SIGNAL DESIGN OF AN UNCONTROLLED ROAD INTERSECTION BY WEBSTER METHOD

A project report submitted in partial fulfillment of the requirements for the award of the degree of

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Mini Project Report

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CERTIFICATE

This is to certify that "**Signal design of an uncontrolled road intersection by Webster method**" is the bonafide work carried during the academic year 2021-2022 by "**A.Raj kumar** " under the guidance of **Mrs. Sai Priya**, **Assistant Professor** is submitted to the Department of Civil Engineering, MVGR College of Engineering (Autonomous), Vizianagaram.

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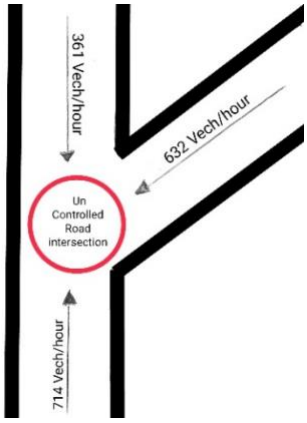
ABSTRACT:

A traffic signal is used as an instructing device that indicates the road user to act according to the displayed sign. Signal designing is a technique which is generally adopted by the traffic engineers use to determine who has the right-of-way at an intersection which involves deciding how much green time the traffic lights shall provide at an intersection approach, how long the pedestrian walk signal should be, and many numerous other factors. The design of traffic signal nowadays has become an important factor for major intersections of towns and cities. Traffic signal controls the movement of traffic and not only reduces accidents but enables the road safety users to effectively use the area of road at intersection. An uncontrolled 3 road intersection (Kothavalasa Junction) is considered and signal designing is carried out using Webster method of Signal design.

KEY WORDS : Webster method; right of way; amber;

INTRODUCTION :

Road signal design is a must requirement for traffic today which enables smooth flow of traffic, prevents accidents and controls traffic movement at an intersection. Due to the growing population in India, there is a rapid growth in employment and therefore transportation, in these days have become a very important. In order to get a grip on traffic movement and to eliminate problems, these signals are much more useful.



Traffic signals are mostly found at intersections or places where regulation of traffic is necessary. Rules associated with traffic signals are very simple and easy to understand.
Following the traffic signal ensures road safety and to make things simple to understand, these signals have been using a universal colour code.
1. Red light - stop or to bring your vehicle to a complete halt. This is done to let the other side of the traffic flow.
2. Amber - slow down the vehicle before the signal turns red.
3. Green light - to go.

Terminology used in signal designing :-

- Optimum cycle length (Co) : It is the time in seconds that it takes a signal to complete one full cycle of indications.

- Total Lost time (L) : It is the time during which no vehicles are able to pass through an intersection despite the traffic signal displaying a green (go) signal.

- Critical flow ratio (Y) : Critical flow ratio is defined as ratio of design flow rate and saturation flow rate

- Saturation Flow (S) : Saturation flow indicates the number of vehicles passing an intersection with minimum headway during the whole of a ‘green’ period.

- Effective green time (G) : Effective green time is the actual time available for the vehicles to cross the intersection.

- Amber time (A) : Amber time is the actual time available for vehicles to slow down before signal turns red.

- Red time (R) : Red time is the time for which the vehicles need to stop or bring vehicle to complete halt.

METHODOLOGY:

Webster method is a rational approach for signal design. The design is simple and is totally based on formulas laid down by Webster. In this method, the optimum signal cycle corresponding to the minimum total delay to the traffic at the signalised intersection is obtained after detailed studies of cycle time and delay vis-a-vis the traffic volumes approaching the intersection. This is considered to be a rational approach as it has a mathematical basis.

Steps involved in Webster method of Signal design are as follows :

1. The normal flows q1, q2 and q3 on the approach roads, during the design peak hour traffic are obtained from field observations by manual counting and are expressed in PCU.
2. Saturation flow of traffic S1, S2 and S3, is calculated by taking reference from Road Research Laboratory (RRL), UK.

$$S = 524w$$

3. Critical flow ratio (Y), saturation heads (hs) is calculated using below formula,

$$Y = y1+y2+y3$$
$$= (q1/S1)+(q2/S2)+(q3/S3)$$

4. number of phases(n) and red time(R), Total Lost time (L) in seconds is calculated by

$$L = 2n+R$$

5. Based on Total lost time (L) and Critical flow ratio(Y), Optimum Cycle length (Co) is calculated by

$$Co = (1.5L+5)/(1-Y).$$

6. Effective green time in seconds for each individual intersection is calculated by

$$G = y1(Co-L)/Y$$

7. Red time is calculated by subtracting amber time (generally taken as 2 seconds) and green time from optical cycle length.

Location of road intersection : 17.8969738, 83.1853109 - Kothavalasa junction, Andhra Pradesh, 535183.

RESULTS & DISCUSSION :

Normal flow :

q1 = 632 PCU

q2 = 361 PCU

q3 = 714 PCU

Total lost time (L) :

L = 2n+R

= 2(2)+12

= 16 sec.

Saturation flow :

S1 = 525w = 525(7) = 3675 PCU

S2 = 525w = 525(7) = 3675 PCU

S3 = 525w = 525(7) = 3675 PCU

Critical flow ratio (Y) :

Y = (q1/S1)+(q2/S2)+(q3/S3)

= (632/3675)+(361/3675)+(714/3675)

= 0.464

Optimum Cycle length (Co) :

Co = (1.5L+5)/(1-Y)

= (1.5*16+5)/(1-0.464)

= 54.10 sec

Effective Green time (G) :

G1 = y1(Co-L)/Y

= 0.171(54.10-16)/0.464

= 14.92~15 sec.

G2 = y2(Co-L)/Y

= 0.098(54.10-16)/0.464

= 8.01~8 sec.

G3 = y3(Co-L)/Y

= 0.194(54.10-16)/0.464

= 15.96~16 sec.

Amber time (A) :

A1 = A2 = A3 = 2 sec

Red time (R) :

R1 = 54.10-15-2 = 37.1 sec

R2 = 54.10-8-2 = 44.1 sec

R3 = 54.10-16-2 = 36.1 sec

Road intersection 1 :-

Green time = 15 sec

Amber time = 2 sec

Red time = 37.1 sec

Road intersection 2 :-

Green time = 8 sec

Amber time = 2 sec

Red time = 44.1 sec

Road intersection 3 :-

Green time = 16 sec

Amber time = 2 sec

Red time = 36.1 sec

CONCLUSION :

Signal designing at an uncontrolled intersection (kothavalasa junction) is carried out using Webster method of signal design & traffic flow regulatory parameters such as green time, amber time & red time are determined. This signal designing ensures smooth flow of traffic, reduce accidents thereby increasing safety of road users.

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