Efficient And Economical Movement For Road Users By Design Of At-Grade Signalized Intersection At Alugunur

N. Prabhanjan , G.Sahithi , G. Swamy Yadav, Dara. Swetha sudarshan ,M.Guru Prasad

Abstract: Intersections play a major role in diverting traffic flows and reducing accidents. We find many intersections both signalized and non-signalized based on the traffic diversions and conflict points available at the intersection. When the roads at any intersection meet at the same elevation, then we call it an AT-GRADE intersection. For such intersections, diversions occur at some point and hence conflict points are more when compared to another type of intersections. The major objective of this project is to design the At-grade intersection. It has been found that there are huge traffic accidents, congestions, and delays at that particular point. There is a point connecting three roads from cities Karimnagar, Warangal, and Hyderabad. At this point, there is no particular traffic control device for proper guidance to road users. For this point, the Signal design is done using Webster's method. The major data required for providing a signal is traffic flow. With the traffic data available, delays at the intersection and the reasons for the delay can be calculated. These delays are further studied to design the intersection. Traffic flow data can be collected by the manual method and also by using some surveillance cameras. Here the manual method is used to collect the traffic flow which includes the directional movement of traffic for each city and number of conflicts and diversions which are appearing at the junction. In this project, signals are designed not only for vehicles but also for pedestrians. Channelization is a small construction in the junction to provide proper diversions to the users. Here the channel is also designed for safe diversion of vehicles at entry and exits of the intersection. Pedestrian paths and road markings are provided at the intersection for the safe and economical movement of road users.

Index Terms: at-grade Intersection, traffic congestions, Webster method, pedestrians, conflict points, traffic flow, diversions, channels.

1 INTRODUCTION

Pavements used on highways are mostly of flexible pavements. To some extent on highways rigid pavements are also used. Soil components may change from place to place like black cotton soils are less used for the foundation works as these soils are expansive in nature and also high potential for shrinkage (Shaik 2017). To increase the strength of such pavements several admixtures are also used (Ravindran 2016, Venkat Reddy 2018). Intersections on road ways act as connectors to different directions and areas, which are sometimes very dangerous when not signalized. The design of new intersections is immensely important in developing areas. Especially in smart cities improvement of signalized intersections are important (Venkat Reddy 2017).In developing countries like India, the Urban population is growing rapidly. One of the biggest problems we are facing mobility in urban areas. There are a lot of problems with ineffective, improper guidance of traffic (Sudharshan 2016). The problem is for the vehicle drivers as well as pedestrians. Improper guidance will cause delays and leads to the cause of accidents. Commonly the city consists of all types of vehicleslike two and three-wheeled and unidirectional modes like four-wheelers also(Shamsul 2013). Commonly these causes can be reduced by giving proper guidance and construction of Intersections. These Intersections can reduce the delays and accidents also (Ramkumar 2016). By providing active control measures can reduce traffic delays and accidents in urban cities. These measures consist of providing signboards, road markings, and signal devices. These traffic control measures can give an effective and efficient guide to the road users as well as pedestrians (Gomasta 2015). Intersection is the meeting of two or more roads. These intersections give proper access to the road users. The road users consist of not only motor vehicles as well as transit, bicyclist, pedestrians also. The construction of junction provides, not only for active control measures as well as providing channelization and sidewalks (Santhaveerana 2015). The number of diverging, conflicts, merging mainly depends on the type of intersection and the design elements provided in junction. Based on the traffic flows and the number of conflicts the signal is designed for intersections. In metropolitan cities or max traffic capacity cites are organizing by providing proper signals only. Signalized intersections can provide more efficient economic access to road users. The proper designing of the signals is the more important factor for safe and comfort diversions of traffic and which leads to the reduction of delays and accidents. Traffic Engineers should have to concentrate on traffic situations thoroughly to provide suitable cycle length and timings of colors (Aziz 2018). Based on the traffic data available and the congestions noticed occurring in the place called Alugunur located in Karimnagar with a junction called Alugunur chowrasta in Karimnagar meeting of three roads which connecting major cities like Karimnagar, Warangal, and Hyderabad. By huge traffic movement for these cities led to traffic congestions and delays, there is no proper guidance for road users like pedestrians and vehicles. There is a requirement of Y-Intersection for proper, safe and economical movement of traffic with signals. Soils that would have been discarded some past decades ago because of their poor engineering properties, while selecting suitable materials for construction, have become soils that construction engineers can no longer ignore.

2 OBJECTIVES:

- To evaluate the traffic accidents and traffic congestions and traffic delays at Alugunur chowrasta.
- To design the signals for proper guidance to the road users by Webster's method.
- To design the Y-intersection suitable to a particular area.

3 SCOPE:

The scope of the present study is to design the Y-Intersection and signal design by the traffic data that particular point for reduction of accidents and traffic delays for future traffic.

4 METHODOLOGY:

The methodology adopted in this study includes:

- Collection of the traffic data
- Analyze the data for the design and construction of Y-Intersection
- Conducting traffic movement for the design of signals by Webster's method
- Analysis of results and formulation of conclusions.

Collection of the traffic data: There are two types of methods of collection traffic data by manual and automatic count. A more suitable and convenient type of method is manual count. We can calculate the data clearly we can identify what type of vehicle, classification of vehicle, traffic turning movements, occupancy of vehicle an movement of pedestrians also. We are collecting the total traffic data record for each direction in the site only. This will give the importance of traffic in each direction.

FROM WARANGAL

ENTERING TO	KARIMNAGAR			HYDERABAD		
vehicle type	NO.S	PCU FACTORS	PCU	NO.S	PCU FACTORS	PCU
	1	2	1*2	1	2	1*2
buses	66	3	198	18	3	54
trucks	88	3	264	6	3	18
two wheelers	276	1	276	26	1	26
auto rikshaw	100	1	100	17	1	17
car	700	0.5	350	52	0.5	26
agricultural tractors	6	1	6	3	1	3
cycles	30	0.5	15	14	0.5	7
pedestrians	8			75		
TOTAL	1217 PCU'S			226 PCU'S		

Note: The vehicle are coming from Warangal and entering into karimnagar and Warangal are 1217 and 226 PCU'S respectively.

FROM KARIMNAGAR

ENTERING TO	HYDERABAD			WARANGAL		
vehicle type	NO.S	PCU FACTORS	PCU	NO.S	PCU FACTORS	PCU
	1	2	1*2	1	2	1*2
buses	202	3	606	77	3	231
trucks	166	3	498	88	3	264
two wheelers	365	1	365	200	1	200
auto rikshaw	334	1	334	190	1	190
car	885	0.5	442.5	662	0.5	331
agricultural tractors	4	1	4	9	1	9
cycles	8	0.5	4	24	0.5	12
pedestrains	8			33		
TOTAL	2261.5 PCU'S			1270 PCU'S		

Note: The vehicle are coming from karimnagar and entering into Hyderabad and Warangal are 2261.5 and 1270 PCU'S respectively.

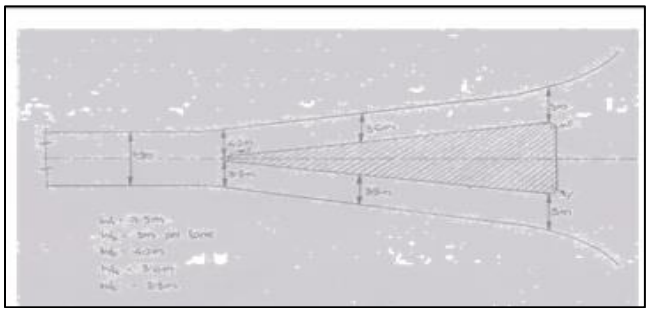
FROM HYDERABAD

ENTERING TO	KARIMNAGAR			WARANGAL		
vehicle type	NO.S	PCU FACTORS	PCU	NO.S	PCU FACTORS	PCU
	1	2	1*2	1	2	1*2
buses	251	3	753	0	3	0
trucks	319	3	957	10	3	30
two wheelers	376	1	376	17	1	17
auto rikshaw	168	1	168	10	1	10
car	238	0.5	119	44	0.5	22
agricultural tractors	0	1	0	2	1	2
cycles	18	0.5	9	22	0.5	11
pedestrains	40			57		
TOTAL	2422 PCU'S			149 PCU'S		

Note: The vehicle are coming from Hyderabad and entering into karimnagar and Warangal are 2422 and 149 PCU'S respectively.

5 DESIGN OF ISLAND:

Alignment Of Island:
W_1 = 7.5m
W_2 = road width – island width
=7.5 – 1.5= 6m (for two lanes)
W_2 = 3m for each lane
W_3 = W_1/2 or 4.2m (whichever is maximum)
=7.5/2= 3.75m or 4.2m
W_3 = 4.2m
W_4 = (W_2 + W_3)/2
(3 + 4.2)/2= 7.2/2
W_4 = 3.6m
W_5 = W_2 + 0.3m=3 + 0.3
W_5 = 3.3m



Island alignment design(at Algunoor)Design Procedure for Traffic Signal Design:
· Traffic survey
· Cycle length determination
· Green splitting
· Pedestrian requirements

6 TRAFFIC SURVEY:

As we know that our country INDIA has mixed traffic, the dynamic and static characteristics of vehicles are different so as to bring them on a common factor the vehicle count is converted into "PCU". Now thus the traffic volume is obtained on a common basis it can be further used for the design of traffic signals. Let us first understand the geographical location of the traffic signal to be designed (in this case it is ALGUNOOR junction KARIMNAGAR). We are going to design Traffic signals for the "Y" junction. So it has three phases as there are three legal possible ways of a right turn. The figure below shows the plan of the junction.

Details of Traffic Survey:
After conducting a detailed survey at the site the following details are obtained:
NORMAL FLOW or APROACH FLOW (q)
Hyderabad - Warangal : 280PCU'S
Warangal - Karimnagar : 285 PCU'S
Karimnagar - Hyderabad : 627 PCU'S

6 SATURATED FLOW (s) are
HYDERABAD ROAD :1900 PCU'S
WARANGAL ROAD :1400 PCU'S
KARIMNAGAR ROAD :1900 PCU'S
Thus we can obtain "y" which is the ratio of normal flow to saturated flow.

$$y = q/s$$

Hence,

a) $y_a = 0.15$
b) $y_b = 0.20$
c) $y_c = 0.33$

$$Y = y_a + y_b + y_c = 0.15+0.20+0.33$$
$$Y = 0.68$$

Now the formulae according to the Webster method are given as follows:
C_0 = (1.5L + 5)/ (1 - Y)
"L" is the loss of time calculated by the following formulae
L=2n+R.
n = number of phases
R = total red time
Here L is obtained as 18 seconds as it is 3 phase and total red time is considered as 12 seconds.
L = 2 * 3 + 12
L = 18 seconds
And hence the cycle length becomes
C_0 = (1.5 * 18 + 5)/ (1 – 0.68)
C_0 = 104 seconds

7 GREEN SPLITTING:

Green splitting is the time of green provided for each phase it can be obtained by the Webster formulae given by
G_a= (y_a/ Y) * (C_0 - R)
015/0.68) * (104 –
12) G_a =
20seconds
G_b = (y_b/Y) * (C_0 – R)
(0.20/0.68) * (104 – 12)
G_b = 25 seconds
G_c = (y_c/Y) * (C_0 – R)
= (0.33/0.68) *(104-12)
G_c = 40 seconds
The values obtained are G_a = 20seconds, G_b = 25 seconds and G_c= 40seconds.

Pedestrian Requirements:
From warrant-3 of IRC 93-1985 the minimum requirement of all red time to the amount of pedestrians is taken as 12 seconds. This is provided so because of safe zebra crossing of pedestrians.

8 RESULTS:

Thus the summary of traffic signals design is as follows
GREEN TIME AT a (Hyderabad - Warangal) = 20 seconds.
GREEN TIME AT b (Warangal - Karimnagar)= 25 seconds.
GREEN TIME AT c (Karimnagar - Hyderabad) = 44seconds.
ALL RED TIME = 12seconds.
AMBER TIME = 3seconds.
Thus total CYCLE LENGTH is 104 seconds.

9 CONCLUSION:

In this project report, we dealt with traffic surveys, the design of channelized intersection, traffic signal design, pedestrian path, and curb design and road markings. We did a traffic survey on Karimnagar, Hyderabad and Warangal highways during peak hours. We got a traffic count of 1546 on Warangal

highway, a traffic count of 3161 on Hyderabad highway and a traffic count of 1817 on Karimnagar highway. For channelization, we design triangular islands of 1.5m width and 6m length. The corner radius of 1foot is desirable. The offset distance is 1m from the road edge. The width of the curb is 9 inches. The depth of the curb is 1 ½ foot from ground level. The length of the curb is 6m (i.e. same as the length of the island). The traffic signal design includes green time at (Hyderabad - Warangal) is 20 seconds, green time at (Warangal – Karimnagar) is 2 5 seconds and green time at (Karimnagar - Hyderabad) is 44seconds. All red time is 12 seconds and amber time is 3 seconds. Thus total cycle length is 104 Seconds.The pedestrian sidewalk width is 1m and its length is 4m on Warangal – Hyderabad highway. The width of the curb is 9 inches. Finished top-level and curb height for bus stops to be 150 mm (as there is an Algunoor bus stop).

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