International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Traffic Congestion Overcome By Rotary Design

Krutika M. Gamit[1], Aney K. Patel[2], Ankit S. Vasava[3], Viral N. Patel[4], Rutvij J. Maheta[5], Rajan J. Lad[6]

[1,2,3,4,5]*Student, Dept. of Civil Engineering, GIDC Degree Engineering College, Abrama, Navsari, Gujarat, India.*
[6]*Assistant Professor, Dept. of Civil Engineering, GIDC Degree Engineering College, Abrama Navsari, Gujarat, India*

---***---

Abstract – *One way to control the traffic at busy intersection is to construct a roundabout or rotary intersection, which is a special type of at grade intersection, where all converging vehicles are forced to move round a central island in clock-wise direction. The present study aims to design a rotary for an uncontrolled multi leg intersection located in near Railway Station of Valsad, India. The intersection has four approach roads with traffic in all the approach roads and there is signal but not working even there is no traffic police to control the traffic at present and hence chaos during peak hours. In order to design the rotary, it is essential to have the information on traffic volumes coming from the approach roads.*

***Key Words*: Traffic Congestion, Intersection, Capacity, Weaving, Traffic Volume.**

1. INTRODUCTION

Nowadays traffic is increasing, with increasing in population, which occurs pollution like air pollution, noise pollution, which harmful for environment, human as well as animals.

There are various ways to control traffic like signals, sign, rotary, road marking. The other way like signal, sign, etc have less efficiency to control traffic. In this, time delay affecting to drivers. So that, we select to design rotary to control traffic.

1.1 Objectives

- To control the merging and diverging operations at crossing.
- To provide equal opportunity for turning right or going straight to all type of vehicular traffic.
- To eliminate the necessity of traffic police or signal to control traffic at intersection.
- To minimize the number of accidents and severity of accidents because of low relative speed.

1.2 Design Speed

All the vehicles are required to reduce their speed at a rotary. Therefore, the design speed of a rotary will be much lower than the roads leading to it. Although it is possible to design roundabout without much speed reduction, the geometry may lead to vary large size incurring huge cost of construction. The normal practice is to keep the design speed as 30 and 40 kmph for urban and rural areas respectively.

1.3 Shape of Central Island

The shape of intersection depends on the number and the layout of intersecting roads. The various shapes considered to suit different conditions are circular, elliptical, turbine, tangent, each having its own advantages and limitations.

1.4 Entry, Exit and Island Radius

The radius at the entry depends on various factors like design speed, super-elevation, and co efficient of friction. The entry to the rotary is not straight, but a small curvature is introduced. This will force the driver to reduce the speed. The entry radius of about 20 and 25 metres is ideal for urban and rural design respectively.

The exit radius should be higher than the entry radius and the radius of the rotary island so that the vehicles will discharge from the rotary at a higher rate. A general practice to keep the exit radius as 1.5 to 2 times the entry radius. However, if pedestrian movement is higher at the exit approach, then the exit radius could be set as same as that of the entry radius.

The radius of the central island is governed by the design speed, and radius of the entry curve. The radius of the central island, in practice, is given a slightly higher radius so that the movement of the traffic already in the rotary will have priority. The radius of the central island which is about 1.3 times that of the entry curve is adequate for all practical purposes.

1.5 Radius of Rotary Roadway

Allowable radius of the curve should be taken as,

$$R = \frac{V^2}{127f}$$

Where co-efficient of friction ‘f’ is taken as 0.43 and 0.47 for the speeds 40 and 30 kmph respectively with factor of safety of 1.5. The IRC has suggested the radius of entry curve to be 20to 35 m and 15 to 25 m for rotary design speeds of 40 and 30 kmph.

1.6 Width of Rotary

IRC suggests that a two lane road of 7 meter width should be kept as 7 metre for urban roads and 6.5 metre for rural roads. Further, a three lane road of 10.5 metre is to be reduced to 7 metre and 7.5 metre respectively for urban and rural roads.

The width of the weaving section should be higher than the width at entry and exit. Normally this will be one lade more than the average entry and exit width. Thus the weaving width is given as,

$$w_{weaving} = \left(\frac{e_1 + e_2}{2}\right) + 3.5\text{m}$$

1.7 Capacity

The capacity of rotary is determine by the capacity of each weaving section. Transportation road research lab (TRL) proposed the following empirical formula to find the capacity of the weaving section.

$$Q_w = \frac{280w\left(1+\frac{e}{w}\right)\left(1-\frac{p}{3}\right)}{1+\frac{w}{l}}$$

Where e is the average entry and exit width i.e. $\frac{e_1 + e_2}{2}$, w is the weaving width, l is the length of weaving, and p is the proportion of weaving traffic to the non–weaving traffic. Figure 3 shows four types of movements at a weaving section, a and d are the non-weaving traffic and b and c are the weaving traffic. Therefore,

$$p = \frac{b+c}{a+b+c+d}$$

2. TRAFFIC SURVEY AND DATA COLLECTION

Table -1: Volume Count of Vehicles

Approach	Right	Left	Straight
North	768	117	1501
South	498	785	1580
East	371	395	1028
West	480	560	643

Fig.1 Map of Kalyan Baug Intersection, Valsad, Gujarat, India (Google Map).

2.1 Calculation

- For rotary in urban areas, design speed =30kmph
- Since intersection legs carry nearly equal traffic, a circular centre island will be adopted.
- The Entry and Exit angle will be 45° each.
- A radius of 20m of entry, 40m at exit and 40m for Central Island be adopted.

North:

Right turning:

=548(0.75) +276(1) +180(1) +1(2.8) +23(1) +0(2.8) +22(0.5) +8(5)

= 670 pcu/hr

Straight:

=676(0.75) +295(1) +262(1) +48(2.8) +151(1) +38(2.8) +13(0.5) +18(5)

=1045 pcu/hr

Left turning:

=47(0.75) +26(1) +2(1) +0(2.8) +5(1) +3(2.8) +2(0.5) +32(5)

= 262 pcu/hr

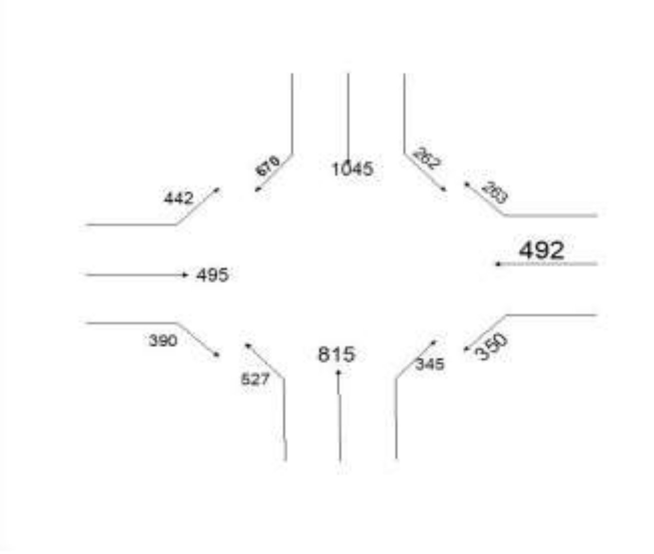

Fig.2 Traffic approach of The Rotary

The traffic in one leg can be calculated as under:

North:

Going out =442+815+263

=1683 pcu/hr

Coming in=670+1045+262

=2106 pcu/hr

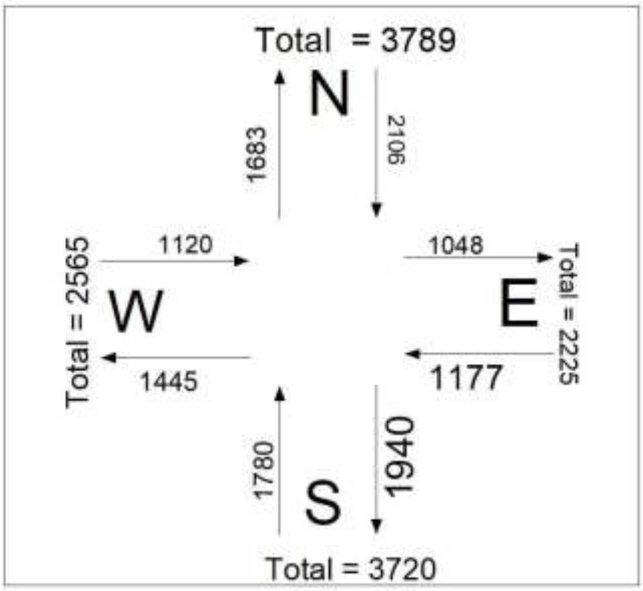

Fig.3 Volume in Each Leg PCU/hr

3. CAPACITY OF ROTARY

- Maximum flow in one direction is 2106 pcu/hr, which is good enough.
- The width of carriage way at entry and exit may be taken 10m.
- Take e_1 = 14m,

  e_2 = 14m

$\therefore e = \frac{e_1+e_2}{2}$

$= \frac{14+14}{2}$

= 14m

$\therefore w = \frac{e_1+e_2}{2} + 3.5$

$= \frac{14+14}{2} + 3.5$

=17.5m

- The minimum length of weaving section should be 30m (for 30kmph design speed).

$\therefore$ l =30m

$\frac{w}{l} = \frac{17.5}{30}$ =0.58 > 0.40 $\therefore$Not Ok

- $\frac{w}{l}$ ratio should be between 0.12 to 0.40

$\therefore$ Taking l = 50m

$\therefore \frac{w}{l} = \frac{17.5}{50}$

= 0.35

This is in between 0.12 to 0.40.

$\therefore$ OK

Now,

$\frac{e}{w} = \frac{10}{17.5}$ =0.8 which is in between 0.4 to 1

$\therefore$ OK

L = 50m which is in between 18 to 90.

$\therefore$ OK

P = 0.71 which is in between 0.4 to 1

$\therefore$ OK

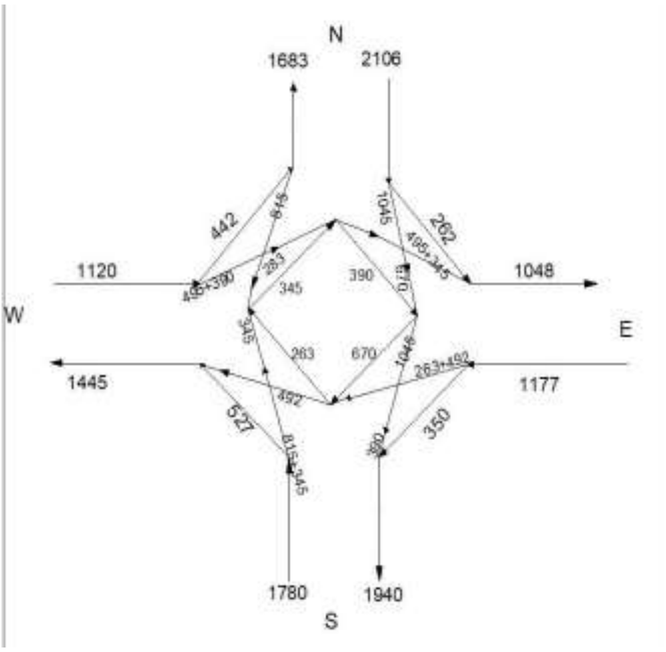

Fig 4.Weaving of Vehicles in All Approaches

The maximum weaving occurs in N – W section,

$$\therefore p = \frac{b+c}{a+b+c+d}$$

Now,

a = 442

d = 345

b = 495+390 =885

c =815+263 =1078

$$p = \frac{b+c}{a+b+c+d}$$

$$= \frac{885+1078}{442+345+885+1078}$$

$$= 0.71$$

Now, calculation of capacity

$$Q_w = \frac{280w\left(1+\frac{e}{w}\right)\left(1-\frac{p}{3}\right)}{1+\frac{w}{l}}$$

$$= \frac{280*17.5\left(1+\frac{14}{17.5}\right)\left(1-\frac{0.71}{3}\right)}{1+\frac{17.5}{50}}$$

= 4986.89 pcu/hr

$\cong$ 5000 pcu/hr

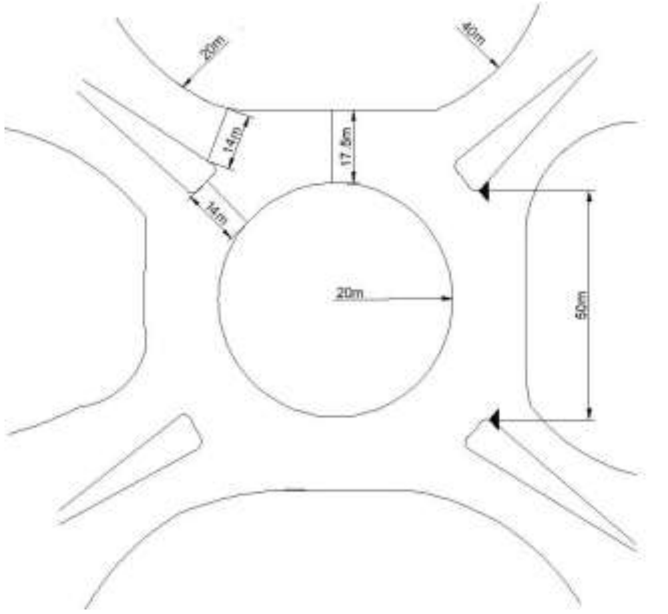

Fig 5. Design of Final Rotary

4. CONCLUSIONS

Traffic volume at Kalyan Baug intersection is 3789, our design 4986.89 pcu/hr which is more than the require so that design is acceptable.

There are few area still required to reduce congestion at junction, For betterment of the intersection are:

- Provide the road crossing near the intersection.
- Provide Odd- even parking.
- Expanding the area for better approach.

REFERENCES

- Prof. Shweta Rokade, Roshni Nasre, Mangla Rahangdale, Pintu Devanth, Raja Malaykorwar, Ankit Kumar (ACE Nogthana, Wardha) – Design of Rotary Intersection at Bajaj square Wardha.
- Binny N. Pandya (LDRP-ITR, Gandhinagar), Abhinav Yadav (CEPT University, Ahmedabad), Prof. Kumkum Bhattacharya (LDRP-ITR) – Evaluation and reconfiguration of heterogeneous Traffic at Rotary intersection: Chiloda circle.
- Rakesh Kumar Chhalotre, Dr. Y. P. Joshi, (Samrat Ashoke Technological institute Vidisha) - Case study of Prabhat Square Raisen Road Bhopal.
- Shaikh Vasim, Prof, Khushbu Bhatt, Prof. Siddharth Gupte (Parul institute of engineering and

technology, Parul University) – Analysis of Rotary Intersection at Vadodara.

- Mira Patel (L D College of Engineering, Ahmedabad, Gujarat) – Solution for Reduction of Traffic Congestion: A case study of Thaltej Rotary Intersections.

- Veethika Gomasta, Mohit Malviya, Abhishek Singh, Saleem Akhtar (UIP – RGPV, Bhopal, India) – Design and Analysis of intersection for improved Traffic Flow at Bhopal-case Studies of Jyoti Talkies Square and Vallabh Bhawan Roundabout.

- www.sciencedirect.com

- https://es.scribd.com/document/246780261/EVALUATION-OF-CAPACITY-AND-LEVEL-OF-SERVICE-OF-URBAN-ROADS

- http://www.ijtte.com/study/93/MEASURING_URBAN_TRAFFIC_CONGESTION_____A_REVIEW.html