DESIGNING OF TRAFFIC SIGNAL AT T-INTERSECTION QAMARWARI CHOWK IN SRINAGAR, J&K

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ABSTRACT *Rapid growth of vehicular population has resulted in traffic congestion at the intersections where there is absence of certain assets like traffic signals, shortage of lane width etc. In present study traffic studies were carried out and measurements were taken at the "Qamarwari Chowk" which is a T-Intersection in order to design traffic signal. This will help in highlighting the problems which are in turn a cause of congestion at the intersection.*

Key words: *Carriageway Width, Passenger Car Unit, T-Intersection, Traffic Signal, Traffic Volume.*

1. INTRODUCTION

Srinagar being the capital is connected to different districts through network of roads which in turn forms a number of junctions in and around the city. One of such junctions is Qamarwari junction which connects Srinagar city with four districts namely Baramulla, Kupwara, Bandipora and Ganderbal. The junction attracts a lot of traffic especially during peak morning and evening hours. Since the junction is poorly developed as per present day demands thus results in average delay of one hour per day for the commuters. It is in pace to mention that development of the junction has not taken place partly due to turmoil for last two and a half decades and partly due to negligence on the part of politicians. In order to overcome the problem traffic studies and measurements at the intersection are being undertaken so that problem areas are identified and remedial measures suggested. The major aim of this study is to solve congestion and make the traffic flow smooth at this T- intersection, which could be done with the help of Traffic Signal Design. The design could be carried out with the help of many methods but design as per IRC guidelines is chosen which works out to be efficient. The method also explains about the pedestrian green time which is a very important concern regarding safety.

Figure 1 Traffic jam at Qamarwari Chowk during peak hour

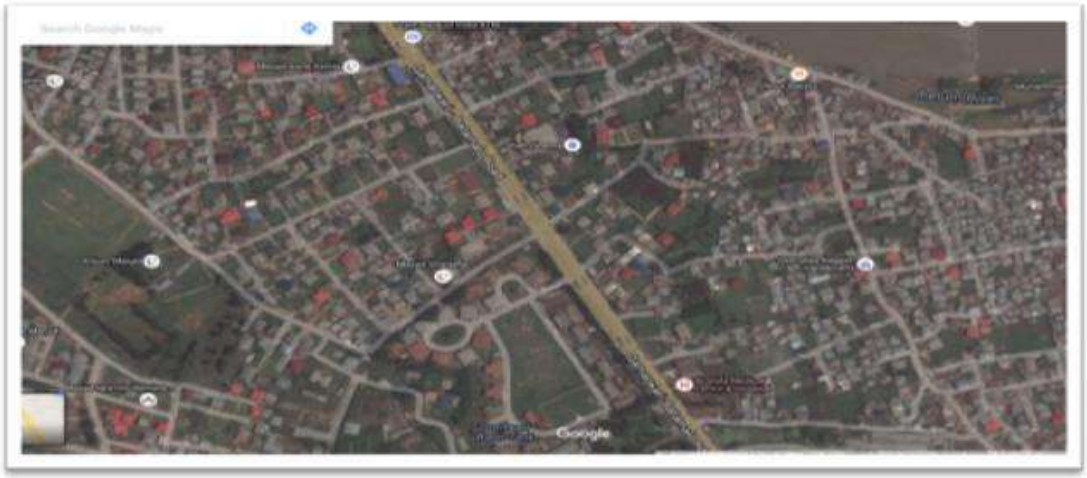

Figure 2 Aerial view of Qamarwari chowk T- intersection

2. TRAFFIC VOLUME STUDIES

The traffic volume data was collected at the intersection by taking 15 minute counts (manual).

The data shown in the tables is the peak hour data for which the signal was designed. The peak hour observed was during the morning.

The average traffic volume was also calculated for eight hours of the day. Starting from 9:00am in the morning to 5:00pm in the evening, the average traffic volume for these eight hours came out to be equal to 895 PCU/hr on Road-1 approaching from HMT and 669 PCU/hr approaching from Batamaloo.

Solving Congestion by Designing of Traffic Signal At T-Intersection (Qamarwari Chowk) In Srinagar, J&K

Also the average traffic volume of eight hours on Road-2 came out to be equal to 289 PCU/hr. This is more than the data which has to be met while taking in consideration the traffic signal design.

The volume of traffic approaching the intersection during design hour is shown in tabular form below:

Table 1 Traffic volume counts on Road-1 (from HMT towards intersection) (9:00am to 10:00am)

Type of Vehicle	No of Vehicles	PCU equivalent	Multiplying Factor	PCU/hr
Motorcycles and Scooters	116	0.50	4	232
Cars, Tempos, Auto-rickshaws, etc	108	1	4	432
Agriculture Tractor, LCV	37	1.50	4	222
Trucks and Buses	9	3	4	108
				TOTAL = 994

Table 2 Traffic volume counts on Road-2 (from Eidgah and Chattabal towards intersection) (9:00am to 10:00am)

Type of Vehicle	No of Vehicles	PCU equivalent	Multiplying Factor	PCU/hr
Motorcycles and Scooters	29	0.50	4	58
Cars, Tempos, Auto-rickshaws, etc	34	1	4	134
Agriculture Tractor, LCV	14	1.50	4	84
Trucks and Buses	4	3	4	48
				TOTAL = 325

Table 3 Traffic volume counts on Road-1 (from Batamaloo towards intersection) (9:00am to 10:00am)

Type of Vehicle	No of Vehicles	PCU equivalent	Multiplying Factor	PCU/hr
Motorcycles and Scooters	55	0.50	4	110
Cars, Tempos, etc	68	1	4	272
Agriculture Tractor, LCV	54	1.50	4	324
Trucks and Buses	6	3	4	72
				TOTAL = 778

3. MEASUREMENTS AT QAMARWARI JUNCTION

The carriageway width was measured with the help of measuring tape and also the width of footpath was measured and the appropriate data was put together so that proper site map would be made. This was a very difficult task to do because in the presence of traffic, the safety was the bigger concern. The traffic would have been stopped for some while but that would have led to traffic jams and being a transportation engineer, this could not be tolerated.

In figure 3, it is shown that the Road-1 is having a width of 11.5m. The traffic on Road-1 is two-way traffic and Road-1 is having four lanes.

It is also shown in figure 3, that Road-2 is having a total width of 10m. The traffic on Road-2 is two-way traffic and the number of lanes is two only.

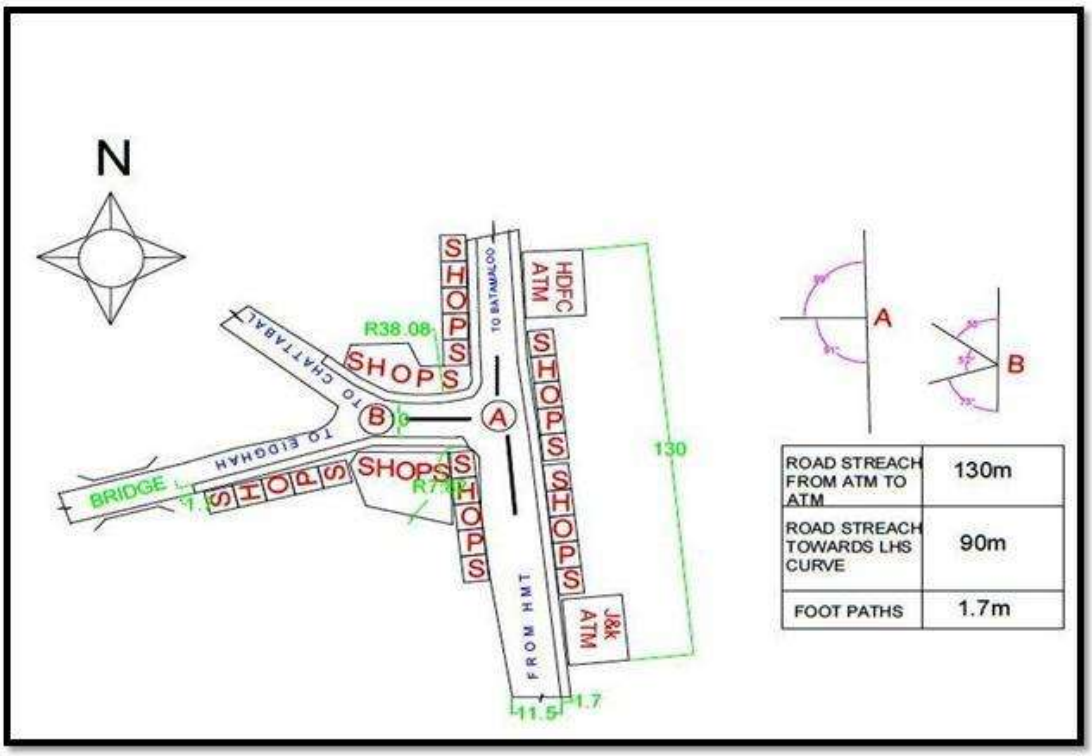

Figure 3 Site Map of Qamarwari Junction ("A" represents Road-1 and "B" represents Road-2)

4. DESIGN OF TRAFFIC SIGNAL AT QAMARWARI T-INTERSECTION AS PER IRC GUIDELINES

Width of Road-1 = 11.5m or total 4 lanes, with 2 lanes in each direction. Width of Road-2 = 10m or total 2 lanes, with one lane in each direction. Approach volumes on Road-1 = 994 PCU/hr and 778 PCU/hr.

Approach volume on Road-2 = 325 PCU/hr. Pedestrian walking speed = 1.2m/s.

Design traffic on Road-1 = higher of the two approach volume per lane = (994/2) = 497 PCU/hr.

Design traffic on Road-2 = 325 PCU/hr.

Step-1, Pedestrian Crossing Time

- Pedestrian green time for Road-1 = (11.5/1.2) + 7 = 17 sec.
- Pedestrian green time for Road-2 = (10/1.2) + 7 = 15 sec.

Step-2, Minimum green time for traffic

- Minimum green time for vehicles on Road-2, G_2 = 17 sec.
- Minimum green time for Road-1, G_1 = 17 x (497/325) = 26.0 sec.

Step-3, Revised green time for traffic signals

Adding 2.0 sec each towards clearance amber and 2.0 sec inter-green period for each phase, total cycle time required = (2 + 17 + 2) + (2 + 26 + 2) = 51 sec.

- Signal cycle time may be conveniently set into multiples of five sec and so the cycle time = 55 sec.

The extra time of 55 – 51 = 4.0 sec per cycle may be apportioned to the green times of Road-1 and Road-2, as 3.0 and 1.0 sec respectively.

Therefore adopt;

- G_1 = 26 + 3.0 = 29.0 sec (approximately).
- G_2 = 17 + 1 = 18.0 sec (approximately).
- Adjusting Amber timing; G_2 = 18 + 2 = 20.0 sec.

Step-4, Check for clearing the vehicles arrived during the green phase

- Vehicle arrivals per lane per cycle on Road-1 = (497/55) = 9.03 PCU per cycle.

Minimum green time required per cycle to clear vehicles on Road-1 = 6 + (9.03 – 1) 2 = 22.07 sec (less than 29 sec and therefore accepted).

- Vehicle arriva ls per lane per cycle on Road-2 = (325/55) = 5.90 PCU per cycle.

Minimum green time required per cycle to clear vehicles on Road-2 = 6 + (5.90 - 1) 2 = 15.81 sec (less than 18.0 sec and therefore accepted).

As the green time already provided for the two ro ads by pedestrian crossing criteria are higher than these values, the above design values are alright.

Step-5, Check for optimum signal cycle Webster's equation

Lost time per cycle = (amber time + inter- green time + time lost for initial delay of first vehicle) for two phases = (2 + 2 +4) x 2 = 16 sec.

Saturation flow for Road-1 of width 5.75m = 525 x 5.75 = 3018.75 PCU/hr. Saturation flow for Road-2 of width 5m = 2550 PCU/hr.

- y_1 = 994/3018.75 = 0.329 and
- y_2 = 325/2550 = 0.061.

Therefore; $Y = y_1 + y_2 = 0.329 + 0.127 = 0.456$.

Optimum signal cycle time, C_0 = (1.5L+5/1-Y) = (1.5x16+5/1-0.456) = 53.4 sec. Therefore the cycle time of 55 sec designed earlier is acceptable.

5. RESULTS

The outcome of the experimental work is represented in table 4 and the proper phase diagram is also shown in figure 4 which is in accordance with the given table.

Table 4 Showing details of Signal Timings

ROAD	GREEN PHASE, G sec	AMBER TIME, sec	RED PHASE, R sec	CYCLE TIME, C sec
Road-1	29	2	(22 + 2)	55
Road-2	20	2	(31 + 2)	55

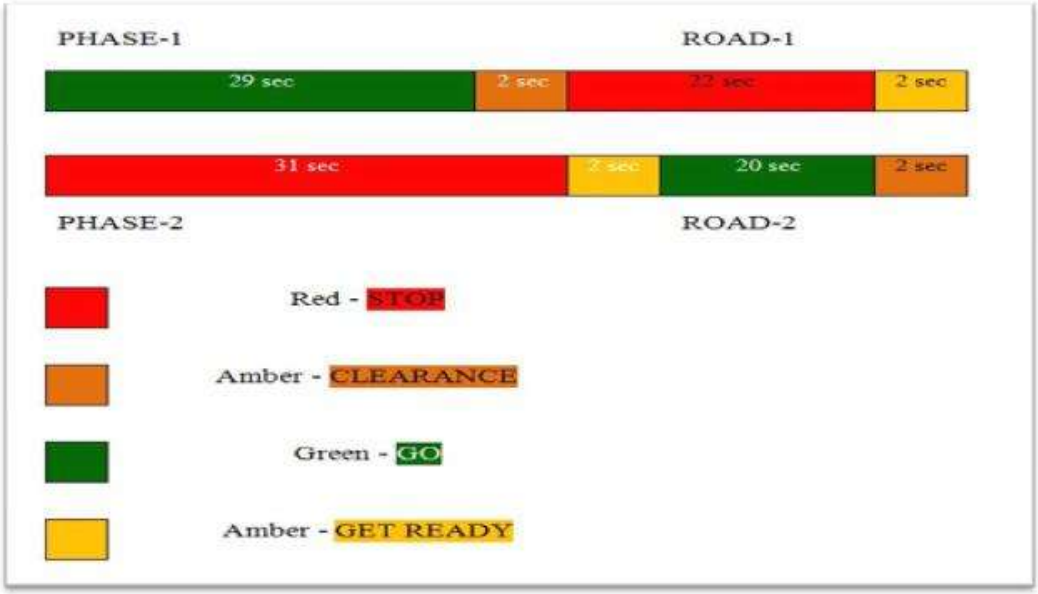

Figure 4 Recommended Two-phase Signal timings for Qamarwari Junction

6. CONCLUSIONS AND RECOMMENDATIONS

The outcome of the whole study is the fact that the widening of the road needs to be done at the intersection. The road widening will cater for a lot of traffic and would handle the high volume of traffic efficiently. The main conclusion other than road widening is the installation of traffic signal at the intersection. Traffic signals in general will carry out the smooth running of traffic. The traffic signals have following advantages if installed at the intersection:

- The traffic signals will provide orderly movement of traffic at this intersection.
- The quality of traffic flow would get improved by forming compact platoons of vehicles, provided all the vehicles move at approximately the same speed.
- There would be reduction in accidents due to crossing conflict, notably the right angled collisions.
- The Traffic handling capacity would be highest among the different types of intersections due to the reason that it is at-grade.
- This will provide a chance to the traffic of minor road to cross the continuous traffic flow of main road at reasonable intervals of time.
- The Pedestrians can cross the road safely at this intersection.
- The signal system, if properly coordinated, would result in a reasonable speed along the major road traffic.
- At this intersection automatic traffic signal should be installed because they may work out to be more economical when compared to manual control.

Thus by traffic signal design, the traffic could be at least handled which is not in the hands of traffic police and in turn will help in solving congestion.

There is also a lot of future work which could be carried out at the intersection other than traffic signal design. Since this intersection is in the middle of four districts which means commuters have to commute through this intersection regularly. Thus it has to handle a huge traffic smoothly and efficiently and for the purpose to be served there becomes a better scope for future work which could be carried out at this intersection. The future work which could be carried out includes:

- Estimation of capacity could be carried out at this intersection. This can be done with the help of Gap acceptance method which is elaborated in Highway Capacity Manual (2000).
- The three phase signal design could be carried out at this intersection in which turning movements of vehicles is also included. Currently at this intersection, the vehicles have to cover a lot of distance for the right turn, so two phase signal design was carried out.
- Last but not the least, the Geometric re-design of the intersection seems to be a necessary study which should be carried out in the near future. The proper sight distance, carriageway width and other features which form an important part of Geometric design have to be calculated and compared with the current scenario such that the faults will come onto the picture and hence a proper solution would be provided.

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