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# Enhancing and Improvement of Traffic Intersection at VIP Road, Surat

**Prof. Nirav D. Parmar, Prof. Darshan Mehta**
Assistant Professor, Civil Engineering Department, DGGEC, Surat, Gujarat, India

## ABSTRACT

This paper presents the improvement of Traffic Intersection at VIP road Surat city. The city rapidly developing in Urbanization and Industrialization. Due to the Urbanization, there increase in population as well as vehicular growth. Thereby increase in the traffic congestion on the roads. The aim of this paper to improvement of traffic condition at VIP road. The traffic analysis with the classify volume count at the intersection with using empirical formula, video- graphy and vissim simulation as per the IRC guidelines.

**Keywords:** Un-signalized Intersection, Traffic Flow, Traffic Safety, Traffic Congestion, Traffic Conflict points.

## I. INTRODUCTION

The Surat is rapidly developing in urbanization and Industrialization. Due to the Urbanization, there increase in population as well as vehicular growth. Thereby increase in the traffic congestion on the roads. Most of public transports are stuck in the traffic jams and they fall behind the schedules. Traffic Data Collection and traffic volumes are basic requirements for planning of road development and management. Traffic flow pattern appears to be random in distribution, as it reflects the motivation of peoples in terms of different composition of vehicles on different types of roads under various environmental conditions.

Traffic volume studies are carried out to determine the number, movements and classifications of roadway vehicles at a given location. These data help in identifying critical flow time periods, determining the influence of large vehicles or pedestrians on vehicle traffic flow, or document traffic volume trends. The length of the sample period depends on the type of count which is used and the intended use of the data recorded. For example, an intersection count may be carried out during the peak flow period. If so, manual count with 30 minutes intervals could be used to obtain the traffic volume data. Traffic improvement through installation of Traffic Control Devices and give probable Solution for the Traffic Congestion. I have selected a intersection situated near SHYAM MANDIR Junction on VIP road, Althan, Surat. The Intersection is STAGGERED type-intersection. There also exist Bus Rapid Transit System (BRTS) near the intersection. The traffic congestion at the intersection is due to lack of traffic devices.

Figure 1: Actual image at Shyam Mandir Intersection

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Figure 2: Google image at Shyam Madir Intersection

## II. DATA COLLECTION

Traffic Volume count survey has been performed at the Shyam mandir intersection. The traffic data is collected using video graphic method and manually count the measurement. The number of different types of vehicle approaching the intersection from all the four directions is counted and their values are converted into the Passenger Car Unit (PCU). Data has been collected at morning peak hours (9:00 AM to 11:00 AM) and evening peak hours (6:00 PM to 8:00 PM). Traffic data at particular route is shown in the table and graphs are prepared.

**Table 1**. Road Inventory Data Survey

| | | Shyam Mandir to AnuvratDwar | Shyam Mandir to Althan Circle | Shyam Mandir to Star Property | Shyam Mandir to Vesu |
|---|---|---|---|---|---|
| **Footpath Width (Meter)** | LHS | 4.0 | 4.0 | - | - |
| | RHS | 3.0 | 4.0 | - | - |
| **Carriageway Width (Meter)** | LHS | 10 | 9.0 | 7.0 | 10.5 |
| | RHS | 10 | 9.0 | 7.0 | 10.5 |
| **Median width (Meter)** | | - | - | 1.0 | 1.5 |
| **BRTS Road (Meter)** | Width | 7.0 | 7.0 | - | - |
| | Median | 1.0 | 1.0 | - | - |
| **Street Light** | LHS/RHS | YES | YES | YES | YES |
| **Traffic Signal** | LHS/RHS | NO | NO | NO | NO |
| **BRTS Junction** | LHS/RHS | YES | YES | NO | NO |
| **Parking** | LHS/RHS | YES | NO | NO | NO |

## III. DATA ANALYSIS

The videography carried out at morning peak hours (9:00 AM to 11:00 AM) and evening peak hours (6:00 PM to 8:00 PM). From the videography identified peak hour volume from the all approach at the intersection in PCU.

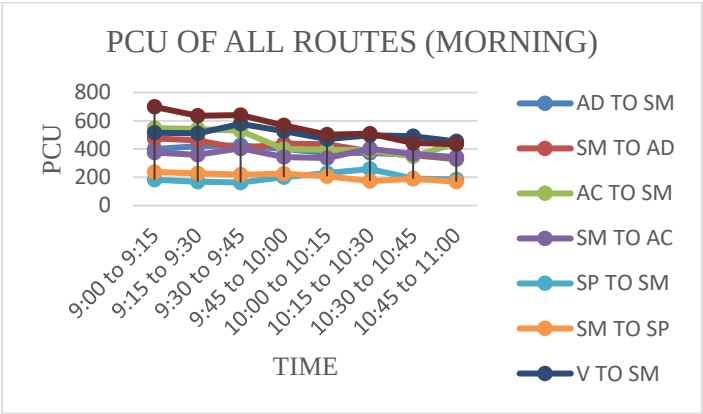


Figure 3 : Graph showing vehicle volume along all routes (Morning)

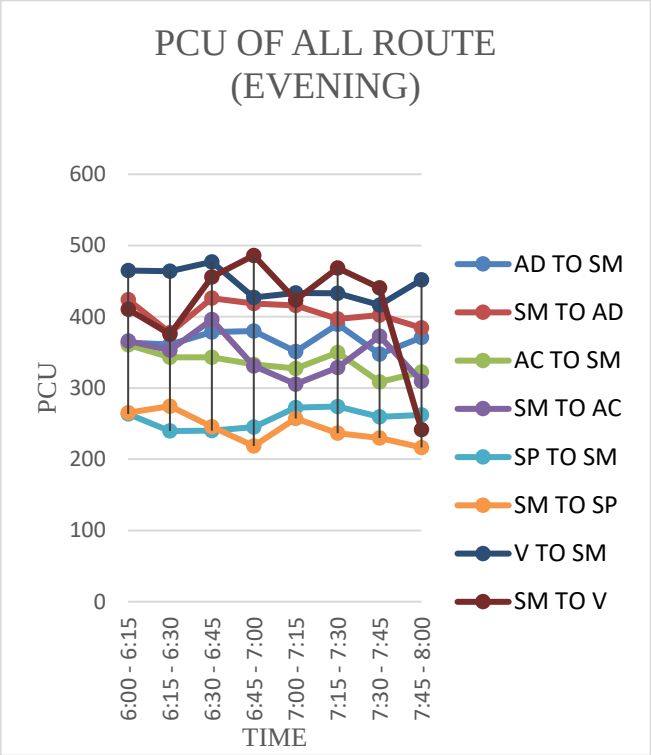


Figure 4 : Graph showing vehicle volume along all routes (Morning)

It was found from the above the graph that in morning 09:00 am to 10:00 am maximum hourly volume at Shyam mandir towards Vesu road. Same for the evening 6:45 to 7:45 pm maximum hourly volume at Shyam mandir towards Vesu road. There has been required to redesign the rotary as per IRC recommendation steps mentioned below.

## IV. VEHICLE COMPOSITION

The vehicle compositions at the Shyam mandir junction during morning peak hours and evening peak hours are shown below.

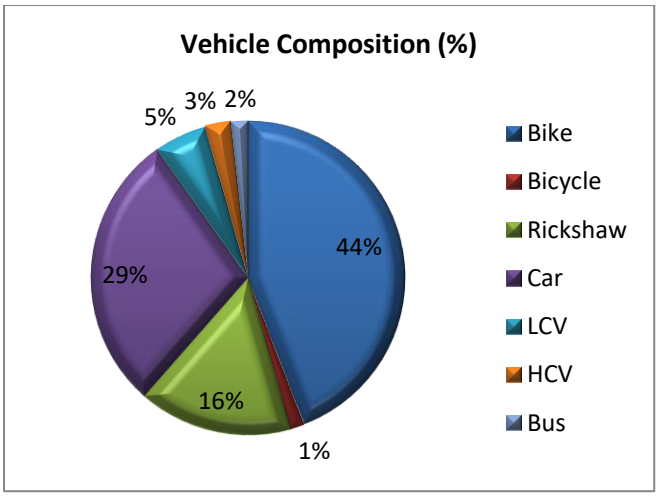


Figure 5 Vehicle compositions during morning time

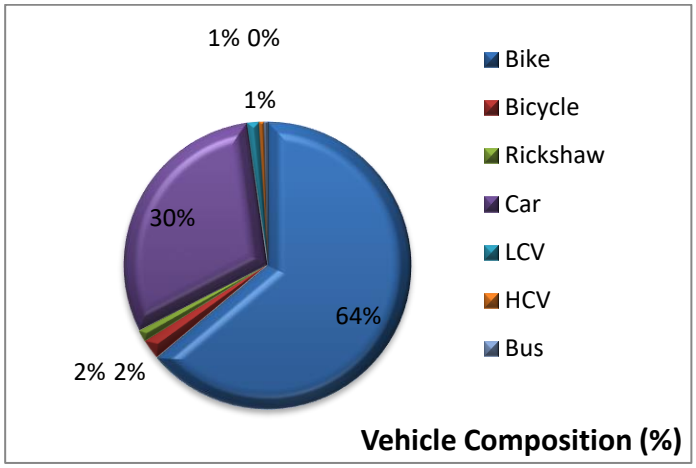


Figure 6 Vehicle Compositions during evening time

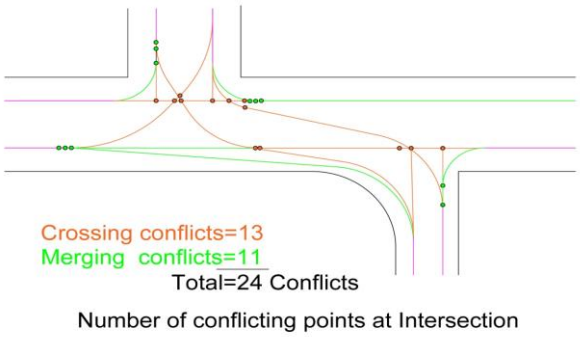


Figure 7 Conflicts – Staggered intersection (both two way)

On staggered road intersection with two way traffic, the total numbers of conflict points are 24. This consists of 13 crossing conflict points and 11 merging conflict points.

## V. DESIGN OF ROTARY

Classified volume count:After studying the traffic congestion at the site, classified volume count survey is carried out. Data obtained after carrying survey in morning peak hours from 9 to 11am and evening peak hours from 6 to 8 pm are as shown in figure 8 with each approach direction wise PCU. Inflow and out flow PCU volume at the each road of the intersection are in figure 9. After that calculate the design the network at the intersection as per the IRC guideline shown in figure 10. Use the empirical formula to find out the capacity with proportion of weaving length at each flow with there direction wise PCU value.

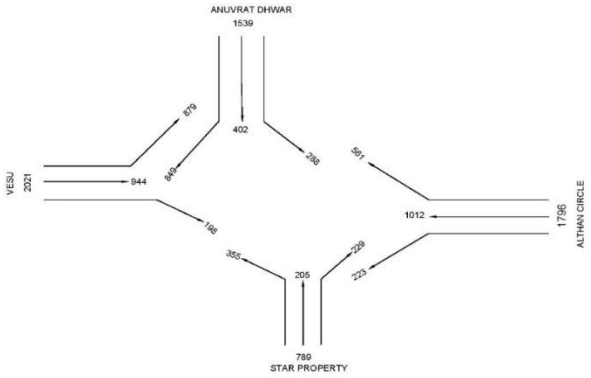


**Figure 8 Traffic in terms of PCU from each leg**

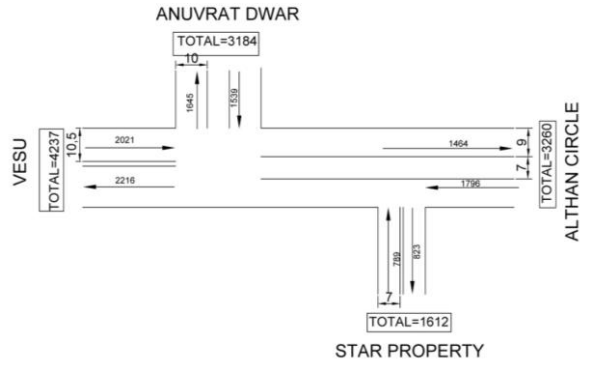


**Figure 9 Traffic in each leg**

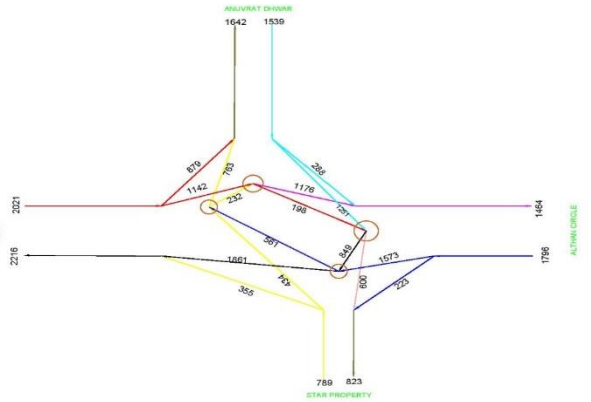


**Figure 10 Traffic network**

p = proportion of weaving section given by

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

a = left turning traffic moving along left extreme lane

d = right turning traffic moving along right extreme lane

b = crossing/weaving traffic turning toward right while entering the rotary

c = crossing/weaving traffic turning toward left while

$$p = \frac{1012 + 434}{355 + 1012 + 434 + 849} = 0.55$$

Capacity of rotary is calculated by the Empirical formula proposed by Transportation Road Research Lab (TRL)

$$Q_p = \frac{280W\left(1 + \frac{e}{W}\right)\left(1 - \frac{p}{3}\right)}{1 + \frac{W}{L}}$$

$$Qp = \frac{280 * 15.25(1 + \frac{11.75}{15.25})(1 - \frac{0.55}{3})}{1 + \frac{15.25}{43}}$$

=4555 PCU/hr

This is very much higher than the traffic flow of 4555 PCU/ hour, and the design is acceptable.

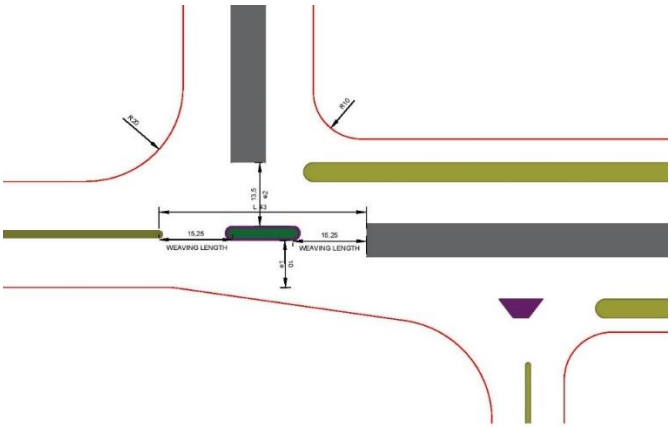


**Figure 11 Design of rotary intersection**

## VI. DESIGN OF TRAFFIC SIGNAL

IRC suggested,

Walking speed = 1.2 m/sec

Initial walking time = 7 sec

Check for Optimization of Signal Timing at Intersection by Webster's Formula

The saturation flow values may be assumed from the below table for calculating the cycle length.

**Table 2 Saturation flow value**

| Saturation flow (PCU/hour) | Road Width (m) |
|---|---|
| 1850 | 3 |
| 1890 | 3.5 |
| 1950 | 4.0 |
| 2250 | 4.5 |
| 2550 | 5.0 |
| 2990 | 5.5 |

The above table is valid up to road width of 5.5m and width above 5.5m can be assumed as 525 per meter road width up to 18 meters.

$C_o = \frac{1.5L+5}{1-y}$

where,

L= Lost time per cycle= (amber + inter green + time lost for Initial delay for two phases= (2+2+4) × 2= 16 sec.

Y=Volume/saturation flow for critical approach in each phase

Co = Optimum cycle length

The lost time is calculated from amber time, inter green time and Initial delay of 4 sec for first vehicle on each leg. Lost time per cycle = (amber + inter green + time lost for Initial delay for two phases) = (2+2+4) ×2 = 16sec.

Saturation flow for road 1 of width 10.5 m = 525×10.5 = 5513 PCU/ hr

Saturation flow for road 2 of width 10 m = 525×10 = 5250 PCU/ hr

Saturation flow for road 3 of width 9.0 m = 525×9.0 = 4725 PCU/ hr

Saturation flow for road 4 of width 7.0 m = 525×7.0 = 3675 PCU/ hr

$y_1 = \frac{673.67}{5513} = 0.12$

$y_2 = \frac{513}{5250} = 0.09$

$y_3 = \frac{1796}{4725} = 0.13$

$y_4 = \frac{789}{3675} = 0.10$

Optimum Cycle Time,

$C_o = \frac{1.5L+5}{1-y}$

**Table 3 Optimal cycle time**

| | Q | S | Y = Q/S | Co (second) |
|---|---|---|---|---|
| Road 1 | 673.67 | 5513 | 0.12 | 33 |
| Road 2 | 513 | 5250 | 0.09 | 32 |
| Road 3 | 1796 | 4725 | 0.13 | 33 |
| Road 4 | 789 | 3675 | 0.10 | 32 |

The provided cycle length is safe as the optimum cycle length is less than provided.

Therefore, cycle time 65 sec is acceptable.

**Table 4 Details of signal timings**

| Signal Timing | Initial Amber (s) | Green (s) | Clearance Amber (s) | Red (s) | Cycle length (s) |
|---|---|---|---|---|---|
| Vesu Road | 2 | 32 | 2 | 94 | 130 |
| Anuvrat Dwar Road | 2 | 29 | 2 | 97 | 130 |
| Althan Circle Road | 2 | 35 | 2 | 91 | 130 |
| Star Property Road | 2 | 22 | 2 | 104 | 130 |

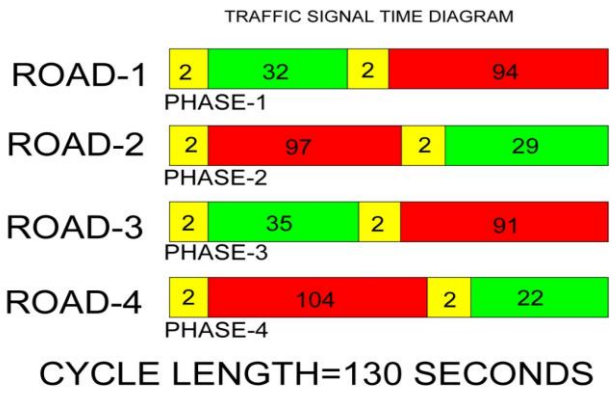


**Figure 12 Cycle length diagram**

## VII. CONCLUSION

After conducting the traffic volume study at Shyam mandir junction, it was found that there is heavy traffic due to exist of Shree Shyam baba temple at the intersection, absence of traffic signal at intersection, existing BRTS station nearby, halt by auto rickshaw and un-authorised parking at outside of the temple. Traffic volume count survey is carried out at the intersection during morning peak hours (9:00 AM to 11:00 AM) and evening peak hours (6:00 PM to 8:00

PM) and it is showed that maximum traffic is during morning peak hours which are 4237 PCU/hr.

To mitigate the problems at intersection various solutions are proposed. They are Signalization of the intersection. Diverting all vehicles which going towards star property road to Althan Circle. Making Star property road as one way road i.e. Vehicle movement is towards the intersection only. Provision of Island From the IRC guidelines the probable solution was a Rotary and Rotary has been designed the improvement of the Shyam mandir junction. Existing Traffic at the Junction was about **4237 PCU/ hour** in peak hour of a particular route is considered for design. Various attempts were made to get the design capacity of the intersection capacity and the obtained capacity is **4555 PCU/hour** which is more than the present capacity.

Traffic signals are design by using IRC method. According to this method, the total cycle time is 130 second. This cycle time is efficient for the movement of the vehicles.

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