A PERFORMANCE ANALYSIS AND DESIGN OF SKEWED INTERSECTION AT VIVEKANAND TIRAHA (VIDISHA) : A CASE STUDY

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Abstract*: *The increasing traffic volume at Vivekananda Tiraha has increased many problems like congestion , increasing conflict points, roadside parking hindering traffic movement, oversized vehicles , etc. In order to solvethese problems in an efficient and appropriate manner a traffic management system should be designed at the intersection. A performance study of skewed intersections at Vivekananda Tiraha is done to regulate the flow of traffic in a channelized manner. To solve this either a Rotary for a traffic signal can be designed at an intersection.Rotary requires bulging of the weaving area to provide yielding of vehicles coming from Vidisha. It also requires widening of approach from Bhopal end in order to counter problem of skewness, as vehicles coming from Bhopal are not able to see the complete weaving area and tends to move straightwards towards Vidisha.Widening also required for construction of splitter island on undivided Bhopal leg. Thus rotary of proper dimension cannot be constructed due to lack of space at the junction .Thus the best choice we have is installation of a traffic signal with proper markings at each approach .For achieving this objective PCU count has been worked out using traffic control room cameras installed at the intersection.

***Keywords*: Skewed Intersection, Widening, Roadside parking , Conflict Points**

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I. OBJECTIVES OF STUDY

The objectives of study are as follows-

i) To identify the shortcomings at the intersection in order to reduce the severity of conflict points.

ii)To suggest the best possible traffic management system with its applicability ..

II. TRAFFIC DATA COLLECTION

Combination of videographic and manual method is used in order to collect the traffic volume data along with its direction of turn at the intersection is carried out using cameras of the traffic control room that are used by Traffic Police of Vidisha.I have taken the permission from the superintendent of police to watch out all these videos for my traffic volume data count. I alone performed the whole work of traffic volume data from the cameras available at the intersection. It took six days to record the whole data of 12 hours from 9 AM to 9 PM .I used to count for 5 to 6 hours a day at the control room. Later on I counted peak hour traffic volume for 7 days. A total of five cameras were installed with three of them facing to the respective legs and the rest two towards the junction area .While performing my traffic volume count, I used 3 cameras at a time to collect the data coming from one leg at a time .

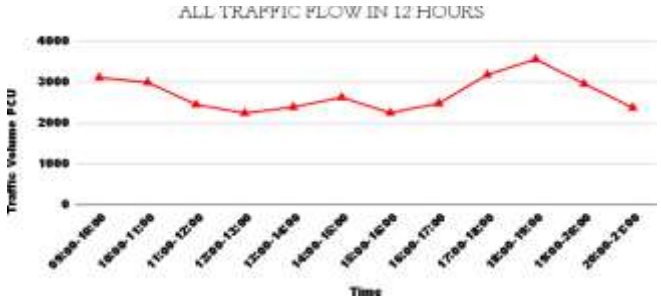

Figure 1: Traffic Volume from 9 am to 9 pm

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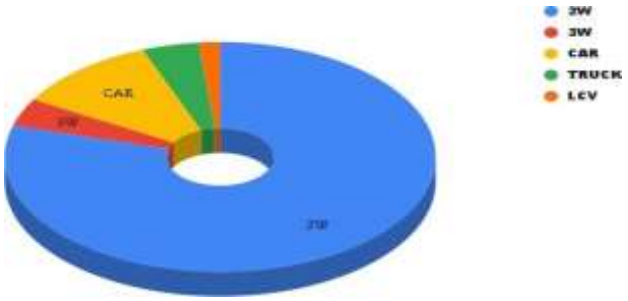


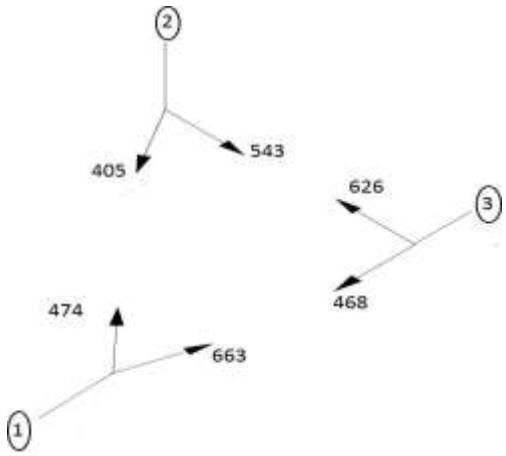
Figure SEQ Figure * ARABIC 2: Composition of Traffic Flow

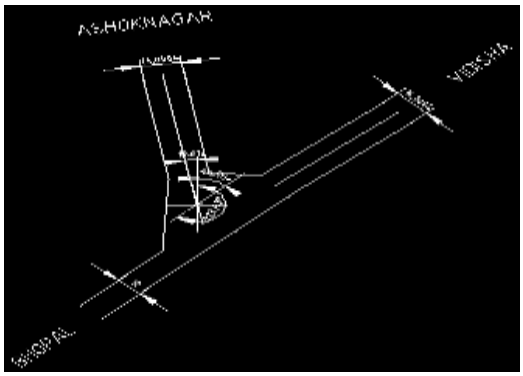
Summary of Data Extraction

Peak periods are between 09:00 am to 10:00 pm and from 06:00 pm to 07:00 pm. Traffic on approaches are unequal in numbers as well as in type. Traffic volume proportion which are passing selected intersections consist of: Two – Wheeler (79%) Personal Car(10.83%) Auto Rickshaw (3.9 %)LCV (1.59) % Bus and Truck (4.27) %

III. DESIGN OF THE INTERSECTION

A. ROTARY DESIGN: CALCULATION OF CAPACITY USING IRC 1976





Let us assume the design speed is 30 kmph.
(1)Entry Radius 15 to 25 m.
Take Entry Radius 15m.
(2)Exit Radius 1.5 to 2 times of entry radius Take Exit Radius = 22.5 m
(3) Central Island Radius is theoretically equal to 1.33 times the entry radius Take Central Island Radius =20 m
(4)Width of the rotary: Based on IRC the 3-lane width of approach should have
(5)entry width 7 m (ii) exit width 7.5 m. (5)Weaving width =10.5m
(6)As per IRC minimum weaving length 30 m for speed of 30 kmph and weaving length is 4 times the weaving width . Taken weaving length = 30m
(7)Weaving ratio=Max(P1-3+P3-2+P1-2) =0.73 (8)Q =[280W(1+e/W)(1+P/3)]/[1-W/L] = 2758 PCU
Thus capacity of the rotary intersection using formula comes out at 2758 PCU.
Capacity after calculation as per roundabout dimensions which is too less than traffic volume of 3179. Thus by this approach the design of the rotary cannot be provided at the intersection.

ROTARY DESIGN: CALCULATION OF CAPACITY BY INDO HCM

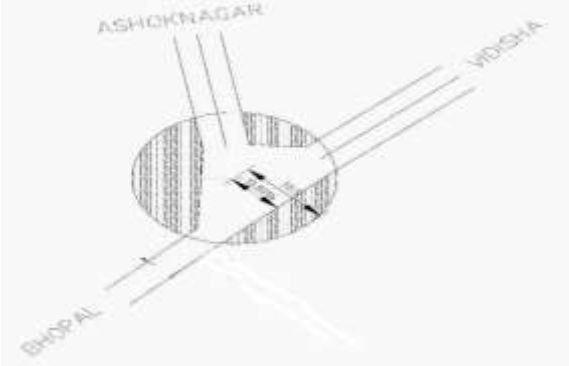
Let us design for a diameter of 44 m A=3600/Tf=2903.2
B= (Tc -0.5*Tf)/3600=0.00029

Table 1 Capacity of each arm

Combination number	Circulating flow +total flow in rest o arm	Total Capacity (pcu/hr)
1. Bhopal	2903+405+543+626+468	4945
2.Ashoknagar	2903+626+468+663+474	5134
3.Vidisha	2903+663+474+405+543	4988

Capacity of Roundabout= (max entry capacity of a arm +Flow at remaining two arm) = 5134

The deficiency of the area is also cross checked by doing field surveys. It shows the maximum radius of circle that can be inscribed in intersection is of 18 m .But according to design requirement ,radius required is 32.5m



DESIGN OF TRAFFIC SIGNAL

Three phase traffic signals are defined for the intersection for further calculation. Pedestrian Design

Let us permit crossing in two stages

Thus width to be crossed from kerb to median=7m

Time required to cover the distance=7/1.2=5.8=6 sec(approx) Total time required for pedestrian phase=6+4=10 sec

Table 2: Green time for each arm

From	Bhopal (BPL)		Ashoknagar(ASH)		Vidisha(VID)	
To	ASH	VID	VID	BPL	BPL	ASH
PCU	398	511	416	318	370	470
Saturation Flow	S=525*W=2990		S=525*W=3998		S=525*7=3998	
Critical flow	Y1 =Q1/S1 = 909/2990=0.3		Y2 =Q2/S2 =734/3938 =0.19		Y3=Q3/S3 =840/3938 =0.22	
Green time	G1=(Y1/Y)*(C-L) =50 sec		G2=(Y2/Y)*(C-L) =32sec		G3=(Y3/Y)*(C-L) =36 sec	

Summation Y=Y1+Y2+Y3=0.72

Loss time = 10+ nl+R=10+3*2+(4+4)=24 sec Cycle Time C=(1.5l+5)/(1-Y) =142 sec

(in multiple of 5) C=145 sec

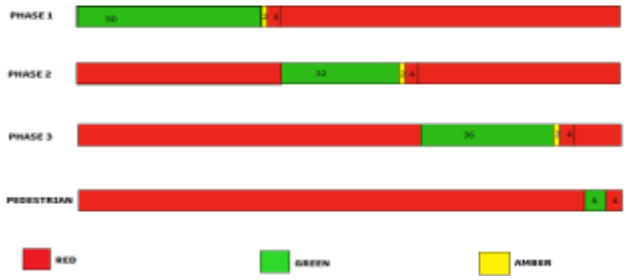


Figure .6. Phase Diagram of Traffic Signal

IV. CONCLUSION

(i) The research designed a roundabout to reduce the number and severity of conflict points from 9 points to 6 points but, due to following are the problems in its application :

➢ Two roads viz vidisha to Bhopal are straight , thus in order to provide roundabout a bulging area required to produce a yielding effect in vehicles coming from Vidisha

which reduces the speed while entering the intersection. But due to buildings on the roadside leads to unavailability of land.

➢ Leg joining from bhopal end has comparatively less width than other leg and undivided carriageway. Thus in order to provide a splitter island in bhopal approach the road requires a widening of the road which also has area constraints.

➢ The deficiency of the area is also cross checked by doing field surveys. It shows the maximum radius of circle that can be inscribed in intersection is of 18 m ,since the area available is 1134m2 .But according to design requirement radius is 32.5m and thus required area of 3318m2.

(ii) The second outcome of the whole study is the fact that traffic signals will provide orderly movement of traffic at this intersection .The quality of traffic flow would be improved by forming compact platoons of vehicles provided all the vehicles move at approximately the same speed. There will be a reduction in crossing conflict probability.

The traffic handling capacity would be highest among the different types of intersection .Pedestrian can also cross the road safely in that intersection.Another way to minimize the number and severity of conflict points and smoothen the traffic flow is also possible by time sharing, the research result shows that sharing time by applying traffic signal systems can reach us to our objectives which is mentioned before. A traffic signal with the effective green time equal to 145 seconds in 3 phases has been suggested for regulating current traffic at vivekanand square 3 – leg intersection.

(iii) The third outcome of the study is the widening of roads and intersections are being turned for roadside parking. In the absence of provision for parking of vehicles in special building complexes and shops ,vehicle parking on the roadsides has resulted in free flow of traffic being hit.Thus there is a need to address parking problems on the street .This can be reduced by raising the requirement for parking spaces, using smart parking availability by real time parking ability occupancy.

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