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ANALYSIS AND DEVELOPMENT OF ROTARY INTERSECTION

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Abstract: -India is the fifth largest automobile manufacture in the world. The development of infrastructure and transport sector has subsequently been receiving a much-needed boost. A Heterogeneous traffic at rotary intersection consists of vehicle that has different speeds, sizes, operating characteristics and vehicles spacing. The Indian traffic is heterogeneous traffic. Homogeneous design method do not fit the heterogeneous situation, specially is non-lane-based roadways that populates the developing world. This paper reviews the status of heterogeneous mixes worldwide, and what factors need to be considered in such mixes at rotary intersection and compare the relationship of flow and density with fundamental diagrams. The issues of safety, modeling, and non-motorized transporter considered, and solutions for these are discussed. These are important because the need for an understanding of heterogeneous mixes will grow in the future due to their presence in developing world mega cities and growth in the developed world.

Keywords:- Rotary intersection, traffic stream parameters, Flow-density relation

I. INTRODUCTION

Rotary intersections or round about are special form of at-grade intersections laid out for the movement of traffic in one direction around a central traffic island. Essentially all the major conflicts at an intersection namely the collision between through and right-turn movements are converted into milder conflicts namely merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction in orderly fashion. They then weave out of the rotary to the desired direction.

1.1 Design elements

The design elements include design speed, radius at entry, exit and the central island, weaving length and width, entry and exit widths. In addition the capacity of the rotary can also be determined by using some empirical formula. A typical rotary and the important design elements are shown in figure.

1.2 Design speed

All the vehicles are required to reduce their speed at a rotary. Therefore, the design speed of a rotary will be much lower than the roads leading to it. Although it is possible to design roundabout without much speed reduction, the geometry may lead to very large size incurring huge cost of construction. The normal practice is to keep the design speed as 30 and 40 kmph for urban and rural areas respectively.

Objective:-

The main objectives of this research work are to determine the influence of the following.

- To study macroscopic traffic parameters (delay, flow, speed, and density)
- To find the behavior of traffic flow at intersection.
- To establish new model for typical Indian rotary intersection.
- To avoid the accidents and collision at rotary intersection.

To find out the causes and solution for accidents at rotary intersection of typical Indian highways.

II. DATA COLLECTION

Traffic data was collected on Nagpur roadways section i.e. medical square .The data was collected by considering the flow near the rotary intersection, by using digital video camera. The video camera was kept on

the top of the building from where entire view of rotary intersection can be observed. A 30m length was marked on roadways section to locate the distance travelled and to record time taken by vehicle to travel 30m distance.

Figure1. 30m marking on road

Then the data was collected on every seven days from morning 8am to evening 6pm.This covered peak flow and off peak flow condition. The road section was access controlled. The data contained in the video clips was analyzed in the VLC media player using frame by frame analysis. The time required by each vehicle to cover the distance of 30m was recorded from the video clip and the number of vehicles of each entity type crossing a particular section in 5 minute was recorded. This procedure was repeated for each route.

General inspection of data showed presence of heterogeneous vehicle classification on road shown in TABLE1.

Table 1. Classification of vehicles available on road.

SR.NO.	TYPES OF VEHICLES
1.	Heavy vehicle
2.	Big car
3.	Small car
4.	Three wheelers
5.	Two wheelers

Here we study six route of rotary intersection:-
Route1:- From Medical square to Ajani square.
Route2:- From Medical square to Ghat road.
Route3:- From Medical square to Baidnath chawk.
Route4:- From Medical square to Uthkhana road.
Route5:- From Medical square to Krida chawk
Route6:- From Medical to Tukdoji Square.
Out of which we are showing here data of only Route No. -1

2.1 Density calculation :-

From the observed data of speed and flow above, density is calculated by using continuity equation (Gerlough and Huber 1975), as follows:

$$K=q/u$$

Where, K = traffic density in lanes in vehicles/km.

Q = traffic flow across the lane in vehicles/hr.
u = weighted avg. speed in km/hr.

Date	Time	Time Interval (min.)	Flow (q) (veh/5min)	Flow (q) (veh/hr)	Speed(v) (kmph)	Density (k) (veh/km/ln)
4-03-2016 (Route 1)	Morning-8-10 am	0-5	180	2160	33	65
		6-10	143	1716	31.2	55
Away from intersection		11-15	120	1440	32.6	44
		16-20	121	1452	31.6	46
	Afternoon - 12-2pm	0-5	150	1800	34.2	53
		6-10	162	1944	33.7	58
		11-15	161	1932	32.1	60
		16-20	174	2088	34.8	60
	Evening-4pm-6pm	0-5	121	1452	31.4	46
		6-10	175	2100	31.8	66
		11-15	154	1848	32.5	57
		16-20	166	1992	31.1	64

III. OBSERVATION TABLE

The observed and calculated data was collected in the following format of speed, flow and density.

For Route-1

Table .2. Calculation of Speed and density (Towards Intersection)

Table3. Calculation of Speed and density (Away from intersection)

Date	Time	Time Interval(min.)	Flow (q) (veh/5min)	Flow (q) (veh/hr)	Speed(v) (kmph)	Density (k) (veh/km/ln)
4-03-2016 (Route 1)	Morning-8-10 am	0-5	137	1644	32.1	51
		6-10	135	1620	33.5	48
Towards Intersection		11-15	112	1344	34.1	39
		16-20	120	1440	33.1	44
	Afternoon-12-2pm	0-5	135	1620	34.5	47
		6-10	187	2244	31.4	71
		11-15	174	2088	31.9	65
		16-20	187	2244	32.5	69
	Evening-4pm-6pm	0-5	135	1620	33.2	49
		6-10	145	1740	34.2	51
		11-15	128	1536	33.7	46
		16-20	154	1848	34.6	53

IV. RESULT & DISCUSSION

The speed observations are plotted against flow as shown in figure. The Greens held Model of speed-flow depict congested as well as uncongested region. Data points in congested region are observed when the flow reaches to the maximum value and vehicles are still being added to the traffic stream. In congested region gradual congestion takes place. It is observed in these studies that the data points in congestion region do not exist. This is due to lesser no. of vehicles utilizing facility. Hence the data points on congested or infeasible region are not observed. Flow-density relationship which is the basic nature of traffics shown in figure. This value does not match with fundamental diagram of traffic flow i. e. value does not reaches up to the am density. The reason is the modeled value is not calibrated for present situation. And we get new regression equation for heterogeneous traffic. Also on the rotary intersection, if we install the signal and time should be adjusted in such a way that two opposite route traffic are free to move at a particular designed time., then we can reduce the congestion and avoid the collision in the queue. The following graphs are showing the relationship between flow and density.

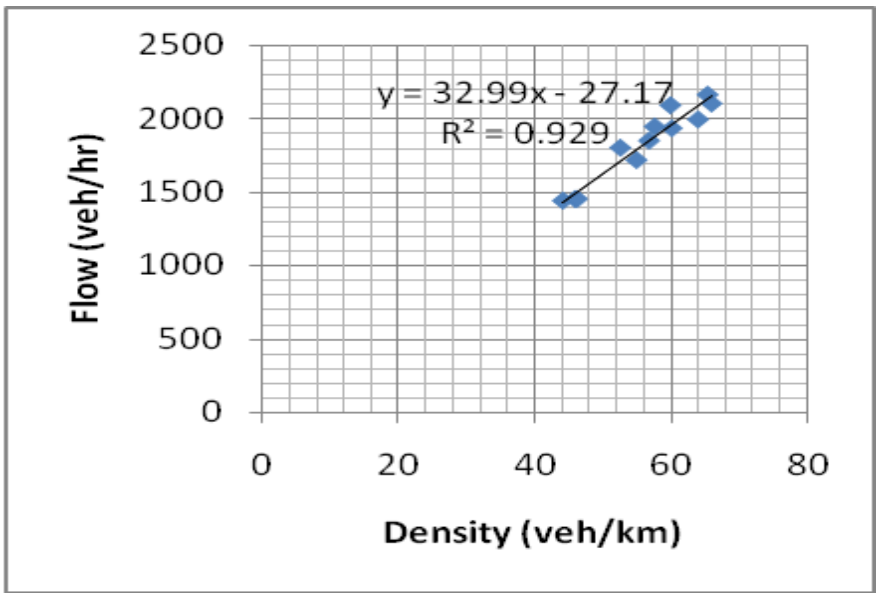

Figure 2. – Flow-density Curve(Towards Intersection)

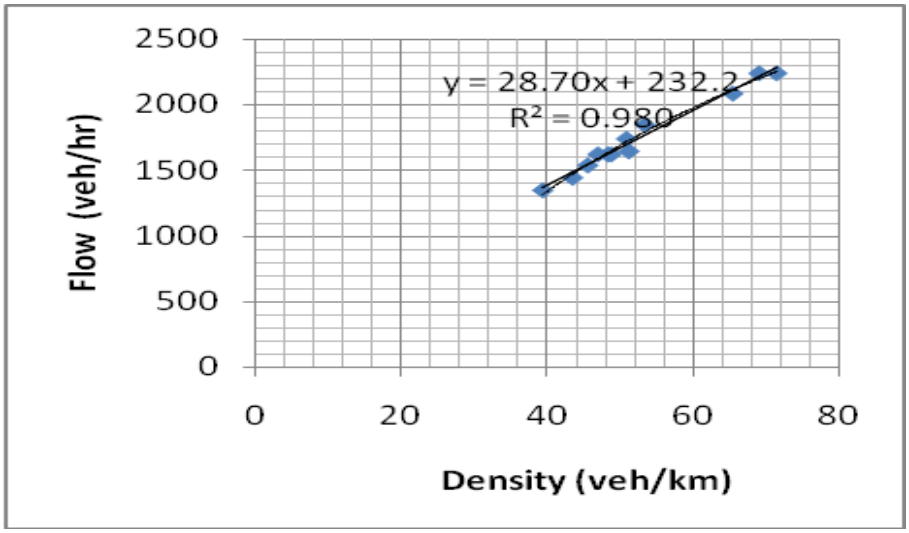

Figure 3. – Flow-density Curve (Away from Intersection)

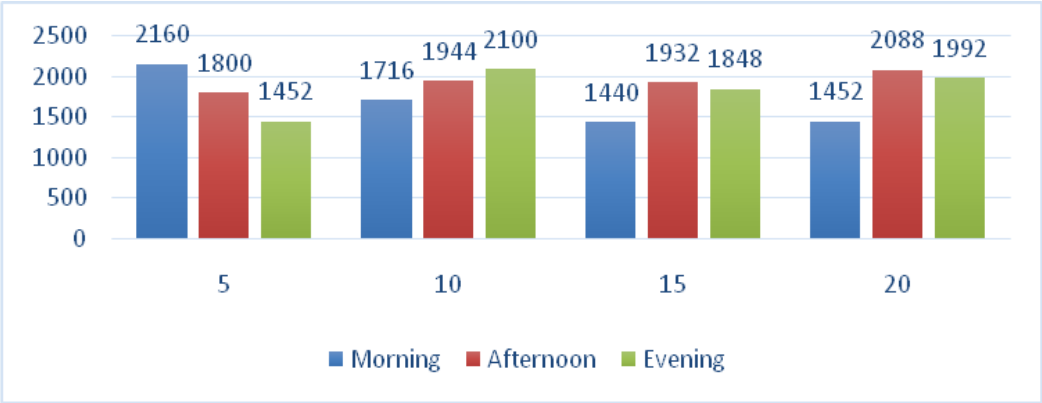

Figure 4. Comparison of flow with respect to time

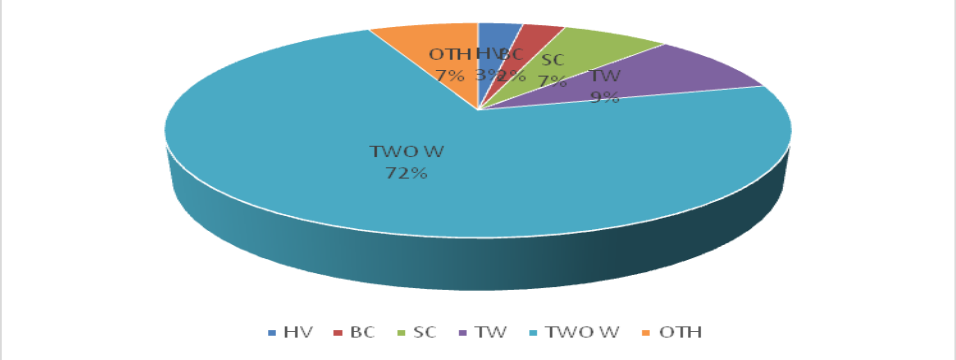

Figure 5. Proportion of vehicles

V. CONCLUSION

From the survey we find out that our Indian traffic is Heterogeneous traffic. According to our complete analysis we found the traffic stream parameters. We get standard relationship between traffic stream parameters. It is concluded that existing equation of homogeneous traffic stream are not suitable for the Heterogeneous traffic of Indian highways. Thus we need to create new equation for this Heterogeneous traffic of Indian scenario and we get two linear regression equations. Also after all the calculation we had conclude that the rotary intersection i.e. (medical square, Nagpur) should be signalized at a particular time to control traffic volume which is increasing day by day.

REFERENCES

[1] Fazio, J., and Tiwari, G. (1995). Nonmotorized & Motorized traffic accidents and conflicts on Delhi streets. Transportation Research Record.1487, *Transportation Research Board, Washi2013ngton,* D.C., 68–74.

[2] Gerlough, D. L., and Huber, M. J. (1975). Traffic flow theory: A monograph. Transportation Research Board, National *Research Council, Washington, D.C*

[3] Krishna Rao K. V. (may 8,2007), Introduction to traffic Engineering Chapter 33, Traffic Stream model, NPTEL

[4] Lindsey, C.R.; Verhoef, E.T. (1999). Congestion Modeling, Tinbergen Institute Discussion Papers 99-091/3, Tinbergen Institute.

[5] Maria de Lurdes Simões et al (1943), Modeling and Simulation of Traffic Movements at Semiactuated Signalized Intersections. 10.1061/(*ASCE*)TE.-5436.0000124

[6] Singh, R. (1999). Improved Speed-Flow Relationships: Application to Transportation Planning Models. *Boston, Massachusetts.*

[7] ThamizhArasan V. and Vedagiri P. (December 2009) Stimulating Heterogeneous Traffic Flow on Road With or Without Traffic Lanes, *Journal of Infrastructure Systems, Vol.15, No. 4.305.*

[8] Tohti G. et al (2013), Traffic Flow Modeling and Simulation of Signalized Intersections. *National Natural Science Foundation of China (81160458) and (11072209).*

[9] Transportation Research Board 2001. Highway Capacity Manual 2000. 500 Fifth St. NW, *Washington,* D.C.1776/2001: 1-9.

[10] Wardrop, J. G. (1952). Some theoretical aspects of road traffic research. Proc., Institution of Civil Engineers, Part II, Vol. I, 325– 362.

[11] Waseem Akram (10 august, 2010), Greensheild's And Greenberg's Model, Matric No. 092-90-4968