GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

SIGNAL DESIGN FOR SUKHPURA CHOWK INTERSECTION ROHTAK

Bhupinder Malik, Harish Panghal, Pankaj Joon, Gaurav*

Deptt. of Civil Engineering, Ganga Technical Campus Bahadurgarh, Haryana, India
Deptt. of Civil Engineering, C. R. Govt Polytechnic Sanghi, Rohtak, Haryana, India

ABSTRACT

Transportation is a key feature for development of countries and societies because it is very imported in our day to day life and plays a vital role in the life. As the size of cities is increasing and the number of vehicles, many forms of traffic congestion, generally at intersections are found. In cities, traffic jam is a major problem. On National highways traffic is moved with a high speed, at intersection when local traffic is mixed with high speed traffic, jam is formed. This is the main reason for arising pollution, time consuming, accidents and improper traffic management at intersection. For reducing the effects, some solution is should be provided. That's why an analysis and volume count survey is carried out and the capacity of vehicle all around the existing intersection is calculated. Various techniques are used like traffic signal, traffic sign, redesigning of intersection, are proposed and their suitability is checked. This article tells about the study of traffic properties and improvement of the major intersection in Rohtak City. The above study is at Sukhpura Chowk Rotary Intersection. The result obtained from the calculations will be helpful in knowing the conditions and properties of the traffic volume along the intersection and will help the traffic administration and city planner in framing scientific and successful policies to prevent traffic problems in future.

Keywords- *City, Transport, Traffic, Signal, Rotary, Intersection*.

Introduction

Transport is an all operable industry. It penetrate into all phase of production and distribution of goods. In the production stage, transportation is required for carrying raw material and in the distribution stages; transportation is required from farm and factories to the marketing centre for distribution to the retailers and consumers. Transportation improvement has increased personal mobility, reduce travel time, permit greater freedom to select the people their work and in the carrying of goods. However the unprecedented growth of vehicles ownership especially the small cars and scooters in recent years, our cities are beset with serious traffic problems like congestion and causalities particularly at road intersection due to land constraints. A multidisciplinary approach is needed in understanding the situation and providing the solutions. To solve the problems of congestion at intersection, coordination of traffic regulation is required and intersectional area may be expanded or grade separations may be adopted. In order to study and evaluate the congestion at urban intersection, it is important to acquire factual knowledge of traffic characteristic and to carryout studies and analyse the situation for relieving congestion thereby increasing the capacity of intersection.

Rohtak is known as "Heart of Haryana" it lies in the centre of Haryana. Rohtak is a city in north-eastern Haryana, in northern India. The total population of Rohtak is 1058683(2011) and the sex ratio (F: M) is 868:1000.It has one of the highest number of vehicles per capita in Haryana. It is connected to cities like Delhi by road and rail. Rohtak is well connected to district like Gohana, Jhajjar, Riwari on NH 71 and Delhi, Bhiwani, Hissar on NH10. The Rohtak city is connected by road to seven major cities with three national highway (NH10 NH71 NH71-A) and two state highways (SH16 SH18) NH-10 from Delhi to Hissar & Pilani, NH-71 Panipat-Rohtak-Riwari. SH-16 Sanauli-Panipat-Rohtak-Bhiwani, SH-18 Rohtak-Kharkhoda-Delhi Border. The city is a major centre of education & sports in the state. The Maharishi Dayanand University , Post Graduate Institute(medical college), State Institute, Indian Institute Of Management , Rajiv Gandhi Sports Complex, Ch. Bansi Lal Cricket Stadium(Lahli). Rohtak Is Famous for Their clothes market known as "Shori Cloth Market". Quilla Road is an upmarket place near old walled city, where people come from all parts of the city and surrounding towns.

LITERATURE REVIEW

Traffic Signal Design

Traffic signals are manually, mechanically and electrically or electrically operated devices which by means of its indications, direct traffic to stop or to proceed at intersection. The indication shown by a signal face is an aspect which follows a sequence or red, red and amber together, green and amber. Thus signals are widely used in the assignment of right of way on intersections.

Advantages of Signals

The following are the various advantages of providing traffic signals,

1. They provide orderly movement of traffic and increase the traffic handling capacity of most of the intersections at grade.
2. They reduce certain types of accidents, notably the right angled collisions.
3. The quality of traffic flow is improved by forming compact platoons of vehicles, provided all the vehicles move at approximately the same speed.
4. Pedestrians can cross the roads safely at the signalized intersection.
5. The signals allow crossing of the heavy traffic flow with safety.
6. When the signal system is properly co-ordinate, there is a reasonable speed along the major road traffic.
7. Signals provide a chance to crossing traffic of minor road to cross the path of continuous flow of traffic stream at reasonable intervals of time.

Disadvantages of Signals

The following are the various disadvantages of providing traffic signals,

1. Failure of the signal due to electric power failure or any other defect may cause confusion.
2. The rear-end collision may increase.
3. Improper design and location of signals may lead to the violation of control system.

Terms Associated with Traffic Signals

The modern traffic signals allocate time in variety of ways from simplest to pre-timed mode to most complex multiphase actuated mode. The basic terminology of traffic signals is described as follows:

The following terms are commonly used to describe traffic signal operation:

Cycle **:** Complete sequence of signal indications.

Cycle length **:** Total time for the signal to complete one cycle given by symbol C (second).

Phase **:** part of the cycle allocated to any combination of traffic movements receiving the right of way simultaneously during one or more intervals.

Interval **:** Period of time during which all signals indications remain constant.

Green time **:** The time within a given phase during which the indications is shown is known as green time.

Lost time **:** The time during which, the intersection is not effectively used by any movement. These times occur during the portion of change in interval and at the beginning of each phase as the first few cars in standing queue experience start-up delays.

Effective green time: the time during which a given phase is effectively available for stable moving platoons of vehicles in the permitted movements. this is generally taken to be the green time plus the change interval minus the lost time for designated phase given by symbol g.

Green ratio: the ratio of the effective green time to the cycle length given by symbol g/c for phase 1.

Effective red: the time during which a given moments or set of movement is effectively not permitted. It is taken as cycle length minus the effective green time. It is given by symbol r1 (second).

METHODOLOGY

Several methods are available to estimate the optimum cycle length and green time for each phase. Some of these methods are listed below:

1. Trial Cycle Method.
2. Approximate Method.

3. Davidson Method.
4. Webster's Method.
5. I.R.C. Method.

Trial Cycle Method

The 15 mints traffic counts $n_1$and n_2 on road 1and 2 are noted during the design peak hour flow, some suitable trial cycle c1 seconds is assumed and the number of assumed cycle in the 15 mints or 15 x 60 seconds period is found to be $900/C_I$. Assuming an average cycle time headway calculated to clear the traffic during the trial cycle.

$G1 = \frac{2.5n_1c_1}{900}$

And

$G2 = \frac{2.5n_2c_2}{900}$

The amber periods A1 and A2 are either calculated or assumed suitable (3 to 4 seconds) in the cycle length, c1 calculated equal to (G1 +G2 + A1 + A2) seconds. If the calculated cycle length c1 works out to be approximately equal to the assumed cycle length c1, the cycle length is accepted as the design cycle. Otherwise, the trials are repeated till the trial cycle length work out approximately equal to the calculated value.

Approximate Method

The following design procedure is suggested for the simple design of two phase signal at a cross road along with pedestrian signals.

Based on the approach speeds of the vehicles the suitable clearance interval between green and red period i.e. clearance amber periods are selected. The amber periods may be taken as 2,3 and 4 seconds for low, medium and high approach speeds.

Based on pedestrian walking speed of 1.2m/ second the pedestrian clearance time is also calculated.
Minimum red time of traffic signal is taken as pedestrian clearance time for crossing plus initial interval for pedestrian to start crossing. The red is equal to the minimum green time plus amber time for the crossroad.
The minimum green time is calculated based on pedestrian criteria, equal to pedestrian clearance time for cross road interval when pedestrian may start to cross, minimum amber period for the crossroad.
When pedestrian signal is used, the initial interval is the "WALK" period; this should not be less than 7 seconds. Where no pedestrian signal is used, a minimum period of 5 seconds is used as initial interval.
The actual green time needed is then increased based on the ratio of approach volume for the heaviest traffic per hour per lane. The cycle length so obtained is adjusted for the next interval. The extra time is then distributed to green timings in proportion to the approaching volume of traffic.

The values so obtained are calculated on pedestrian basis as the controlled settings are per centof cycle. The timings so obtained are installed in the controller and the operations are then observed at the site during peak traffic hours. Corrections needed are carried out accordingly.

Webster's Method

This method is devised to estimate the optimum cycle length and affected green time for each approach. The field studies consist of:
The saturation flow "S" per unit on each approach of the intersection.
The normal flow "g" on each approach during the design hour.
The length of the cycle time under fixed time operation is dependent on the traffic conditions, where the intersection is heavily trafficked, and cycle time must be longer than when intersection is lightly trafficked. The cycle depends on the following factors:
Average delay to vehicles passing through the intersection.
Proportion of lost time to cycle time.

ISSN 2348 – 8034
Impact Factor- 4.022

For the traffic flow volume, there is an optimum cycle time which results in minimum delay to vehicles. It was found by Webster by differentiating the equation of overall delay at an intersection with respect to cycle time that the cycle time with minimum delay can be given by following equation.

$$\text{Co} = \frac{1.5\,L + 5}{1 - (Y1 + Y2 + \cdots Yn)}$$

$$\text{Co} = \frac{1.5\,L + 5}{1 - Y}$$

Where

C_0 = Optimum Cycle length
L = Total lost time per cycle in seconds
= Maximum ratios of flow to saturation flow per phase

Y = q / s

Where

q = Design flow
s= saturation flow

The figure shows that as soon as the green signal is given, the rate of discharge begins to pick up and some time is lost before the flow reaches maximum value. Similarly at the termination of Green phase, the flow tends to taper off, involving a further lost time.

The lost time for a phase is

l = k + a – g

Where

l = lost time for the phase
k= Green time for the phase
a= Amber time for the phase

g= effective green time =**b/s**

Where

b= Number of vehicles discharged on the average during a saturated phase.

Total lost Time, L = nl + R

Where

n=Number of phases in the cycle
R= all red time

Y-Value

The ratio of design flow to saturation flow for all approaches taking separately is known as y-value. There is normally more than one approach for a single phase. The approach with maximum Y-value should be considered in that phase. It should be noted that when cycle length is varied within range of 0.75 Co and 1.5 Co, the minimum delay is never exceeded by more than 10% to 20%. This factor is very useful in deducting a compromise cycle time for pre timed signals, when the traffic flow change considerably during the day.

Green Time

To minimize the overall delay to the traffic at the intersection, the rule for setting green time was derived from delay equation. It was found that ratios of effective green times should be equal to the ratio of the Y-values.

g1=Y1
----
g2=Y2

Where g1 and g2 are effective green times of phase 1 and 2 respectively.

The lost time in average signal cycle caused by starting delays and reduced flow during the amber period amounts to about 2 seconds as found by experiments. But, the lost time may range from 0 to 7 seconds. There exists a relation between inter-green period and lost time. Thus, if the inter-green period is "I" seconds and starting delays plus unused amber time are "I" Lost Time seconds of each combined green and amber period, then lost time corresponding to each change of phase is given by [(I-a)=I] seconds. Thus lost time "L" is **L = n (l – a) + nl**

Where

n= Number of phases

Saturation Flow

It is the flow which could be obtained if there was a continuous queue of vehicles and they were given a 100% green time. But actually, when the green time commences, vehicles take some time to start and accelerate to normal running speed. But after few seconds, the queue discharges at more or less constant rate, called saturation flow. It is generally expressed in vehicle per hour of green time, as the flow is less in the first few seconds of green phase. It becomes convenient to replace green and amber into effective green time throughout which the flow is assume no flow is taking place. So, capacity of intersection is directly proportional to effective green time.

Capacity = G_s/c vehicle/hr.

Where

g = G-L

g = Effective green time in a cycle

G = Effective green time a cycle

L = lost time in a cycle.

The width of approach rather than number of lanes has proved to be most significant for the capacity of typical approach. Available data indicate that fundamentally, with reasonable tolerance, intersection approach width. In determining the Y-Value, the saturation flow should be measured rather than estimated value. The method of measuring the saturation flow is described in R.R.L. publication. For designing new signal installation the following formula should be used.

S = 525 W P.C.U./ hr.

Where "s" is saturation flow and "w" is the width of approach road measured from kerb to inside od pedestrian refuge or central line whichever is nearer or to the inside of central reserve in case of dual carriageway. Above formula is valid for widths from 5.5 m to 18m. for lesser widths, the values may be obtained from the table

Table 2.3 Saturation Flow

Width W (m)	3	3.5	4	4.5	5	5.5
Saturation S (P.C.U./hr.)	1850	1890	1950	2250	2550	2900

When the approaches are in gradient, the saturation flow needs some adjustment. Approximately this can be done by decreasing the saturation flow35 for each 1% uphill gradient and increasing the saturation flow by 3% for each 1% uphill gradient and increasing the saturation flow by 3% for each 1% of downhill gradient.

$$S = \frac{1800}{[1+(\frac{1.52}{r})]}$$

P.C.U./ hr. for single file stream or 1600 P.C.U. /hr.

$$S = \frac{3000}{[1+(\frac{1.52}{r})]}$$

ISSN 2348 – 8034
Impact Factor- 4.022

P.C.U./hr. For double file stream.
Where
r = is the radius of curvature of the right turning stream through a right angle in meters.

IRC METHOD FOR SIGNAL DESIGN

a) The pedestrian green time required for the major and minor roads are calculated based on walking speed of 1.2 m /second and pedestrian reaction time of 5 seconds. These are the minimum green time required for the vehicular traffic on the minor and major roads respectively.
b) The green time required for the vehicular traffic on the major road is increased in proportion to the traffic on the two approach roads.
c) The cycle time is calculated after allowing amber time of 2 seconds.
d) The minimum green time required for clearing vehicles arriving during a cycle is determined for each lane of the approach road assuming that the first vehicles will take 6 seconds and the subsequent vehicles (PCU) of the queue will be cleared at a rate of 2 seconds each. The minimum green time required for the vehicular traffic on any of the approaches is limited to 16 seconds.
e) The optimum signal cycle time is calculated using Webster's formula. The saturation flow value may be assumed 1850,1890.1925,2250,2250 and 2990 PCU per hour for the approach road way widths (kerb it median or centre line) of 3.00,3.5,4.00,4.5,5.00,5.5 meters; for widths above 5.5 meters, the saturation flow may be assumed as 525 PCU per hour per meter width. The lost time is calculated from the amber time, inter-green time and the initial delay of 4 seconds for the first vehicle on each leg.
f) The signal cycle time and the phases may be revised keeping in view the green time required for clearing the vehicles and optimum cycle length determined in steps (d) and (e) above.

CONCEPT OF PASSENGER CAR UNIT AND TRAFFIC VOLUME

The Traffic on the road is composed of a number of types of vehicles, and its capacity is generally expressed in terms of a common Unit called the passenger car unit. Different vehicles have different characteristics and they offer different degrees of interference, to the moving traffic. Every aspect of them e.g. ranges of speed, wheel loads; turning radius etc. affects the design of the road and intersections, The interference of different types of vehicles with a wide range of speed in a traffic stream results in increased requirements of over-taking operation and reduction in average speed of vehicles. Therefore, it is necessary to evaluate the equivalent factors for various classes of vehicles under typical geometric and traffic conditions. Indian road congress has tentatively suggested the equivalent factors of passenger car units (PCU). The appropriate values of PCU are given by I.R.C for different types of vehicles under varying conditions are given in Table 2.

Class of Vehicle	Urban area	Rural area	Round about	Traffic signal	Level terrain	Rolling terrain	Mountain terrain
Car/Jeep	1.00	1.00	1.00	1.00	1.00	1.00	1.00
M. Cycle/Scooter	0.75	1.00	0.75	0.33	1.00	1.25	-
Medium toHeavy GoodVehicle	2.00	3.00	2.80	1.75	2.00	4.00	6.00
Busses/Heavy Trucks	3.00	3.00	2.80	2.25	3.00	6.00	8.00
Pedal cycle/Rickshaw	0.33	0.50	0.50	0.20	0.50	0.60	-

TABLE - 2.4 PCU FOR DIFFERENT CLASS OF VEHICLES

DESIGN OF SIGNAL TIMING

GENERAL

Design of signal scheme includes selection of types of signals, number of phases, amber period, cycle time and time allotted each phase and other specified features such as exclusive turning phase or pedestrian phase. Based on the field traffic studies data , the signal timings are calculated by Webster's Method as modified by IRC. This is a rational approach and it gives the optimum cycle time with minimum delay to the vehicles. Existing signal times were observed for all the legs on the intersection.

SUKHPURA CHOWK INTERSECTION

The four phases that exists at the intersection are:

Phase I – Bus Stand Side

Straight going towards Jind By-Pass Road and right turning towards Gohana Road Side.

Phase II – Rohtak City Side

Straight going towards Gohana Road Side and right turning towards Bus Stand Side.

Phase III – Gohana Road Side

Straight going towards Rohtak City Side and right turning towards Jind By-Pass Side.

Phase IV – Jind By-Pass Side

Straight going towards Bus Stand Side and right turning towards Rohtak City Side.

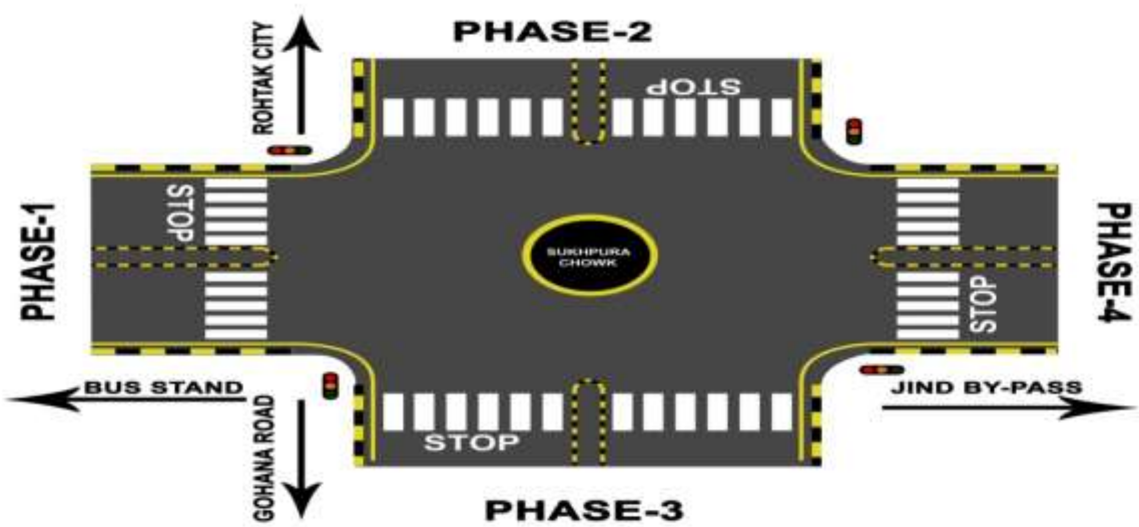

Figure 5.1 Sukhpura Chowk Intersection

CALCULATION OF SATURATION FLOW

Saturation Flow of Traffic from different roads in PCU\Hr. has been worked out taking into account the good site characteristics and as such saturation flow values have been taken as120% of standard value.

From Bus Stand Side:-

a. For Straight and left turning traffic
   Average width = 6.75m
   Saturation Flow S_1= 1.2 x 525 x W
   = 1.2 x 525 x 6.75
   = 4252.5 PCU\Hr.

b. Right Turning Traffic
   Saturation Flow S2 = $\frac{3000}{1+\frac{1.52}{r}} \times 1.2$ PCU\Hr. (For Double File Stream)
   (For IRC Recommendation r= 15)

= 3269 PCU\Hr.

1. From Rohtak City Side:-

a. For Straight and left turning traffic
Average width = 8.5 m
Saturation Flow S_1= 1.2 x 525 x W
= 1.2 x 525 x 8.5
= 5355 PCU\Hr.

b. Right Turning Traffic
Saturation Flow S2 = $\frac{3000}{1+\frac{1.52}{r}}$ **x 1.2** PCU\Hr. (For Double File Stream)
(For IRC Recommendation r= 15)
= 3269 PCU\Hr.

2. From Gohana Road Side:-

a. For Straight and left turning traffic
Average width = 7m
Saturation Flow S_1= 1.2 x 525 x W
= 1.2 x 525 x 7
= 4410 PCU\Hr.

b. Right Turning Traffic
Saturation Flow S2 = $\frac{3000}{1+\frac{1.52}{r}}$ **x 1.2** PCU\Hr. (For Double File Stream)
(For IRC Recommendation r= 15)
= 3269 PCU\Hr.

3. From Jind By-Pass Side:-

a. For Straight and left turning traffic
Average width = 7.3m
Saturation Flow S_1= 1.2 x 525 x W
= 1.2 x 525 x 7.3
= 4599 PCU\Hr.

b. Right Turning Traffic
Saturation Flow S2 = $\frac{3000}{1+\frac{1.52}{r}}$ **x 1.2** PCU\Hr. (For Double File Stream)
(For IRC Recommendation r= 15)
= 3269 PCU\Hr.

Calculation of Y value for intersection												
From	**Bus Stand Side**			**Rohtak City Side**			**Gohana Road Side**			**Jind By-Pass Side**		
To	**L**	**S**	**R**	**L**	**S**	**R**	**L**	**S**	**R**	**L**	**S**	**R**
Present Traffic Flow PCU/Hr.	361	335	268	252	347	873	215	256	164	493	276	943
Correction For Left Turn (25%)	90.25			63			53.75			123.3		

Phase 1 Total Flow "q1"	786.25		116									
Saturation Flow "S1"	4252.5		3269									
Y- Value Y1 = q1/s1	0.18		0.04									
Phase-II Total Flow "q2"				662		873						
Saturation Flow "S2"				5355		3269						
Y- Value Y2 = q2/s2				0.12		0.27						
Phase-III Total Flow "q3"							524.75		164			
Saturation Flow "S3"							4410		3269			
Y- Value Y3 = q3/s3							0.12		0.05			
Phase-IV Total Flow "q4"										892.25		943
Saturation Flow "S4"										4599		3269
Y- Value Y4 = q4/s4										0.19		0.29

TABLE 5.1CALCULATION OF Y VALUE FOR INTERSECTION

CALCULATION OF OPTIMUM CYCLE LENGTH:-

Based on the approach speed at the intersection and as per British Practice, the following assumptions can be made:
Inter green Period (I) = 4 Seconds
Amber Period (a) = 2 Seconds
Time Lost Due to Starting (l) = 3 Seconds per phaseDelays
Time Lost per cycle L is calculated below:

$L = \sum (I – a) + \sum l$
$= 4 (4\text{-}3) + 4 \times 2$
$= 12$ Seconds

It may be noted that :

1.) The effect of left turning traffic has been accounted by counting each left turner as equivalent to 1.25 straight ahead vehicles when it constitutes more than 10% of the total traffic in approach.
2.) The effect of right turning traffic (i.e. each right turner is equivalent to 1.75 straight ahead vehicles) has not been applied since it has been decided to provide a separate phase for the right turning traffic.

ISSN 2348 – 8034
Impact Factor- 4.022

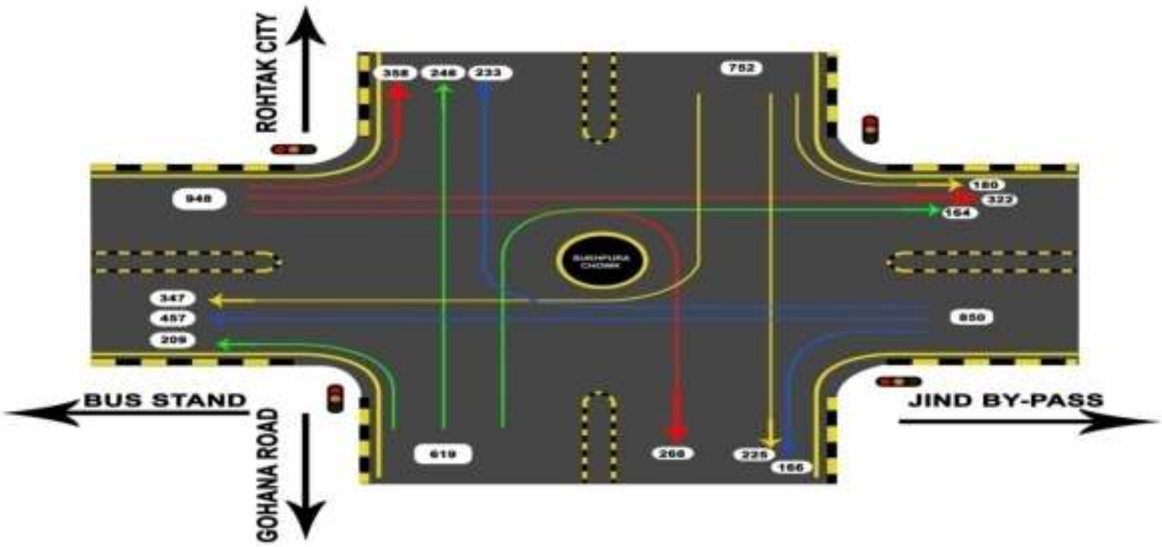

Figure 5.2 Traffic Flow& Traffic Volume Data

Considering a double file stream to cater for the expected high volume at the intersection in the near future Optimum Cycle Length Co is calculated below

$Co = \frac{1.5\,L+5}{1-Y1-Y2-Y3-Y4}$

$Co = \frac{1.5\,L+5}{1-Y1-Y2-Y3-Y4}$

$Co = \frac{1.5\,X\,16+5}{1-0.18-0.27-0.12-0.29}$

Co = 165 Seconds

Green Time Apportionment:-

Now we compute apportionment green time for each phase, it has been found that least delay occurs when the green time for each phase is proportional to its Y value.

The above rule gives

$g_n = \frac{Yn}{Y}\ (Co - L)$

Where Co is optimum cycle length

L is the total lost time per cycle

Effective Green Time = Co –L

For Phase I :-

$g_1 = \frac{Y4}{Y1+Y2+Y3+Y4}\ (Co - L)$

$g_1 = \frac{0.18}{0.18+0.27+0.12+0.29}\ (164 - 12)$

g1 = 32 Seconds

For Phase II :-

$g_2 = \frac{Y4}{Y1+Y2+Y3+Y4}\ (Co - L)$

$g_2 = \frac{0.27}{0.18+0.27+0.12+0.29}\ (164 - 12)$

g2 = 48 Seconds

For Phase III :-

$g_3 = \frac{Y4}{Y1+Y2+Y3+Y4}\ (Co - L)$

$g_3 = \frac{0.12}{0.18+0.27+0.12+0.29}\ (164 - 12)$

g3 = 22 Seconds

ISSN 2348 – 8034
Impact Factor- 4.022

For Phase IV :-

$g_4 = \frac{Y4}{Y1+Y2+Y3+Y4}(Co - L)$

$g_4 = \frac{0.29}{0.18+0.27+0.12+0.29}(164 - 12)$

g_4 = 51 Seconds

Taking Amber period as 3 Seconds after each green time

New Cycle Length = 32 + 3 + 48 + 3 + 22 + 3 + 51+3

= 165 Seconds

As per H.M.S.O. "Technical Paper No. 56" the cycle length is in between 0.75 Co to 1.5 Co. hence the delay will not be more than 10% to 20% above that given by optimum cycle.

Total Green Time including Red\Amber Time is :

$Gn = g_n + R_a$

G1 = 32 + 2 = 34 Seconds

G2 = 48 + 2 = 50 Seconds

G3 = 22 + 2 = 24 Seconds

G4 = 51 + 2 = 53 Seconds

Controllers setting for various phases Gn – a

For Phase I:- 34 – 3 = 31 Seconds

For Phase II:- 50 – 3 = 47 Seconds

For Phase II :- 53 – 3 = 50 Seconds

For Phase IV:- 22 – 3 = 19 Seconds

Traffic Signal Timing Chart				
Road Side	**Phase**	**Intersection**	**Signal Aspect**	**Signal Time (Seconds)**
Bus Stand Side	I	Sukhpura Chowk Intersection	Green	31
			Amber	3
			Red	131
Rohtak City Side	II		Green	47
			Amber	3
			Red	115
Gohana Road Side	III		Green	50
			Amber	3
			Red	112
Jind By-Pass Side	IV		Green	19
			Amber	3

			Red	143

TABLE 5.2TRAFFIC SIGNAL TIMING CHART

CONCLUSIONS

Intersections under study are the most critical, as it provides the access to number of institutes such as schools, Bus stand, Residential areas, Commercial complexes, Hospital, Milk plant, banquet halls. The traffic problems on these routes are increasing at very fast rate. With the help of field studies carried out on intersection, the important conclusions have been made.

1) In urban area, signals are found to be more efficient and suitable then the roundabouts due to space restriction. But in rural areas, roundabouts may be used with great efficiency.
2) Traffic is uneven on all the four legs approaching to the intersection. Bus stand side road carries higher traffic despite of lower lane width (13.50 m) and no divider is provide 0n this road as compared to the other crossing roads.
3) Bikes and Auto Rickshaws coming from Buss stand side road and turning towards Rohtak city side at unscheduled place during peak hours near the intersection leading to traffic congestion.
4) Traffic from Rohtak city side to bus stand side possesses slow speed leading to congestion.
5) Existing signal is not in working stage so, unable to handle peak traffic (during morning and evening hours) at the intersection.
6) As per traffic survey data, peak traffic volume at the intersections is 3074 PCU /hr. this high right turning traffic volume is the major cause of lockup at the intersection.
7) Alternate arrangement need to be explored for diverting through traffic on Gohana By-Pass Near new bus stand Rohtak as the intersection may not be able to handle growing traffic requirement efficiently in near future.
8) The prevalent road user's behaviour and field study, calls for immediate improvement of intersection by providing zebra crossing, traffic lane marking, railing and lighting.
9) Traffic signal is designed by Webster method on the basis of traffic volume study at the intersection and an optimum cycle length is calculated as 164 seconds (for four phase signal) and 180 seconds (for five phase signal). In 180 seconds cycle length, 16 seconds is kept for pedestrians. However as pedestrian traffic is not much, four phase signal with cycle length of 164 seconds may be adopted.
10) The peak traffic volume on this intersection found is to be 3074 PCU/Hr. which is very high as compared to the geometric standard of the road. Max. volume of traffic was observed during the morning and evening peak hours between 8:30 A.M to 9:30A.M and 5:00 P.M to 6:00 P.M, this is due to the same opening timing and closing timings of varies educational institutes and offices, and due to presence of bus stand there are frequent moments of busses which reduces the capacity of road to carry the traffic there for adding up to the problems. This intersection has also heavily trafficked due to the presence of resident colony and school nearby.
11) The projected traffic for the next five years comes out to be 9095 PCU/Hr. which is very high compared to the geometric standard of the intersection.
12) Level of the services of the approaches to the inter section can be assessed from the V/C ratio as the ratios are 0.77 for major road and 0.94 for the minor road, the LOS found 0.83 which means value lies between C & D
13) The signal timing of the intersection have been revised using IRC recommendation. Optimum cycle length for an isolated fixed time signals, for the present traffic volume is calculated as 165 seconds. whereas the existing cycle length is 95 seconds.
14) With the recent construction/shifting of the bus stand, the problem of congestion increased to manifold, this route service the one of the common route for the long route commuters, as the route is also known as Sukhpura Chowk.
15) The movements of the vehicles along the road is also affected due to the illegal parking and use of wrong side by the residents/commuters, thus causes inconvenience to the vehicles and there might to be chances of accidents.

16) Due to the presence of wine shop, gym, and banquet hall near the intersection, there is no facility for the parking this stretch is the most accident-prone-zone.
17) Hospital and residential colony nearby the intersection is also causes heavily trafficked.
18) Due to the illegal parking in front of the shopkeeper the width of the is further reduced thus causing congestion on the road and also there is little enforcement of laws in this regard.

REFERENCES

[1] Bindra , S.P. "A Course in Highway Engg. (Dhanpat Rai & Sons __ 1986)
[2] Datta Tapan K. "Advanced Traffic Signal Systems".
[3] H.M.S.O. "Research on Road Traffic Road Research Laboratory (London 1965)
[4] H.M.S.O. "Road in Urban Areas" London 1966
[5] H.M.S.O. "Technical Paper 56 (London)"
[6] H.M.S.O. "Urban Traffic Engg. Techniques Advisory Memorandum (London 1965)
[7] Highway Research Board "highway Capacity Manual Special Report No. 87"
[8] Highway Research Board "Traffic Control Devices" Bulletin No. 170
[9] Indian Road Congress "IRC 65-1976 Recommended Practice for traffic rotaries "New Delhi"
[10] Indian Road Congress "IRC 93- 1985 guidelines on installation of road Traffic Signal"
[11] Institute of Town planning, India "Journal 6-4, 61-67, October - December 2009"
[12] Institute of Transportation Engineers "Transportation and Traffic Engg. Handbook (U.S.A. 1976)"
[13] Institute of Urban Transport, India "Code of Practice Part - II"
[14] Kadiyali, L.R "Traffic Engg. and Transportation Planning "Khanna Publishers 1983.
[15] Khanna, S.K Justo C.E.G. "Highway Engg., (Nem Chand & Bros. Roorkee 1987)"