Rotary Feasibility at Akhbarnagar Circle

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***Abstract* - India's rapid economic growth has put the country on a progressive mode but it has had its fair share of problems, traffic being one of them. Vehicular traffic on Indian roads have increased substantially over the last decade and the country's urban road infrastructure needs a much awaited overhaul to address the problems of ever increasing traffic. This paper attempts to address the traffic problem at Akhbharnagar roundabout in the city of Ahmedabad. In this paper feasibility of the rotary has been checked according to IRC clauses and a corrective measure of implementing a traffic signal system has been suggested.**

***Keywords*: Rotary, Feasibility, Four Phase Signal, Circulating Flow, Weaving and Non-Weaving Ratio**

I. INTRODUCTION

Rotary intersections or roundabouts are special form of at-grade intersections laid out for the movement of traffic in one direction around a central traffic island. Essentially all the major conflicts at an intersection namely the collision between through and right-turn movements are converted into milder conflicts namely merging and diverging. They then weave out of the rotary to the desired direction.

II. LITERATURE REVIEW

This section will provide a comprehensive review of works related to this topic.

I. [1]"According to the guidelines given by the Indian road congress, rotaries doesn't seem to be suitable at every location. There are few guidelines that help in deciding the suitability of a rotary.

1. Rotaries are suitable only when the traffic entering from all the four approaches are relatively equal.
2. A total volume of about 3000 vehicles/ hour can be considered as the upper limiting case and a volume of 500 vehicles/ hour is the lower limit.
3. A rotary is beneficial when the proportion of the right-turn traffic is very high; especially when it is more than 30%.
4. It is more suitable when there are more than 4 approaches or if there is no separate lanes available for right-turn traffic. They are ideally suited if the intersection geometry is complex."

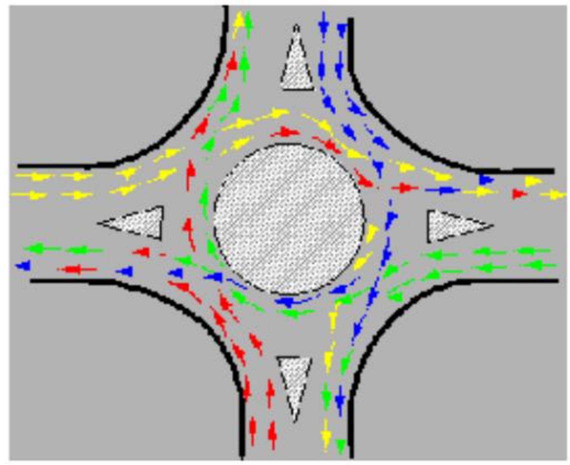

Fig. 1 Vehicular Flow at a Roundabout

II. [2] "Capacity and operational improvement of metering roundabout

Metering systems can improve traffic operation and capacity on unbalanced flow roundabouts. Metering or Ramp Metering is the application of traffic control to freeway onramps to limit the rate of flow entering freeway sections. Metering has several purposes. The dominant purpose is to optimize traffic flow. The likelihood of each vehicle finding a suitable gap into which it can merge is increased, and thus the likelihood of generating shockwaves at freeway on-ramps decreased.

For the field study, one single-lane, 80m circle diameter roundabout in Valencia (Spain) was selected. The signal was placed some distance before the roundabout entrance (20m), on the metered approach. A signal control logic was designed and implemented in the VisVap 2.16 module from VISSIM (Verkehr in Stadein-SIMulation).they tried diff. combination by which average delay could be reduced.

The learnings from the paper is that, in metered roundabout the ratio of entering traffic to conflicting traffic is higher as compared to unmetered roundabout.

In the same manner the average delay is less in metered roundabout as compared to unmetered roundabout. Therefore metered roundabout could be used at places where the capacity of roundabout comes short due to infra. And geometrical constraints or where the PCU exceeds over time."

III. METHODOLOGY

To determine the feasibility of the current roundabout, a methodology was developed in this study. The geometric data for the roundabout and the PCU was collected from actual site and also checked with the help of Google maps. PCU data was collected at peak hours to determine the feasibility of the junction.

IV. DATA COLLECTION

To substantiate our study, manual traffic count was performed for all the roads merging and diverging from the Akhbarnagar Circle.

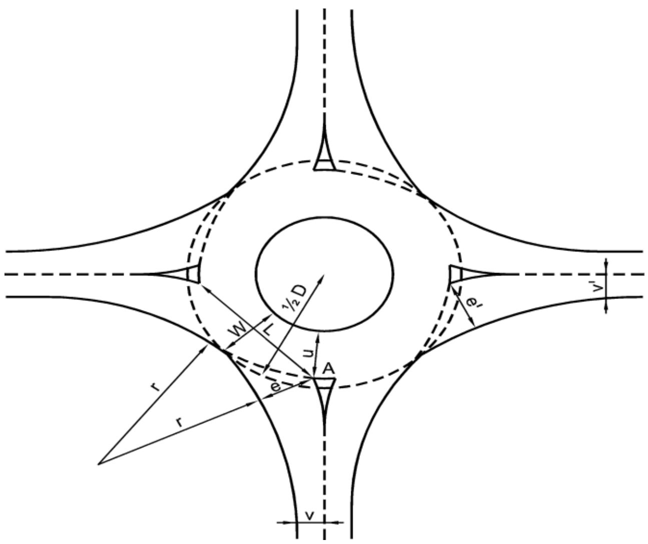

Fig. 2 Geometric Considerations for calculations

Table 1: Geometric Data (mt.)

W	21
E_1	13
E_2	13.5
E	13.25
L	25

Dimensions of the roundabout

E= average entry and exit width = $\frac{(E1+E2)}{2}$

W= weaving width

L = length of weaving

P = proportion of weaving traffic to non -weaving traffic.

D= diameter of the roundabout

Data for 7 days was collected at peak hours from 09:30 to 13:00. To validate the results CCTV footage from the Police commissioner's office was also collected.

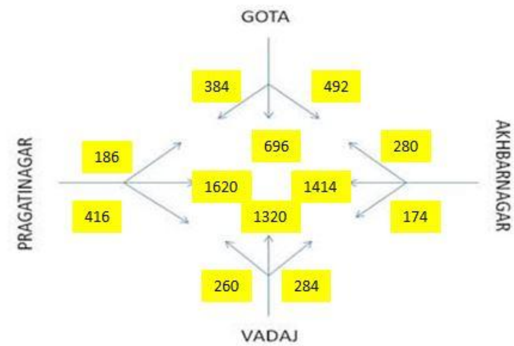

Fig.3 Overall entry traffic flows in PCU/Hr

Table 2. PCU/hr from different pathways

Entry from	PCU/Hr
Vadaj	1864
Akbarnagar	1868
Gota	1572
Pragatinagar	2222

V. CALCULATION

IRC Capacity

$$Q_W: \frac{[280*w*\{1+(e/w)\}*\{1-(P/3)\}]}{[1+(w/l)]}$$

Table 3. Weaving and Non-Weaving Ratio

P_{12}	0.77
P_{23}	0.83
P_{34}	0.86
P_{41}	0.88

Table 4. Desired Value v/s Actual Value

Maximum Value	PCU/Hr Value from traffic
3000	3880
	3762
	3711
	3675

VI. SOLUTION

Four Phase Signal Design

As capacity of roundabout exceeds 3000 pcu/hr as mentioned in IRC 65:1976, there is a need for an alternative solution. A signalised intersection has been proposed as an alternative. Four phase signal has been proposed in this study as shown in figure. Cycle time has been arrived by considering pedestrian walking speed of 1.2 m/s and by considering maximum road width. The phase diagram for signalized intersection is as shown below.

Assume amber time: 2 seconds

Inter green time: 2 seconds

So, the phase time is as follows:

G_1= (14/1.2) +7= 18.67 seconds

G_2= (11.2/1.2) + 7 = 16.33 seconds

G_3= (14/1.2) + 7 = 18.67 seconds

G_4= (14/1.2) + 7 = 18.67 seconds

Where 14m is the maximum width of the remaining approaches of the traffic in phase 1,3 and 4. While 12m is the maximum width of the remaining approaches of the traffic in phase 2.

So cycle time after adding 2 seconds of amber and 2 seconds of inter green time is 88.34 seconds.

Revised signal timing:

G_1 = 19 seconds   G2 = 17 seconds

G_3 = 19 seconds   G4 = 19 seconds

The phase diagram is shown in the figure below:

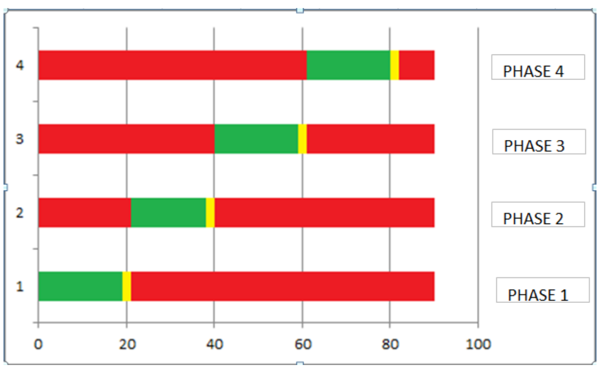

Fig.4 Phase Diagram

VII. CONCLUSION

The present rotary at Akhbarnagar is not feasible as its capacity exceeds 3000 PCU/hr which is the upper limit as mentioned in IRC 65-197-Recommended practice for traffic rotaries. Since the area in the vicinity of the circle poses space constraints, a signalized intersection would be a suitable alternative. A four phase traffic signal has been proposed as a solution with a cycle time of 90 seconds.

REFERENCES

[1]. IRC 65-1976, (1990)-Recommended practices for traffic rotaries

[2]. Marilo Martin-Gasulla, (2016) "Capacity and operational improvement of metering roundabout in Spain." International symposium on Enhancing Highway Performance. Volume 15 295-307

[3]. Mauro, R. and Branco, F. (2010). & quot; Comparative Analysis of Compact Multilane Roundabouts and Turbo-Roundabouts.& quot; J. Transp. Eng., ASCE)TE.1943- 5436.0000106, 316-322.

[4]. Marian Tracz, (2012) Performance and Safety of Roundabouts with Traffic Signals."Sciencedirect". 11 (1) 23-42

[5]. L. R Kadiyali (2011). Traffic Engineering and Transportation Planning. Khanna Publishers, New Delhi

[6]. Raffaele (2010) Calculations of Roundabout, Italy