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# Enhancing Traffic Safety at TGB Intersection on Urban Arterial Road, Surat

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## ABSTRACT

This paper presents the safety parameter with improvement traffic at rotary intersection of urban arterial road of Surat city. Surat city is rapidly growing city with daily increasing vehicular population. It creates traffic problem at peak hour. The aim of this paper to analysis and enhancing the traffic congestion and need to focus on design intersection urgent basis to solve the traffic problem at the junction. The traffic enhancing based on peak hour traffic volume data converting in PCU values as per IRC recommendation. Enhancing the rotary design parameter has been carried out with empirical formula and software analysis taken to managing the traffic flow at rotary intersection.

**Keywords :** Rotary Intersection, Traffic Flow, Traffic Safety, Traffic Congestion, Merging Diverging Traffic.

## I. INTRODUCTION

The "Glob Status Report on Road Safety" published by the World Health Organization (WHO) identified the major causes of traffic collisions as driving over the speed limit, driving under the influence, and not using helmets and seat belts. Failure to maintain lane or yield to oncoming traffic when turning are prime causes of collisions. The report noted users of motorcycles and motor-powered three-wheelers constitute the second largest group of traffic collision deaths.

At the intersection all vehicles are forced to slow down and negotiate the intersection so the cumulative delay is much higher than it should be in a proper intersection. Even when there is relatively low traffic, the vehicles are forced to reduce the speed. Here, the rotary requires a large area which leads to land making them costly at urban areas. Usually, at a rotary the vehicles do not stop. They accelerate and exit the rotary at relatively high speed.

Surat is one of the rapidly developing city in Gujarat. Traffic enhancing is difficult in heterogeneous traffic condition in Surat. The TGB circle has been facing the traffic problem so it has been selected as study area of Surat city. TGB circle having a four-way intersection and more traffic volume at the junction during peak hours. Two major arterial road connected at the junction.

According to Indian Road Congress (IRC) guidelines (IRC-65, 1976), a rotary can be of either circular, elliptical, oval, rectangular shape with four approach roads/legs or it can be of complex intersection with many approaches. At the TGB circle traffic volume counted at week day in morning and evening peak hours by videography and manual counting. The analysis is based on the traffic data and geometric features at the junction. Th selected intersection has four approach road shown in figure 1. Currently there is no signal and traffic police at junction to solve the traffic problem.

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**Figure 1 : Google Image of TGB Circle**

## II. DATA COLLECTION

The procedure for design of such rotaries having only four legs intersecting at right angles is simple and straightforward as given in IRC guidelines. According to Indian Road Congress (IRC) guidelines (IRC-65, 1976), a rotary can be of either circular, elliptical, oval, rectangular shape with four approach roads/legs or it can be of complex intersection with many approaches. In the present study design the for leg rotary intersection at TGB circle Surat city. Videography carried out at the junction for the current traffic volume data and field measurement manually. The data collection was carried out for a duration of eight hours from 7:00 am to 12 am morning and 6:00 pm to 10:00 pm in the evening on a working day using a mobile camera from appropriate location near the TBG intersection. Every 15 min. traffic volume was extracted for all the five classes of vehicles considered, namely, two-wheeler, three-wheeler, passenger cars, light commercial vehicles (LCV) and heavy commercial vehicles (HCV). A total of 18 directions of traffic movements were considered while extracting the 15 min. traffic volume data. The class-wise traffic volumes observed from video were converted to passenger car units (PCU) using the PCU factors suggested in IRC guidelines.

Field measurement manually counted for the actual dimension of the TGB Circle. The dimension of the intersection is like Shape of the rotary is circular with 9.5m radius, average entry and exit width 8.5m, width of weaving section 15m, length of weaving section 38m.

## III. DATA ANALYSIS

The videography carried out at 7:00 am to 12 am morning and 6:00 pm to 10:00 pm in the evening on a working day. From the videography identified the peak of peak hourly volume shown below figure 2.

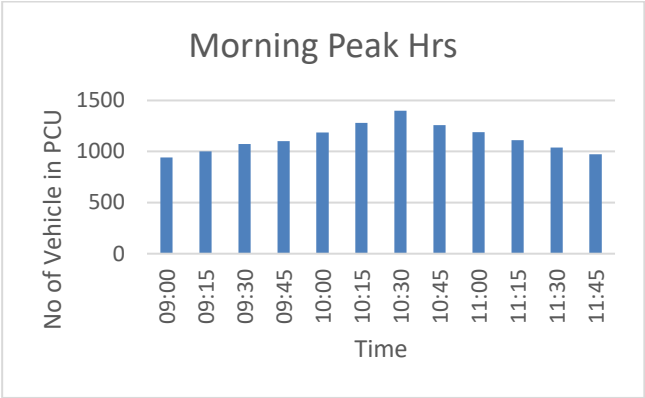


**Figure 2 : Hourly morning volume in PCU**

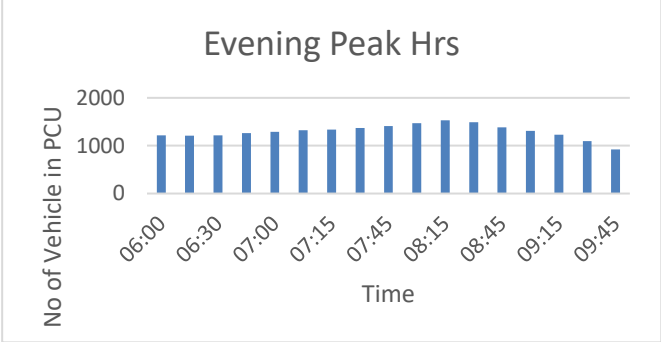


**Figure 3: Hourly evening Volume in PCU**

It was found from the above the graph that in morning 10:00 am to 11:00 am maximum hourly volume with 6020 PCU/hr. Same for the evening 7:45 to 8:45 pm maximum hourly volume with 7029 PCU/hr. The maximum hourly volume from the study was found 7029 PCU/hr. during 9hr volume count. There has been required to redesign the rotary as per IRC recommendation steps mentioned below.

## IV. DESIGN OF ROTARY

The steps for design of rotary intersection following the IRC guidelines. The first step to identify the peak hour volume at intersection. In present study traffic volume found 6020 pCU/Hr in morning peak hrs and 7029 PCU/hr in evening peak hrs. here the direction-wise PCUs Volume is shown in Figure 4.

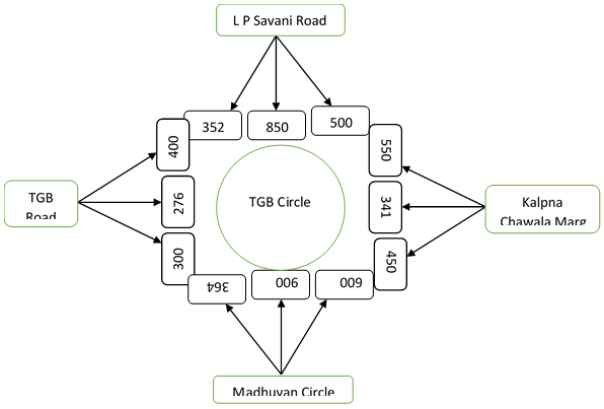


**Figure 4 : Direction Vise Traffic Volume in PCU**

From the figure 5 it can be seen that the traffic volume north towards south direction is very high. The next step is to identified the inflow and out flow traffic volume in each approach road at the intersection. The result shown in below figure. From the figure it can be identify that the maximum inflow and out flow in north to south direction.

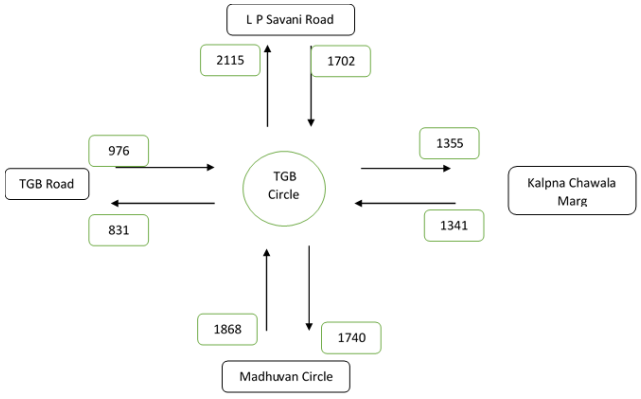


**Figure 5 : Direction vise Inflow and Out Flow**

Then find out the traffic movement like diverging, merging and weaving traffic from each four approach at intersection. It can be help full to find out the proportion of weaving traffic ratio with sum of crossing traffic to total traffic at the junction as per the IRC 65 guideline. Proportion of weaving traffic ration calculated for the four approaches, max ration is 0.71 at L.P. Savani towards Madhuvan Circle.

$$p = \frac{(b+c)}{(a+b+c+d)} \quad (1)$$

According to the IRC guideline find out the geometric condition of the rotary. The capacity of the rotary compares with the proportion of weaving traffic to the total traffic at the intersection. To find out the capacity used the empirical formula is given below.

$$Qp = \frac{280w(1+\frac{e}{w})(1-\frac{p}{3})}{(1+\frac{w}{L})} \quad (2)$$

Where e is the average entry and exit width, w is the weaving width, l is the length of weaving, p is the proportion of weaving traffic to the non-weaving traffic. a and d are the non-weaving traffic and b and c are the weaving traffic. The proportion of weaving traffic was calculated as 0.71. The width of the approach road (15m), the average entry width of the rotary was found to be 12 m and width of the weaving section as 15 m. According to IRC-65:1976, the weaving length should be at least 4 times the width of the weaving section. The weaving length for the present study was calculated as 38 m. Using the above values of average entry width of the rotary, width & length of weaving section, proportion of weaving traffic, the practical capacity of the rotary using equation (2) was calculated as 4133 PCUs which is well above the maximum value of sum of inflow and outflow volumes, i.e., 3817 PCUs. Hence the design can be considered adequate to handle the present approach traffic volumes.

## V. CONCLUSION

Surat is one of the rapidly growing city and urbanization is a serious issue faced by most of the metropolitan cities in India. The city having the widely developed textile market, Industrial area and diamond market with good life style so the people are migrating from rural to urban areas. Due to the urbanization growth of city and vehicle playing major role in traffic condition. The present studies to reduce the traffic at the rotary intersection. At four legs rotary intersection to analysis capacity and redesign the rotary at TGB intersection at Surat city. Traffic volumes count with different approach roads with videography and actual condition field measurement done manual. From the videography analysed traffic volume at each approach found morning and evening peak hour traffic volume. After the analysed traffic volume and capacity at intersection calculated high. Redesign of the rotary geometry condition following IRC guidelines was attempted and some solution required to reduce the traffic congestion at intersection like provide signalized rotary, parking not allowed at intersection.

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