seconds G3 = 32 seconds

Alternative 3: -

- Provision of a traffic signal system which is a combination of automatic actuated system and fixed cycle time system.
- The sensors will work as per the density of vehicles accommodated between two chips placed at a distance, which is calculated on the basis of number of vehicles to be accommodated.

- The system will work automatically as per the sensors during peak hours and will work as per fixed cycle time for rest of the period.
- As it requires sensors and proper planning, this alternative requires maximum time for implementation. However if implemented, it will be a sustainable approach as it will amount to large saving in time and fuel.

VI. CONCLUSION

- Alternative one can be the first preference as it cost least and can be obtained within less period of time.
- Alternative three is more feasible than alternative two as the fixed cycle time obtained is much more than the cycle time of the existing signal at J.W. Marriott.
- Whereas in an automatic actuated signal the signal time varies according to the traffic density and therefore alternative three can be preferred over alternative two.
- But alternative three is expensive and the gestation period is long. Also the sensor system has to be provided along with the fixed cycle time to avoid unnecessary delay.
- In case of limited funds available, alternative two can be used.
- Traffic signal cost

i. Electric = 4 to 5 lakhs

ii. Solar signal = 8 lakhs

REFERENCES

[1] Martin G. Buehler (1983); Forecasting Intersection Traffic Volumes, Journal of Transportation Engineering, Vol. 109, No. 4, July, 1983. ©ASCE, ISSN 0733-947X/83/0004-0519/$01.00.Paper No. 18117, PgNo. 519-533

[2] Yasuji Makigami, Hamao Sakamoto, and MasachikaHayashi (1985); An Analytical Method Of Traffic Flow Using Aerial Photographs, Vol. I l l, No. 4, July, 1985. ©ASCE, ISSN 0733-947X/85/0004-0377/$01.00. Paper No. 19875, PgNo377- 394

[3] Olusegun Adebisi (1987); Improving Manual Counts Of Turning Traffic Volumes At Road Junctions, Journal of Transportation Engineering, Vol. 113, No. 3, May, 1987. ©ASCE, ISSN 0733-947X/87/0003-0256/$01.00. Paper No. 21469, PgNo 256- 267

