DESIGN AND COMPARISON OF TRAFFIC CONTROL AND SIGNAL INITIALIZATION AT TWO INTERSECTIONS

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ABSTRACT: Now a days due to increase in population, traffic congestion is growing and becoming a huge problem in major cities. This leads to many problems like pollution, time delay, accidents, wastage of fuel and time etc. These problems are overcome by providing an efficient traffic control at intersections and that can be achieved by provision of automated volume based traffic signal system for efficient and continuous movement of vehicles through the intersections. So, in our project we calculate the traffic volume by manual counting considering the PCU units for different vehicles. By using WEBSTER’s method, we will calculate the delays at two intersections in pulivendula and compared the variation of Green, Red, Amber times and based on that traffic signal is designed to provide smooth traffic flow at the intersections.

Key words: Traffic Control, PCU, Intersection, Traffic Field Studies, Webster’s Method, Manual count.

I. INTRODUCTION
Intersections are important part of a road section. When provided without any proper traffic control measures they end up with congestion and bottlenecks. So, to prevent this issue, these should be designed on the aim of decreasing. It has been observed during this study that many intersections have become inadequate to handle the present day traffic causing congestion, delays, bottlenecks and accidents particularly during the peak hours as the traffic control system installed on these intersections are pre timed. The efficiency of traffic control at the intersection can now only be improved by the provision of automatic traffic signal system which works on real-time detections and eliminates the wastage of green time allotted to a phase. Traffic signals at the intersections to enable the efficient traffic control of traffic and also the faster clearing off the traffic from the intersection. The signal timings for pre timed traffic signals were redesigned by making use of Webster’s method.

The major traffic problems that every town and city faces in day-to-day life as follows:
1. Insufficient road width
2. Improper signal design
3. Heavy vehicle growth
4. Lack of awareness of traffic rules

The various aids and devices used to control, regulate and guide traffic may called as traffic control devices. The general requirements of traffic control devices are attention, meaning, time for response and respect for road users.

In our project we have chosen to study the traffic flow and traffic capacity of different road junctions and signal design studies in selected locations of pulivendula town. In order to know the traffic capacity, traffic volume studies should be carried out.

II. OBJECTIVE OF THE STUDY
The objective of the study is to identify factors impeding traffic mobility and propose measures to improve the prevailing traffic conditions duly planning for the future. Keeping in view the growth pattern and the socio economic scenario envisaged.

With the objective aforesaid, the scope of services is given here under:
1. Collection and appraisal of data/reports
2. Surveys and investigations
3. Processing
4. Engineering studies
5. Better traffic management measure

III. LITERATURE SURVEY
John A. Bieberitz, P.E.I, Donald J. Lee E.L.T, studied the neighbourhood traffic control in requirement of a traffic signal installation. Neighbourhood traffic control continues to be of major importance to residents who are typically concerned about safe pedestrian crossings and vehicle access to their neighbourhood collector street. Many traffic diverters have been studied over the years to discourage both speeding and through traffic on these streets.

KEVIN FEHON P.E., PTOE and Jim peters., POTE interest in adaptive traffic signals in the U.S.A is increasing and the use adaptive signals is strongly supported by FHWA There are several systems.(notably SCOOT and SCATS)that are widely used through hour the world and several new adaptive products have been recently been released.

Todd Knox; Reginald R. Souleyreth this paper reports the status and preliminary results of an ongoing study investigating the safety benefit of signalising intersections of high-speed (50.mph and greater) divided express ways. Before and after analysis was conducted and compared to empirical Bayesian (EB) techniques. A safety performance function was developed using negative binomial regression for a control group of 67 non-signalised intersections and compared to the performance of 20 intersections signalised between 1994 and 2001.

IV. METHODOLOGY

4.1 TRAFFIC VOLUME STUDY
Traffic volume or flow expressed as the number of vehicles crossing a section of road per unit time. Done by manual or automatic counters. In this study, the type of vehicles and number of vehicles are to be counted including the direction.
of vehicles. Generally, the traffic volume is expressed as vehicles/day or vehicles/hour. Thus the volume can be obtained as a uniform value, when it is expressed in terms of passenger car unit (PCU) per hour or day.

4.2 WEBSTER’S METHOD

- This is a rational method.
- Optimum signal cycle time based on least delay at intersections is worked out.
- Saturation flow(S) and Normal flow and normal flow (q) values per unit time on each road meeting at junction are required for signal design.

4.2.1 OPTIMUM CYCLE TIME

\[ C_0 = \frac{1.5L+5}{1-Y} \]

4.2.2 GREEN TIME ON ROAD

\[ G = \frac{Y}{Y(C_0-L)} \]

Where, \( Y = y_1 + y_2 + y_3 \)

\[ y_1 = \frac{q_1}{s_1}, \quad y_2 = \frac{q_2}{s_2}, \quad y_3 = \frac{q_3}{s_3} \]

4.2.3 LOST TIME PER CYCLE IN SECONDS

\[ L = 2n + R \]

Where, \( n \) = number of phases
\( R \) = all red time

4.3 CALCULATION

\[ Y = \frac{q}{s} \]

\[ y_1 = \frac{713}{3675} = 0.1940; \quad y_2 = \frac{697}{3675} = 0.1896; \quad y_3 = \frac{799}{3675} = 0.2174; \quad y_4 = \frac{675}{3675} = 0.1836. \]

i.e., \( Y = y_1 + y_2 + y_3 + y_4 = 0.7846 \)

\[ L = 2n + R \]

\[ = 2 \times 4 + 0 = 8 \text{ sec} \]

\[ C_0 = \frac{1.54+5}{1-0.7846} = 79 \text{ sec} \]

4.4 GREEN TIMES

\[ G = \frac{Y}{Y(C_0-L)} \]

\[ G_1 = \frac{y_1}{Y(C_0-L)} = \frac{0.1940}{0.7846} = \frac{79-8}{79-8}; = 18 \text{ sec} \]

\[ G_2 = \frac{y_2}{Y(C_0-L)} = \frac{0.1896}{0.7846} = \frac{79-8}{79-8}; = 17 \text{ sec} \]

\[ G_3 = \frac{y_3}{Y(C_0-L)} = \frac{0.2174}{0.7846} = \frac{79-8}{79-8}; = 20 \text{ sec} \]

\[ G_4 = \frac{y_4}{Y(C_0-L)} = \frac{0.1836}{0.7846} = \frac{79-8}{79-8}; = 16 \text{ sec} \]

4.5 AMBER TIMES

Assuming \( A_1 = 2 \text{ sec}; A_2 = 2 \text{ sec}; A_3 = 2 \text{ sec}; A_4 = 2 \text{ sec} \)

4.6 RED TIMES

\( R_1 = C_0-G_1-A_1 = 79-18-2 = 59 \text{ sec} \)
\( R_2 = C_0-G_2-A_2 = 79-17-2 = 60 \text{ sec} \)
\( R_3 = C_0-G_3-A_3 = 79-20-2 = 57 \text{ sec} \)
\( R_4 = C_0-G_4-A_4 = 79-16-2 = 61 \text{ sec} \)

V. RESULTS

1st INTERSECTION

5.1 The traffic intersection flow diagram by traffic volume studies for present work is shown below:

![Traffic Intersection Diagram](image-url)

The vehicular volume at the four approaches of the intersection is present below.

Volume approach:
- Volume on muddanur = 3536 Veh
- Volume on Kadapa = 3187 Veh
- Volume on Pulivendula = 2754 Veh
- Volume on parnapalli = 3336 Veh
- Volume on Major road = 1154 Veh>800 Veh/hr
- Volume on minor road = 996 Veh>250 Veh/hr

Major and minor roads determination by using the above vehicular volume for first intersection result as shown in figure 5.1.
2nd INTERSECTION

5.2 The traffic intersection flow diagram by the traffic volume studies for present work is shown below:

![Traffic intersection flow diagram](image)

Fig 5.2 Traffic intersection flow diagram

The vehicular volume at the four approaches of the intersection is present below.

Volume approach:
- Volume on Anantapur = 3241 Veh
- Volume on Kadapa = 3159 Veh
- Volume on Pulivendula = 3179 Veh
- Volume on Mudigubba = 3166 Veh
- Volume on Major road = 1130 Veh > 800 Veh/hr
- Volume on minor road = 818 Veh > 250 Veh/hr

Major and minor roads determination by using the above vehicular volume for second intersection result as shown in figure 5.2

5.3 The four phase diagram with signal timings at the Pulivendula intersection is as below:

![Four phase diagram](image)

Fig 5.5 The details of design timings at the proposed Pulivendula intersection.

5.4 The four phase diagram with signal timings at the Parnapalli intersection is as below:

![Four phase diagram](image)

Fig 5.6 The details of design timings at the proposed Parnapalli intersection.

The signal timings at two intersections are determined from the above calculations, the signal cycle length for (I) intersection is 79 sec and for (II) intersection is 54 sec. By providing signal at these intersections there will be reduction in the accidents and orderly movement of traffic at these intersections.

VI. CONCLUSION

- The justification of traffic signal installation is done by satisfying the two signal warrants through traffic volume studies.
- By comparing the both rotary signals we are
reducing traffic delay, accidents content & increasing free passage of traffic flow without interruption based on increasing the signal timings at two rotaries.

- The Four Phase traffic signal installation is done efficiently and is presented with the designed signal timings.

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REFERENCES


