

Assessmental Study and Designing of Rotary Intersection at Bajaj Square Wardha

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Abstract - Transportation contributes to the economical, Industrial, social and cultural development of any country. In the recent years the intense growth of vehicle which cause the heavier traffic congestion on intersection, Which going to be even worse in peak hour traffic time. In India number of vehicle are increasing day by day. Thus in cities like Wardha which facing many problems such as frequent occurrence of traffic conjunctions which result in delay, loss of time, increasing fuel consumption, increasing noise pollution and frequent interruption in traffic flow. Bajaj square is one of the busiest square of the wardha, this is only square in Wardha which Serves as a Junction through which number of vehicle enter and leave the city. As this is the most busiest square in the City the square faces many problem belonging to traffic such as collision of vehicles, long queue of number of vehicle due to traffic jam, pedestrian problem, improper handling of traffic in peak hour. Due to the prolong construction activity near the square many times the square face problem of traffic congestion. The Bhaji market and bus stand very near to intersection which helping in in increasing the traffic problem of square. Thus, the present design of rotary intersection is not capable to handle the present traffic scenario incidentally anticipated traffic of square. Aim of project assessment of study of rotary intersection at Bajaj square which include site investigation, measurement present geometry of intersection, followed by traffic volume count, then suggest the design of rotary intersection on the basis of above data to handle the present and anticipated traffic scenario at Rotary intersection at Bajaj square Wardha.

Key Words: Rotary intersection, Peak hour, Congestion, Traffic volume

1. INTRODUCTION

The study area is within the CBD area of Wardha City. Wardha is one of the city of Maharashtra having area 70 km² with population 126444 (census 2011). Growth in percentage of vehicle in 2015-16 (34%), 2016-17 (10.51%). The rapid growth of transportation activities causing acute traffic problem particularly at intersection due to mix complex flow pattern. It is important to design regulation system for this rotary because efficiency of operation, safety, speed, capacity are directly governed by design.

There are many issues related to Bajaj square Rotary intersection as this is most busiest square in the city, The Bajaj square intersection contain four (4) principal arterial Road namely bus stand road, Borgaon road, railway station road, Nagpur Road. All these legs of rotary intersection are busy in all times except from 12.00 noon to 5.00AM. Intersection having a statue of Jamnalalji Bajaj facing towards the railway station road.

Around the intersection having many public establishments are there like petrol pump, bus stop, police station, Bhaji market, APMC Wardha and auto stop within a range of 500 m, so there is a huge amount of mixed traffic in the intersection.

This scenario of traffic at intersection so that there is point of large number of major conflict this conflict may arise due to the crossing manoeuvres of vehicle coming from different direction. Assessment and study of all above problems bring new design of rotary intersection which is little try to solve the problem face by current situation.

1.1 Need for the Study

There has at least two or three news published in local newspaper on the traffic situation about the Wardha city in every month. At Bajaj square the traffic is uncontrollable during peak hours. Due to traffic conjunction the traffic gets delay. The rate of accidents may increase due increased traffic. The congested traffic give rise to conflicts. The situation is also affected by the encroachment and temporary vendors like fruits and vegetables shops on intersection.

An auto stand is located on intersection on the approach roads Bus Stop Road, Market road and Railway Station Road. The parking of the Bus Stop for two wheeler is at intersection which accommodates much space. All these have factors have an adverse impact on road user behavior which enhances possibility of accidents. Therefore it is important to design the intersection for increasing traffic for present and future scope.

1.2 STUDY AREA

Study of the project is within the CBD area of Wardha city. This is the core area if the city where all commercial establishment and activities takes placed. Here petrol pump,

bus stop, police station, Bhaji market, APMC Wardha and auto stop within a range of 500 m The Bajaj square intersection contain four (4) principal arterial Road namely bus stand road, Borgaon road, railway station road, Nagpur Road. Wardha is one of the pre-planned cities in India. The town planners were Sir Reginold craddock and Sir Bachelor. There is one important road was name after Sir Bachelor road. Study area is connected to main road in Wardha city which is important road because this is only one road through which vehicle can entire & leave city. (www.wardha gov.in)

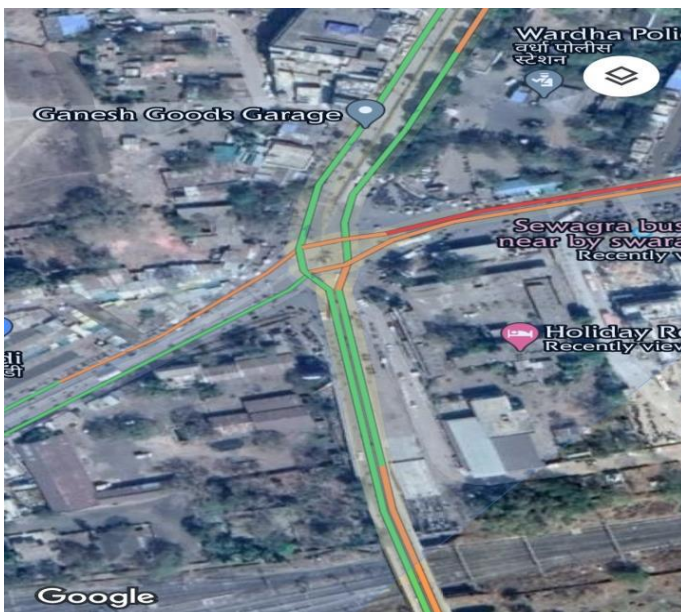


fig1: Study area with green and red lines at intersection

1.3 OBJECTIVE

Following are main objective study:-

A. Study the existing condition of Rotary Intersection:-

This includes Preliminary survey. It involves collect site details and features of the intersection like width of approach roads, Peak Hours etc.

B. To carry out assessment of intersection:-

This includes traffic volume count, weaving sections, directional flow of traffic.

C. Find out flow stream of Weaving Section and designing the new rotary intersection:-

From the manual traffic volume count, find out the flow direction of traffic in PCU/hr, Directional distribution of traffic and also finding the capacity of rotary, from that designing and Plotting design details of the new rotary intersection at Bajaj Square Wardha.

2. METHODOLOGY

1. The Selection of project topic is is assessment study and designing of rotary intersection Bajaj square Wardha. in this project, we assessing the traffic volume of Bajaj square by method of traffic volume count

2. Study the literature review for learning different things about rotary like type of rotary design of rotary, method of traffic volume count, Global trends in Rotary intersection use of software of rotary, effect of traffic volume on Rotary intersection etc.

3. Collect data and study the different common terms in Rotary like Central Island, weaving section, weaving length, waving width entry and exit angle, entry and exit width non weaving section etc. Study the various method of traffic volume count like manual traffic volume count, automatic volume count, traffic manoeuvre like merging, diverging, waving etc.

4. Then do the preliminary survey through which collecting the information of condition of rotary, observation in rotary, naming of approach Road finding the geometric features of intersection and space required for extension of rotary intersection

5. The manual traffic volume count is made for week from 13th of January 2020 to 19th of January 2020 at peak hour of morning and evening at 9:45 a.m. to 10:45 a.m. and 5:30 p.m. to 6:30 p.m.

6. In traffic volume count taken in peak hour approach Road is taken into consideration and here one survey team is work team consists of eight members each will posted on entry and exit of rotary intersection, They enter all vehicle coming in rotary and exit to the rotary. Intersection contain mixed traffic flow so vehicle Count on their type such as two wheeler, three wheeler, Car, HCV truck/ bus, LCV. This process continued till one week from Monday 13th to Sunday 19th of January 2020 on morning and evening session.

7. From that survey determining the net PCU value in single manoeuvre and then calculate total PCU at particular Road to all approach Road on morning session also at evening session.

8. The analysis of all this PCU's can done by tabulating above data by entering all 7 day PCU's on single table containing morning and evening PCU in it. Then with the help of MS Word, MS Excel plot the graph PCU versus days and concluding that peak hour PCU at day of particular session.

9. Calculating the proportion of weaving traffic as flow stream in weaving section and finding the maximum traffic flow on weaving section and calculating practical capacity on the basis of existing intersection dimension and comparison minimum practical capacity with maximum traffic flow on weaving section. If the practical capacity is less than that then redesigning the intersection and finding the theoretical capacity with design of rotary intersection.

4. FIELD DATA COLLECTION

Data collection in the field was carried out using measurements were conducted by one survey team and with writing material, tape, rope, chalk powder etc. so details data collection shows on given fig. and The traffic survey was conducted at week days and weekend. The traffic volume count is done by Manual Traffic Count and converted into PCU's

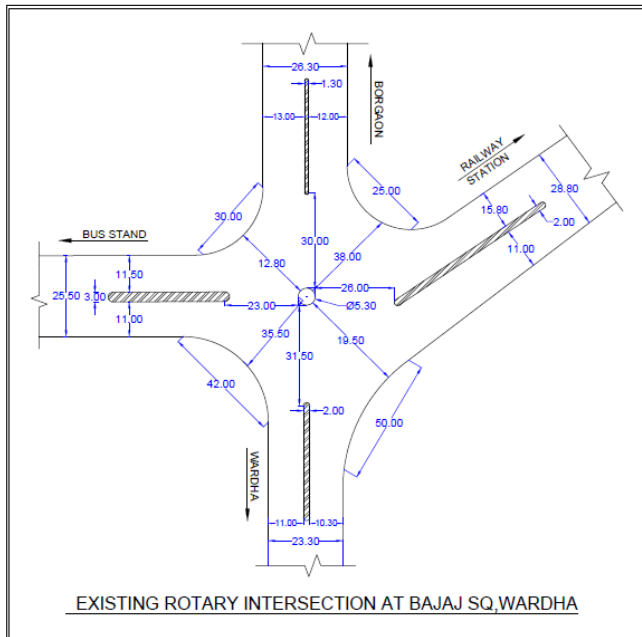


Fig2: Existing Rotary intersection at Bajaj Sq Wardha

5. DATA ANALYSIS

I. The traffic survey was conducted at week days and weekend. The traffic volume in PCU was analyzed manually and the average traffic volume was calculated by taking the average of the values obtained during peak hours of weekends and weekdays. Tabulate above data information with help of MS-Word, MS-Excel. Then with the help of MS-Excel plot the graph of Morning and evening traffic volume

II. Following tables represents directional distribution of traffic across the rotary intersection by peak hours in morning and evening

III. Also, after that the graph represents Morning and evening traffic volume of peak hours and analysis that Sunday evening at railway station road has maximum raffic volume as 3162.4 PCU /hr.

Table1. Borgaon Road

Days	PCU Morning	PCU Evening
Monday	2719.35	2136
Tuesday	2627.6	2137
Wednesday	2726.25	2202.8
Thursday	2665.9	2094.3
Friday	2270.35	1149.65

Saturday	2676.8	2318.8
Sunday	2694.95	2433.45

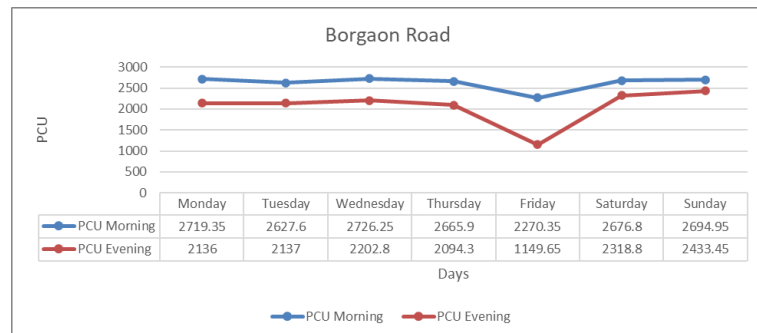


Table2. Bus stop Road

Days	PCU Morning	PCU Evening
Monday	2340.1	1367.25
Tuesday	1363.9	1360.5
Wednesday	1321.45	1404.3
Thursday	1212.4	1374.6
Friday	1236.35	1123.55
Saturday	1333.55	1434.35
Sunday	1073.1	1668.7

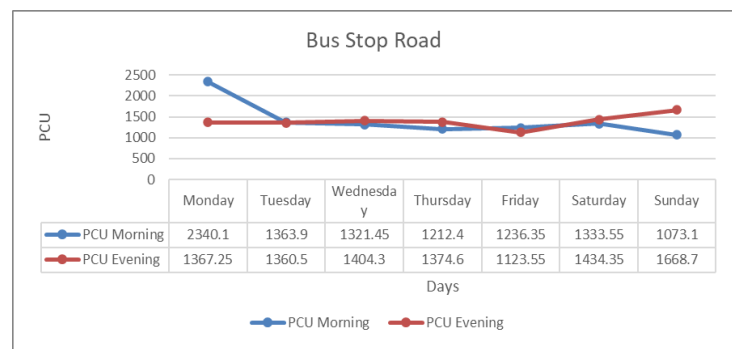


Table3. Market Road

Days	PCU Morning	PCU Evening
Monday	1261.05	1122.25
Tuesday	1093.5	1563.05
Wednesday	1230.9	1535.25
Thursday	1256.75	1471.1
Friday	1649.55	1546.45
Saturday	1195.1	1280.15
Sunday	1081.25	1892.2

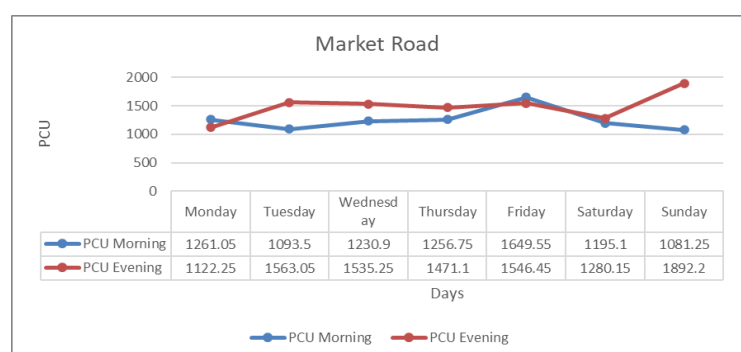
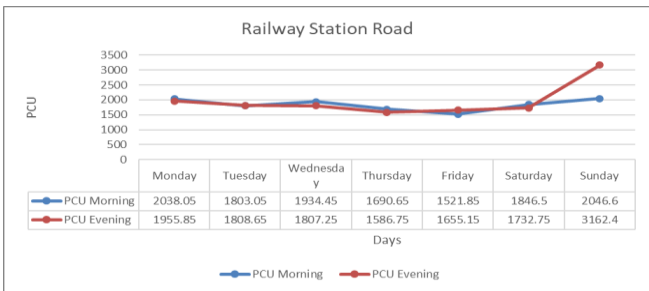


Table4. Railway station Road

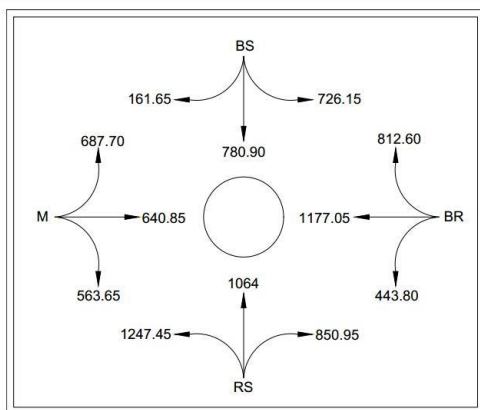
Days	PCU Morning	PCU Evening
Monday	2038.05	1955.85
Tuesday	1803.05	1808.65
Wednesday	1934.45	1807.25
Thursday	1690.65	1586.75
Friday	1521.85	1655.15
Saturday	1846.5	1732.75
Sunday	2046.6	3162.4



6. DESIGN

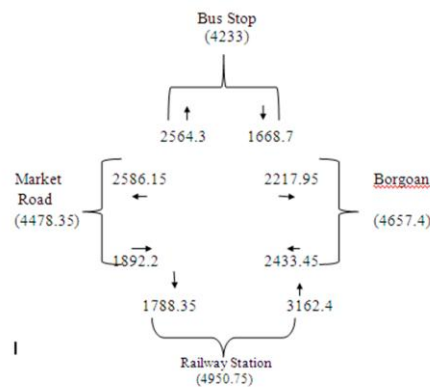
While studding all the graph if seem that railway station road Sunday evening PCU is more as 3162.4 PCU so while designing the capacity of rotary intersection considering Sunday evening all approach road traffic volume data with three PCU

Flow Direction of traffic in PCU/hr of Sunday Evening



Directional distribution of traffic across the Rotary

Fig no. 3



Determine the capacity of the in divided weaving sections

1. Weaving section in the direction of B.R & R.S

$$Q_{(BR - RS)} = 4706.88 \text{ PCU /hr}$$

2. Weaving section in the direction of RS & M

$$Q_{(RS - M)} = 6090.57 \text{ PCU / Hr}$$

3. Weaving section in the direction of M & BS

$$Q_{(M - BS)} = 6696.76 \text{ PCU /Hr}$$

4. Weaving section in the direction of BS & BR

$$Q_{(BS-BR)} = 4611.97 \text{ PCU /Hr}$$

As the rotary geometric value of w, e and L are not same and not in Proper way for all the intersecting approaches

The lowers value of Practical capacity calculated

$Q_{(BS - BR)} = 4611.97 \text{ PCU /Hr}$ is considered to the Practical capacity of rotary intersection

But,

$$(Q_{(BS - BR)} = 4611.97 \text{ PCU/hr}) < (5313.7 \text{ PCU/hr}) \text{ Total traffic in RS-M}$$

$$Q_{(BS-BR)} < 4611.97 \text{ PCU/hr} < 4950.75 \text{ PCU/hr Railway Station Road}$$

i.e. Practical Capacity (4611.97 PCU/hr) < (Maximum total traffic in RS-M weaving section)

So, it is required to Redesigning the Rotary intersection at Bajaj Square Wardha.

Redesign

- Assuming that shape of Rotary is Circular.
- As per IRC Design Speed For urban Area as 30Kmph.
- Assuming Radius at Entry Curve as suggested by IRC 15m as speed 30Kmph.

- Radius of Exit curve = 2 x Radius of Entry
= 2 x 15
= 30 m
- Radius of the Central Island
= 1.33 x Radius of Entry
= 1.33 x 15
= 19.95 m
= **Say 20 m**

$$e = \frac{15+15}{2}$$

$$e = 15 \text{ m}$$

As $\frac{e}{w}$ is Within the Range of 0.4 to 1.00

$$\text{So } \frac{e}{w} = \frac{15}{18} = 0.833$$

As per Fig. 3 Shows directional distribution of traffic cross rotary.

Then Maximum two way flow in the intersection leg such as Railway Station is 4950.75 PCU/hr and Maximum one way directional flow is 3162.4PCU/hr.

So considering the earlier finding of proportion of Weaving Traffic in the Railway Station & Market Road,

$$\text{As } P_{(RS-M)} = 0.613$$

- Assuming that Approach road Carriage Way Width =21m.
- So width of Carriage Way at Entry & Exit, i.e. $e_1 = 15\text{m}$ (As per IRC Table No.2)
- Width of Non Weaving Section i.e. $e_2 = 15\text{m}$ (As per IRC)
- So,
The Width of Weaving Section

$$W = \frac{e_1+e_2}{2} + 3.5$$

$$W = \frac{15+15}{2} + 3.5$$

$$W = 18.5\text{m}$$

But limitations Width of Weaving Section is 6-18 m

So,

$$W = 18 \text{ m}$$

Length of Weaving Section (L),

$$L = 4 \times \text{Width of Weaving Section} \\ = 4 \times 18$$

$$L = 72 \text{ m}$$

As Per IRC $L > 30$ as Design Speed is 30 Kmph

$$\text{Average Entry Width } e = \frac{e_1+e_2}{2}$$

It is safe for Average entry width.

So Theoretical Capacity of Rotary

$$= \frac{280w \left(1 + \frac{e}{w}\right) \left(1 - \frac{P}{3}\right)}{\left(1 + \frac{w}{2}\right)}$$

$$= \frac{280 \times 18 \left(1 + \frac{15}{18}\right) \left(1 - \frac{0.613}{3}\right)}{\left(1 + \frac{18}{2}\right)}$$

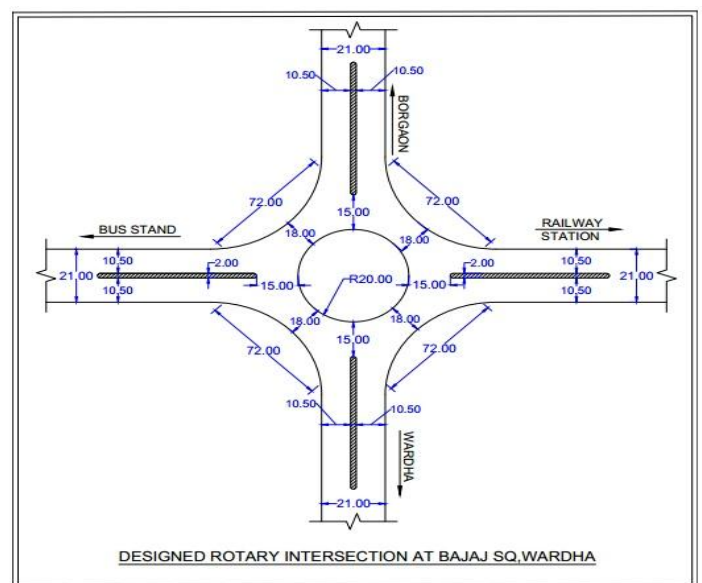
$$= 6084.38 \text{ PCU/hr (on Railway Station \& Market Road)}$$

And sum of the total Traffic of Rotary in that Weaving Section is **5313.7 PCU/hr**

☑ Theoretical Capacity of Rotary

(6084.38PCU/hr) > (5313.7 PCU/hr). Total Traffic in Weaving Section

☑ The Design is Safe.



7. RESULT

From data collection and data analysis get the following result

1. In the preliminary survey at the project site. We thought traffic police, hawkers, vendors and other business man beside the rotary intersection about peak hours at the traffic and found that morning hour is 09:45 AM to 10:45 AM & at the evening 05:30 PM to 06:30 PM, So that we found the peak hours of day.

2. From Bargaon Road peak hour volumes of weekday and weekend at morning session are 2719.35, 2627.6, 2726.25, 2665.9, 2270.35, 2676.8 & 2694.95 respectively. Also at evening session 2136, 2137, 2202.8, 2094.3, 1149.65, 2318.8 & 2433.45 respectively of Monday to Sunday.

3. From Market Road peak hour volumes of weekday and weekend at morning session are 1261.05, 1093.5, 1230.9, 1256.75, 649.55, 1195.1 & 1081.25 respectively. Also at evening session 1122.25, 1536.05, 1471.1, 1546.45, 1280.15 & 1892.2 respectively of Monday to Sunday.

4. From Bus Stand peak hour volume of weekday and weekend at morning session are 2304.1, 1363.9, 1321.45, 1212.41, 1236.35, 1333.55, & 1073.1 respectively. Also at evening session 1367.25, 1360.5, 1404.3, 1374.35, 1123.55, 1434.35 & 1668.7 respectively of Monday to Sunday.

5. From Railway Station peak hour volume of weekday and weekend at morning session are 2038.05, 1803.05, 1934.45, 1690.65, 1521.85, 1846.5 & 2046.6 respectively. Also at evening session 1955.85, 1808.65, 1807.25, 1586.75, 1655.15, 1732.75, 3162.4 respectively of Monday to Sunday.

6. From all the graph it seems that railway station road Sunday evening PCU is more as 3162.4 PCU. Because of Sunday evening traffic volume at railway station road is more so we consider all approach road data at Sunday evening.

7. Proportion of weaving traffic in weaving section BR-RS is 3939.65 PCU/hr, RS-M is 5313.7 PCU/hr, M-BS is 4619.75 PCU/hr. and BS-BR is 3724.15 PCU/hr, So the maximum value 5313.7 PCU/hr is considered for practical capacity and theoretical capacity also.

8. Practical capacity of Rotary intersection 4611.97 PCU/hr is less than the proportion of weaving traffic at section RS-M 5313.7 PCU/hr.

9. Theoretical capacity of rotary intersection 6084.38 PCU/hr is greater than the proportion of weaving traffic at section RS-M i.e 5313.7 PCU/hr.

8. CONCLUSIONS

1. The dissertation entitled "Assessmental Study And Designing of Rotary Intersection At Bajaj Square, Wardha" is taken into view in preliminary survey I found that in morning 09:45 AM to 10:45 AM & evening 05:30PM to 06:30 PM are most busiest hours in a day. I name that hour as peak hour

2. I did the manual traffic volume count study at the project site, The approach road at Project site are named as given by Nagar Parishad.

3. I found that proportion of weaving traffic maximum at RS-M weaving section. As per the new deign of rotary intersection calculated the theoretical capacity found much more than total proportioning of weaving traffic. In such way that we done our assessmental study and design of intersection

9. FUTURE SCOPE OF STUDY

I. Getting broad and more realistic view regarding results on rotary intersection to of study area, the survey carried out which should cover every season of year that is summer season, winter season, monsoon season and festival, that means January to October or November i.e. up to the end of Diwali. Particularly problem of traffic jams seems high on intersection in festival season. For above period perform atomatic traffic count which works on sensors that detect load of the vehicle Also there should extended survey area before Bajaj squar intersection road . Such broad survey helps to make exact traffic volume count.

II. Also design can done with AutoCAD Civil 3D design this process in a comfortable manner within time and it conserves a lot of time and effort

III. As the capacity of rotary increased above 3000 PCU/hr then with the development of new the technologies adding Signaling System

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