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Design of Traffic Control System

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ABSTRACT

Traffic control has been a serious issue since humancivilization. The modern world demands mobility. Cars representthe main method of mobility, but today's congested highways andcity streets don'tmove fast, and sometimes theydon'tmove atall. India has 70% mobility on the road mode; hence themajor problems created in large cities are traffic congestion andwastage of valuable time in developed countries. For this need tosolve the major problem of traffic, to achieve the strategic goal ofreducing the congestion and improving the safety of the roadusers.The main aim is to design the best traffic system that will beflexible and adaptive. Intelligent traffic systems (ITS), sometimescalled intelligent transportation systems, apply communicationsandinformationtechnologytoprovidesolutionstothiscongestionas wellas othertraffic control issues.Theintelligenttransportsystem (ITS)takesthefirst step towards meeting this challenge by providing effective,reliable, meaningful knowledge to motorists in time throughsignals. Problems like high traffic congestion, low transportationefficiency, low safety,and endangered environment can be solvedthroughinnovativeandsophisticatedwaysofhandling thelatesttechniques.Inthispaper,variousfactorsare requiredtoreducethe traffic problem at KatrajChowk, Pune for efficient vehicle movement andimplemented for reducing the traffic problem from the datacollected through traffic surveys at these points &Design ofsignals foronejunctionis carriedout.

Keywords: Intelligenttransportsystem,trafficsignaldesign,trafficcongestion.

I. INTRODUCTION

A. Transportation Engineering

In the society of today, the road network is of great importance. As cities grow, so does the need for transportation, and this puts increased pressure on the infrastructure. Thus, it is of great importance to have a reliable and redundant infrastructure for traffic to make sure that it works even in bad conditions. Several different hazards may have an impact on the road infrastructure, such as natural catastrophes, accidents, or the failure of parts of the road network. Since the different infrastructure systems get more and more intertwined in the society of today and society becomes more vulnerable to catastrophes, these hazards might have effects on other infrastructure systems as well. Thus, more researchers are starting to look at the risk of possible cascaded consequences in interconnected networks. Transport planning has been historically concerned with travel behaviour and the transportation system in some nominallytypical' conditions under which the networks were designed for certain demand and certain capacity. In the past, insufficient consideration has been given to the robustness and associated reliability of road networks. It is only during the last decade that considerable research interest has started to emerge for this important aspect of the transportation system.

B. traffic Signals

Traffic Signals are one of the more familiar types of intersection control. Using either a fixed or adaptive schedule, traffic signals allow certain parts of the intersection to move while forcing other parts to wait, delivering instructions to drivers through a set of colorful lights (generally, of the standard red-yellow (amber)-green format). Some purposes of traffic signals are to improve overall safety, decrease average travel time through an intersection, and equalize the quality of services for all or most traffic streams. Traffic signals provide orderly movement of intersection trafficcan be flexible for changes in traffic flow and can assign priority treatment to certain movements or vehicles, such as emergency services. However, they may increase delay during the off-peak period and increase the probability of certain accidents, such as rear-end collisions. Additionally, when improperly configured, driver irritation can become an issue.

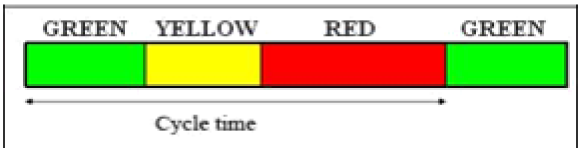

Figure 1: signal timing at a traffic signal

Figure1:Trafficsignal

C. Intelligent Transportation System

Intelligent Transportation Systems (ITS) is the application of computer, electronics, and communication technologies and management strategies in an integrated manner to provide traveller information to increasethe safety and efficiency of the surface transportation systems. These systems involve vehicles, drivers, passengers, road operators, and managers all interacting with each other and the environment, and linking with the complexinfrastructure systems to improve the safety and capacity of road systems.

D. Objectives

The Followings are the objectives of the present paper:

- To design traffic signals of Intersection at KatrajChowk, Pune for efficient vehicle movement.

II. METHODOLOGY

A. Design Step For Traffic Signal At Location

Normal flow, $Y1 = q1 / s1$ and $Y2 = q2 / s2$

Optimum signal cycle time, $Co = (1.5L + 5) / (1-Y)$ Co = the optimal delay cycle length

L = total lost time in sec.

$L = 2n$

n = number of phase R = all red time.

Y = Y1+Y2

Applying green time= G1=(Y1/Y) X (Co-L) G2=(Y1/Y) X (Co-L)

B. Methods Of Designing Intersections

F.V.Webster's method: In the 1950's Webster conducted a series of experiments on pre-timed isolated intersection operation (1) Two traffic signal timing strategies came from his study One is signal phase splits. Webster demonstrated, both theoretically and experimentally, that pre-timed signals should have their critical phases timed for an equal degree of saturation for a given cycle length equation in developing the equation for the optimal minimum delay cycle length, it was assumed that the effective green time of the phases was in the ratio of their respective y values.

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

Where Co = The optimal minimum delay cycle Length

L= Total lost time within the cycle sec Y= the sum of critical phase flow ratio

The above two strategies are very useful for traffic design and planning when the two rules are applied together one can practically minimize the resulting delay at an isolated pre-timed signalized intersection.

C. Design Of Intersection Of Traffic Signal

The design hour traffic volumes in PCU/hr collected can be tabulatedas per the roadway width time taken forthe pedestrian to cross the street is calculated. If there is a large width of streets it is desirable to have a central pedestrian refuge of at least 1m width. The Time that will be needed by pedestrian to reach the pedestrians refuge from the curb will then be:

Time = Distance/velocity= X seconds

This will be the pedestrian clearance interval during which no signal is displayed to the pedestrian and those who have just left the curb or the central refuge before the termination of the pedestrian green signal can reach safely the central refuge of the curb as the case may be. The pedestrian clearance interval is followed by amber of the next vehicular phase and by the red signal in the pedestrian phase.

For the "average" and level sites with the parking prohibited, no corrections are needed for the Saturation flow obtained from the below formula.

S = 525W

Where,

W= width of approach road in Meters

We have to consider straight moving vehicles for that purpose following corrections are applied to the left and right-turning vehicles. The effect of left- turning traffic will be accounted for it constitutes more than 10% of the traffic by counting each left- turner as equivalent to 1.25 straight-ahead vehicles. Since no exclusive right-turning lanes are provided, the effect of right-turning traffic will be accounted for by counting each right turner as equivalent to 1.75 straight-ahead vehicles

Maximum Y (Y max) for two different phases is calculated by the following formula:

Y= (q/s)

Where,

q = flow in arm after applying corrections s = saturation flow

Calculate Intergreen time as follows:

Intergreen period= Amber period (a) + All red period Calculate lost time as follows:

Lost time (L) = Lost time per vehicular phase x Number of phases.

Calculate optimum cycle time:

Optimum cycle time, C0 =[(1.5L+5)÷(1-y)]

Apportioned Green time for each phase by using the following formula

GNS phase = For N-S

GEW phase =For E-W

III.FIELDSTUDY&DATAANALYSIS

A. Volume count data at katraj Chowk

1) From North:

TABLE I VEHICULARMOVEMENTINVEH/HR

From	To	Two Wheeler	Auto Rikshaw	Bus	Truck	Car	Cycle	Pedestrian	Total
North	Straight (S)	1294	127	105	105	164	5	43	1766
	Right(W)	668	41	25	25	375	13	125	1278
	Total	1962	168	130	130	539	18	168	3044

TABLE III VEHICULAR MOVEMENTIN PCU/HR

From	To	Two Wheeler	Auto Rikshaw	Bus	Truck	Car	Cycle	Total
East	Straight(S)	1175	350	570	195	395	5	2690
	Right(W)	668	92	135	216	802	13	1926
	Pucfactor	0.5	1	3	3	1	0.5	
	Total	1843	442	705	411	1197	18	4616

2) Fromwest:

TABLE IIIII VEHICULARWISETURNINGMOVEMENTIN VEH/HR

From	To	Two Wheeler	Auto Rikshaw	Bus	Truck	Car	Cycle	Pedestrian	Total
West	Straight(E)	1532	71	39	142	415	13	72	2284
	Right(S)	235	42	19	14	71	19	64	464
	Total	1767	113	58	156	488	32	136	2748

TABLE IVV VEHICULARMOVEMENTINPCU/HR

From	To	Two	Auto	Bus	Truck	Car	Cycle	Total

		Wheeler	Rikshaw					
West	Straight(E)	766	71	117	426	415	6.5	1801.5
	Right(S)	117.5	42	57	42	71	9.5	339
	Puc Factor	0.5	1	3	3	1	0.5	
	Total	883.5	113	174	468	486	16	2140.5

3) From south

TABLE V VEHICULAR WISEMOVEMENTINVEH/HR

From	To	Two Wheeler	Auto Rikshaw	Bus	Truck	Car	Cycle	Pedestrian	Total
South	Straight(N)	2498	400	118	102	516	16	100	3750
	Left(W)	1357	135	57	135	325	12	124	2145
	Right(E)	177	27	4	29	45	5	40	327
	Total	4032	562	179	266	886	33	264	6222

TABLE VI VEHICULAR MOVEMENTIN PCU/HR

From	To	Two Wheelr	Auto Rikshaw	Bus	Truck	Car	Cycle	Total
South	Straight(N)	1249	400	354	306	516	8	2833
	Left	678.5	84	171	405	325	6	1669.5
	Right(E)	885	27	12	87	45	2.5	262
	Pucfactor	0.5	1	3	3	1	05	
	Total	2016	511	537	798	886	16.5	4764.5

B. Design of intersection Of Trafic signal At katrajchowk(Pune)

TABLE VII THEDESIGNHOURVOLUMESIN PCU/HRCOLLECTEDAREASFOLLOWS

From	N			S			W		
To	W(L)	E(S)	S(R)	S(L)	W(S)	N(R)	N(L)	E(S)	S(R)
Pcu/hr	-	1339.5	924.5	1669.5	2833	262	1801.5	339	611.5

IV. SOLUTION

The roadway width being 40 m the time taken for the pedestriantocross the street is 33 sec witha sped of walk 1.2 m/sec Because of the large width of the street it is desirable to have a central pedestrianrefugeofleast3.7mwidthtimethatwillneededbypedestriantoreachthepedestrianrefugefromthecurb will then be

Time=Distance/Velocity

Distance (width of road)=(40-7.4)/2=16.3mTime= distance / velocity=16.3/1.20=14sec.pedestriangreen time=14sec

Pedestrianclearanceinterval=5sec

Thewidth oftheapproach roadfrom each directionis16.3m

Sincethesiteis‘average’andislevelwiththeparkingprohibited, no correctionsareneededforthe saturation flowobtained from theaboveformula.

S=525W

=525X 16.3 =525 x16.3=8558

TABLE VIII FOLLOWINGTABULATION INDICATES THESEQUENCE OF CALCULATION

From	N			S			W		
To	E (L)	S(S)	W(R)	W(L)	N(S)	E(R)	E(S)	S(R)	N(L)
PCU/hr	-	1339.5	924.5	1669.5	2833	262	1801.5	339	-
CorrectionnfromLeftTurn+25%				417.37					-
CorrectionnfromRightTurn+75%			693.5			196.5		254.75	-
Total		1339.5	161787	2086.8	2833	458.5	1801.5	593.75	-
Q	2957.37			5378.3			2394.75		
S=525W	8558			8558			8558		
Y=(q/s)	0.35			0.63			0.28		

Provide amber time= 5 sec.

All red periods after each vehicular phase=5 sec

Calculation of Intergreen period, Amber time = 10

All red period = 5sec.

Total= 15sec

Pedestrian phase = 14 sec

Amber following phase= 5sec.

Starting delay per vehicular phase= 10 sec.

Lost time = (Pedestrian phase + Amber following phase) + (Intergreen period – Amber time)+ delay per vehicular phase

L = (14 + 5) + (15-5) + (15-5) + (15-5) + 10+10

L= 60 sec.

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

= (1.5X60 + 5)/1-(0.3+0.28)

= 256 say 250 sec.

Effective green time per cycle available to the vehicular phase= Co-L= 250-60 = 190sec. This will be apportioned between N-S and E-W phase as follows-

Gn-s = Yns / Y X (Co – L)

=(0.35 X 190) / (0.35+0.63)

= 68 sec.

Ge-w = Ye-w / Y X (Co – L)

=(0.28 X 190) / (0.35+0.28)

= 78 sec.

V. CONCLUSION

In this paper following parameters of the traffic control system are studied

- Traffic signal
- Intelligent traffic system and also decide location at the point such as KatrajChowk- Pune, for that I am going to study the traffic congestion in Pune city making a smart city
- We have planned for the efficient flow of traffic and making a smart city.

TABLE IX

Location	**Phases**	**Currentgreentime**	**Newgreentime**
KatrajChowk - Pune	Phase1	90 Seconds	68Seconds
	Phase2	90 Seconds	68Seconds
	Phase3	90 Seconds	78Seconds

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