

Analysis and Design of Traffic Signal at Major Locations in Jaipur City

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Abstract

Traffic signal capacity and timing analysis techniques are presented as an aid for detailed geometric and operational design of signalized intersections. Waiting at the traffic signals can be painful. Often, we wonder why the lanes with maximum traffic are not given the green signal at the earliest. Till now, much research has been done but not effectively implemented. Idea aims to intelligently control traffic lights at junctions for minimizing the average delay experienced by road users. In this research paper we calculate the traffic volume. According to this traffic volume we calculate the red, green and yellow light time of four locations that is 7 Number Junction, New Gate, OTS circle. The Concept raised when we faced the delay at the traffic signal location, which made analyzed the signal which is already existed. We redesign the signal according to traffic to lessen delay at the location of traffic signal

1. Introduction

Traffic signal through worldwide is widely used in several cities and is one of the most effective and flexible active control of traffic. The movements of the traffic give rise to the conflicts in different directions which are addressed by time sharing principle. Well-ordered movements of traffic, an intensified capacity of the intersection are the advantages of traffic signal. Traffic signal is the problematical topic. For instance timing a 'WALK' signal for a wide pedestrian crossing and older pedestrians could result in very long waits for vehicles and consequently increase the plausibility results in accidents. As a consequence, optimizing the safety of intersection involves numerous factors like street width, lane width, number of intersecting streets, and availability of time and even/uneven nature of flow, number and type of pedestrians and many other factors. Traffic Signals can be programmed to have various signal timing plans, depending on the time of day.

1. NRI Circle
2. 7 Number Junction
3. OTS Circle
4. New Gate

1. NRI:-On this location we design the traffic signal. Till now there is no need of traffic signal but we design for the future aspect. Fig.1 shows the satellite view of the NRI circle.
2. 7 NUMBER JUNCTION:- On this location we analyze the traffic signal timing. Fig.2 shows the satellite view of the 7 number.

3. OTS CIRCLE:- On this location we analyze the traffic signal timing. Fig.3 shows the satellite view of the OTS circle.
4. NEW GATE: - On this location we analyze the traffic signal timing. Fig.4. shows the satellite view of the New Gate.



Fig.1: NRI CIRCLE



Fig 2: 7 Number Junction



Fig 3: OTS CIRCLE



Fig 4: New Gate

2. Methodology

Stage 1:- First survey the area where the traffic signals are necessary. There are four locations-

1. NRI Circle (Where we design the signal)
2. 7 Number
3. OTS Circle
4. New Gate

Stage 2:- Traffic Volume Calculation of all Four Locations-
Procedure of Traffic Volume:

- Width of road 1 is 28 meter with 8 lane with 4 lane in each direction.
- Width of road 2 is 21 meter with 6 lane with 3 lane in each direction.
- Approach volume of Road1=1375&943 PCU/hour
- Approach volume of Road 2=690&470 PCU/hour
- Pedestrian walking speed is 1.2m/sec. (As per IRC Guideline)
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- Design traffic of Road 1= higher of two approach volume per lane = $(1375/4)=345$ PCU/hour
- Design traffic of Road 2 = higher of two volume per lane = $(690/3) = 230$ PCU/hour

PEDESTRAIN CROSSING TIME:-

Pedestrian green time for Road 1 = $(28/1.2)+7 = 30$ sec.

Pedestrian green time for Road 2 = $(21/1.2)+7=24.5$ sec

MINIMUM GREEN TIME FOR TRAFFIC:-

Minimum Green Time for Vehicle on Road2, $G_2=30$ sec.

Minimum Green Time for Vehicle on Road1, $G_1=30*(345/230) = 45$ sec.

REVISED GREEN TIME FOR TRAFFIC SIGNALS:-

Adding 2 sec each towards clearance amber and 2sec, inter green period for each phase,

Total cycle time required = $(2+30+2) + (2+45+2) = 83$ sec.

Signal cycle time by conveniently set in multiplies of 5 sec and so the cycle time is 85sec.

The extra time $85-83=2$ sec.may be appointed for green time of Road1 and Road2 in 1 second each Therefore adopt, $G_1 = (45+1) = 46$ SEC.

$G_2 = (30+1) = 31$ SEC.

CHECK FOR CLEARING THE VEHICLE ARRIVED DURING GREEN PHASE:-Vehicle arrivals per lane per cycle on Road1= $(1375/85)=16.17$ PCU/cycle.

Minimum green time required per cycle to clear vehicle on Road1= $6 + (16.17-1)*2=16$ sec.

(less than 46 sec. therefore ok) Vehicle arrivals per lane per cycle on Road2= $(690/85) =8.12$ PCU/cycle.

Minimum green time required per cycle vehicle on road1 = $6 + (8.12-1)*2= 20.2$ sec. (Less than 31 sec. therefore OK) So green time period

CHECK FOR OPTIMUM SIGNAL CYCLE BY WESTER'S EQUATION:-

Lost time per cycle = (Amber Time + Inner Green Time +Time lost for initial delay for vehicle)

For Two phase = $(2+2+4)*2=16$ sec. Saturation flow for Road 1 of width 14m = $525*14=7350$ PCU/hour

Saturation flow for Road 2 of width 10.5m

= $525*10.5=5513$ PCU/hour $Y_1=(137/7350)=0.187$ $Y_2=(690/5513)=0.125$ $Y=Y_1+Y_2$

$Y=0.187+0.125$

$Y=0.132$

Optimum signal cycle time, $C0 = (1.5L+5)/(1-Y)$

$= [(1.5*16) +5/ (1-0.312)$

$= 42.15\text{sec.}$

Therefore the cycle time of 85sec. Designed earlier is acceptable.

The detail of the Signal Timing is given below.

Step 3:- With this traffic volume data calculate the red green and amber time by using numerical method.

Step 4:- At last compare the calculated green, red and amber light time to the original light time.

3. Result:-

These following tables are the result of this survey:-

1. NRI Circle (9:30 to 11:30 AM)

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	0	0	0	31	27	4
	0	0	0	31	27	4
Road2	0	0	0	35	31	4
	0	0	0	35	31	4

Table. – 1. NRI Circle (9:30 to 11:30 AM)

2. NRI Circle (5:00 to 7:00 PM)

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	0	0	0	39	35	4
	0	0	0	39	35	4
Road2	0	0	0	37	33	4
	0	0	0	37	33	4

Table. – 2. NRI Circle (5:00 to 7:00 PM)

3. 7 Number Junction (09:30 to 11:30AM)

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	1:20	16	3.7	60	56	4
	1:20	16	3.7	60	56	4
Road2	1:10	25	4	36	32	4
	1:10	25	4	36	32	4

Table. – 3. 7 Number Junction (09:30 to 11:30AM)

4. 7 Number Junction (05:00 to 07:00 PM)

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	01:20	16	3.7	55	51	4
	01:20	16	3.7	55	51	4
Road2	01:10	25	4	35	31	4
	01:10	25	4	35	31	4

Table. – 4. 7 Number Junction (05:00 to 07:00 PM)

7. OTS (5:00 to 7:00 PM) [2&2A]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road 1	1:17	39	3.7	28	24	4
	1:40	41	3.8	28	24	4
Road2	1:30	30	4	36	32	4
	1:32	30	4	36	32	4

Table. – 7. OTS Circle (5:00 to 7:00 PM) [2&2A]

8. OTS (5:00 to 7:00 PM) [2&2B]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road 1	1:17	39	3.7	94	90	4
	1:40	41	3.8	94	90	4
Road2	2:00	10	3	34	30	4
	2:00	10	3	34	30	4

Table. – 8. OTS Circle (5:00 to 7:00 PM) [2&2B]

9. NEW GATE (9:30 to 11:30 AM) [1&2A]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	1:52	40	3	35	31	4
	1:45	40	3	35	31	4
Road2	1:59	45	5	35	31	4
	1:50	45	5	35	31	4

Table. – 9. NEW GATE (9:30 to 11:30 AM) [1&2A]

10. New Gate (9:30 to 11:30AM) [1&2B]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	Yellow
	sec.	sec.	sec.	sec.	sec.	sec.
Road 1	1:52	40	3	65	61	4
	1:45	40	3	65	61	4
Road 2	1:47	50	3	35	31	4
	1:47	50	3	35	31	4

Table. – 10. New Gate (9:30 to 11:30AM) [1&2B]

11. New Gate (5:00 to 7:00PM) [2&2A]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	Yellow
	sec.	sec.	sec.	sec.	sec.	sec.
Road 1	2:00	50	4	46	42	4
	2:10	50	4	46	42	4
Road 2	1:50	45	4	34	30	4
	1:50	45	4	34	30	4

Table. – 11. New Gate(5:00 to 7:00PM) [2&2A]

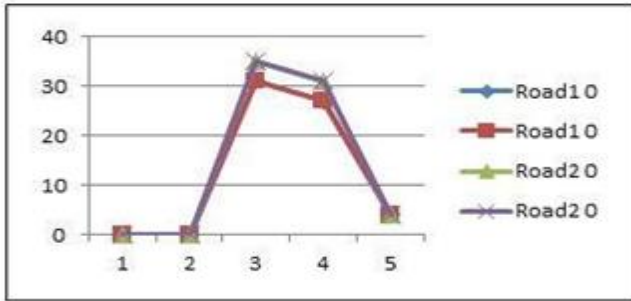
12. New Gate (5:00 to 7:00PM) [2&2B]

S. No.	Collected Time			Analysis Time		
	RED	GREEN	YELLOW	RED	GREEN	YELLOW
	sec.	sec.	sec.	sec.	sec.	sec.
Road1	2:00	50	4	66	62	4
	2:10	50	4	66	62	4
Road2	1:55	45	3	34	30	4
	2:00	45	3	34	30	4

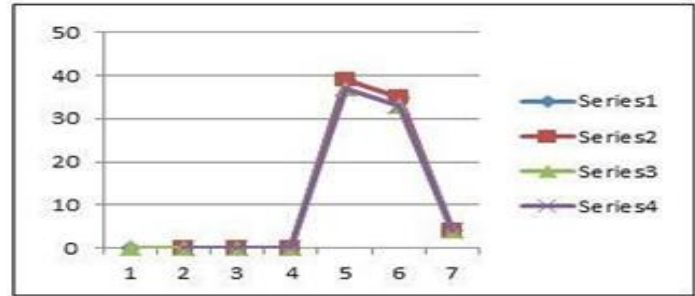
Table. – 12. New Gate (5:00 to 7:00PM) [2&2B]

4. Graph Representation

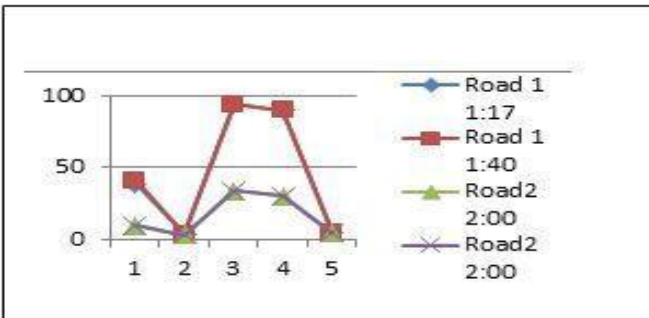
1. NRI (9:30 to 11:30 AM)



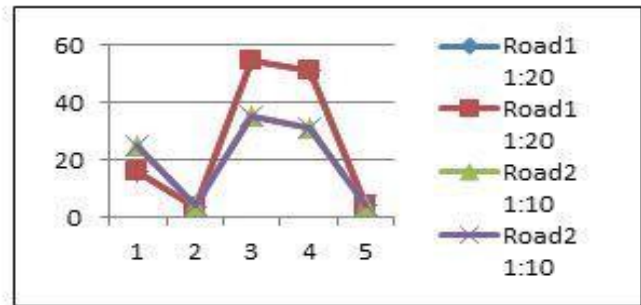
2. NRI (5:00 to 7:00 PM)



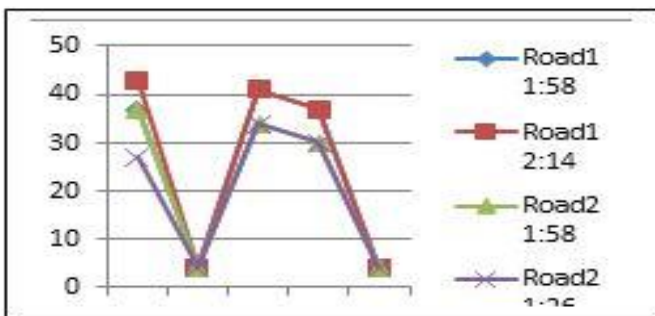
3. 7 Number Junction (09:30 to 11:30AM)



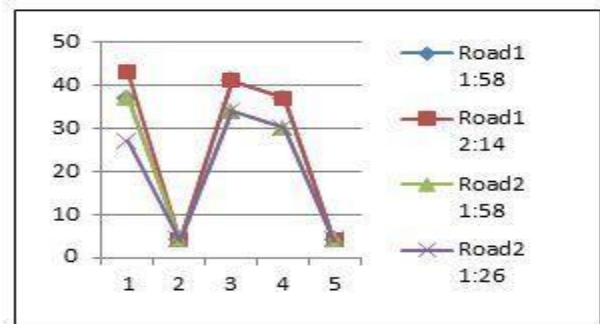
4. 7 Number (05:00 to 07:00 PM)



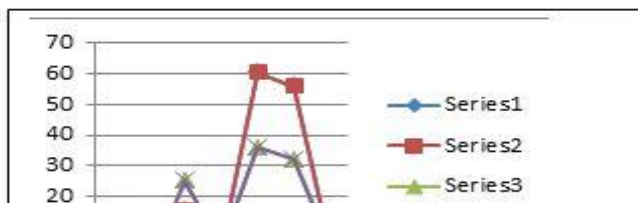
5. OTS (9:30 to 11:30 AM) [1& 2A]



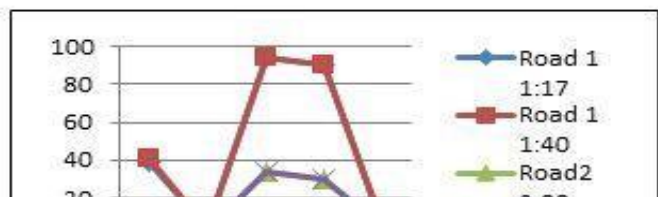
6. OTS (09:30 to 11:30 AM) [1&2B]



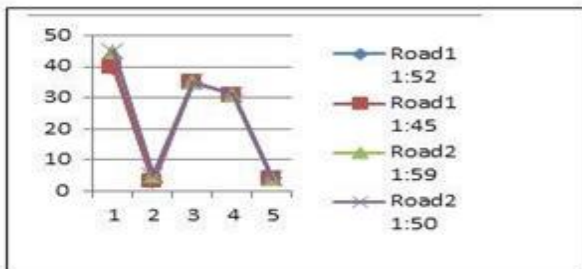
7. OTS (5:00 to 7:00 PM) [2&2A]



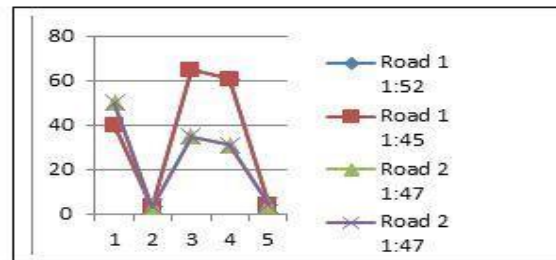
8. OTS (5:00 to 7:00 PM) [2&2B]



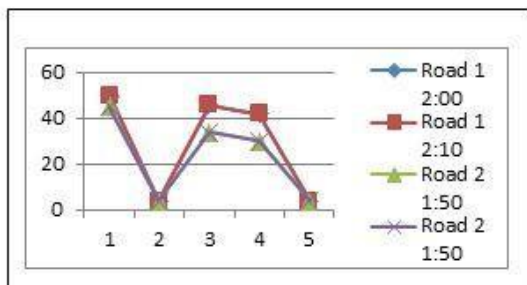
9. NEW GATE (9:30 to 11:30 AM) [1&2A]



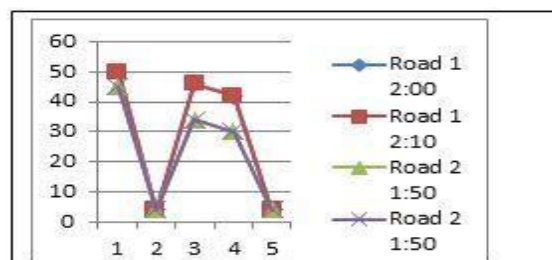
10. NEW GATE (9:30 to 11:30 AM) [1&2B]



11. New Gate (5:00 to 7:00PM) [2&2A]



12. New Gate (5:00 to 7:00PM) [2&2B]



5. Conclusion:-

In this research paper we calculate the traffic volume of all four location and note down the red green and amber light time of the cross road. According to our calculated traffic volume data we calculate the red, green and amber light time of all four locations.

1. **NRI Circle:** At NRI circle till now there is no need of traffic signal but this is developing area so we design the traffic signal over there for future aspect.
2. **7 number Junction:** On this location we analyze the traffic signal time and revised it to our calculated red, green and amber light. One suggestion is that there is a need of traffic police and camera. Because camera record the vehicle who does not follow the rule.
3. **New Gate:** At new gate we first calculate the traffic volume and analyze the signal time which was already exist after that compare it to our calculated signal time (red, green and amber) according to traffic volume. One suggestion is that we can replace the existing door to the sliding door so maximum vehicle can move at a particular time.
4. **OTS Circle:** On this location we analyze the traffic signal time and revised it to our calculated red, green and amber light. On this location we analyze the traffic signal time and revised it to our calculated red, green and amber light. On this location we

can change some geometric design of the road so the maximum vehicle can pass at a particular location

- On the right side of the Tonk Road there is garden which is not necessary we can remove or reduce the size of the garden. So the width of the road increase and vehicle easily move on this road without traffic jam. On the other hand there is jaldhara so we cannot change the road width or remove it.
- We can remove the bus stop of Bajaj Nagar because all 4 side bus stops are available which is not required. On the Side of WTP there is already bus stop available.

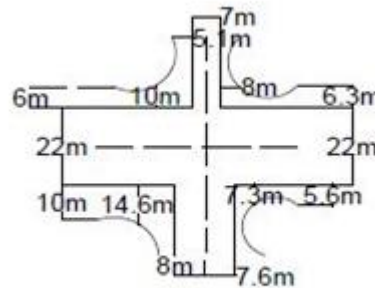


Figure 5: Auto Cad design of OTS Circle

6. References:-

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