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MODELLING OF ROUNDABOUT AT SELECTED FOUR LEGGED INTERSECTION

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ABSTRACT

To categorise the volume of vehicle, determine the speed of different groups of vehicle and determine the queue length. Turning Movement Count (TMC) was determined by manual counting method, Speed analysis was carried out using Direct-Timing procedure, Satish Chandra method was adopted to determine PCU. Modelling of roundabout and traffic simulation was carried out to determine the queue length and delay time at selected intersection using AutoDesk Infraworks Software and its capacity is calculated using IRC 65:1976 codes.

Keywords: *Capacity, Infraworks, Intersection, Roundabout, Speed.*

1. INTRODUCTION

Transportation by roads are more preferred because of its flexibility of service from origin to destination. Passenger and pedestrian will always look for their safety and saving time. Occurrences of accidents has more possibilities at intersection due to high number of conflict points, generally to control the speed, humps are provided at intersection humps may be provided at all the directions or direction which have a major role in accidents, if traffic is still not under control signals are provided, if there is more queue length and delay time then roundabout is provided, it may be with signal or without signal depends on the traffic.

We are suppose to analyse the present situation, carry out different survey to determine the present traffic volume, peak time of traffic flow, model the roundabout and determine its capacity.

2. LIRERATURE REVIEW

A. Pratelli(2006), were studied on "**Design of modern roundabouts in urban traffic systems**" This paper was about paper modern roundabouts design and practice, according to which Modern roundabouts can have significant impacts and benefits in terms of circulation safety, delays and capacity Modern roundabouts, also called second-generation roundabouts, are based on quite different design criteria from those of traffic circles, or

first generation roundabouts, built in the first half of last century. The first generation roundabouts gave priority to traffic flows entering from branches and were designed considering the weaving movements as basic goal. This way, the circles become very large, with long distances between successive branches and with relatively low speeds and circulating flows. On the contrary, modern roundabouts gave priority-to-circle and are designed for lowering speeds, The capacity by using French formulae developed in 80's and main features of roundabout, were the result shown conversion of roundabout reduced delay time by 83%in morning peak and 76% in afternoon peak.

Average accident risk are reduced by 30% than conventional intersection without traffic signals, a study conducted in the year 1998in France analysed the safety record about 552 roundabout with an average daily traffic of about 12500 vehicle, 90% of roundabout had no injury accidents at all. According to this paper public opinion was not to convert the conventional intersection to roundabout even after its predominant advantages but after the implementation and people using roundabout they accepted roundabouts over conventional intersection. Based on the worldwide experience modern roundabout have many advantages like enhanced capacity, reduced queue length and delay time, reduced risk of accidents and construction and maintenance cost are low but effective success of roundabouts relies heavily on carefully following the design guidelines and thorough an analysis of the likely operations characteristics.

3. METHODOLOGY

3.1) PRELIMINARY SURVEY

The intersection which was selected for the study was Intersection at devegowda circle, which is a controlled intersection with four legs, due its long queue length and delay time. Initially road inventory was carried out and present condition of the road was understood, the existing condition of the project corridor is shown in the Fig 1 and Fig 2

Fig 1: Existing Project Corridor towards Girinagar Fig 2: Existing Project Corridor towards Nayandanahalli

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3.2) TURNING MOVEMENT COUNT

Turning movement count was determined by manual counting method in which the number of vehicles moving from one leg of intersection to another are determined and categorised based on type of vehicle at an interval of 15min to a total of 18 hours, results of TMC survey is shown in Fig 5

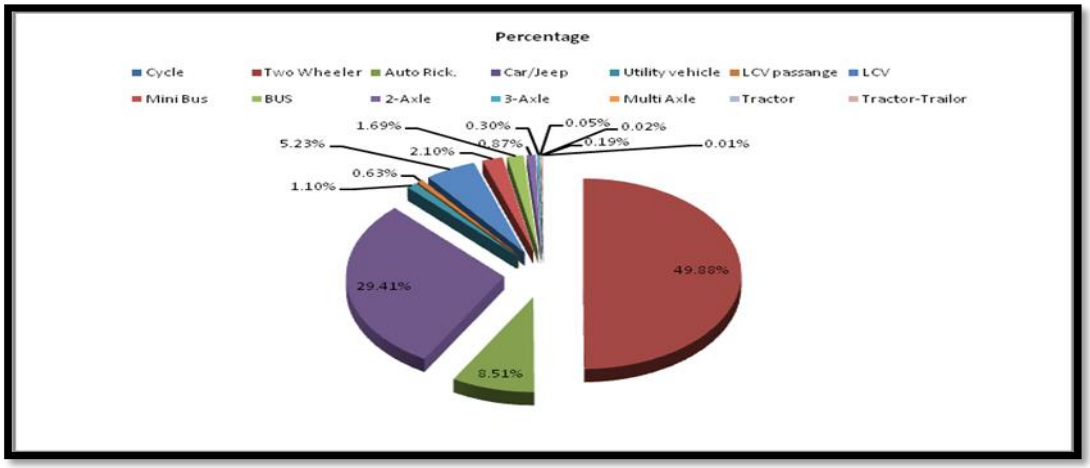

Fig 3 : Traffic volume composition at Devegowda Intersection

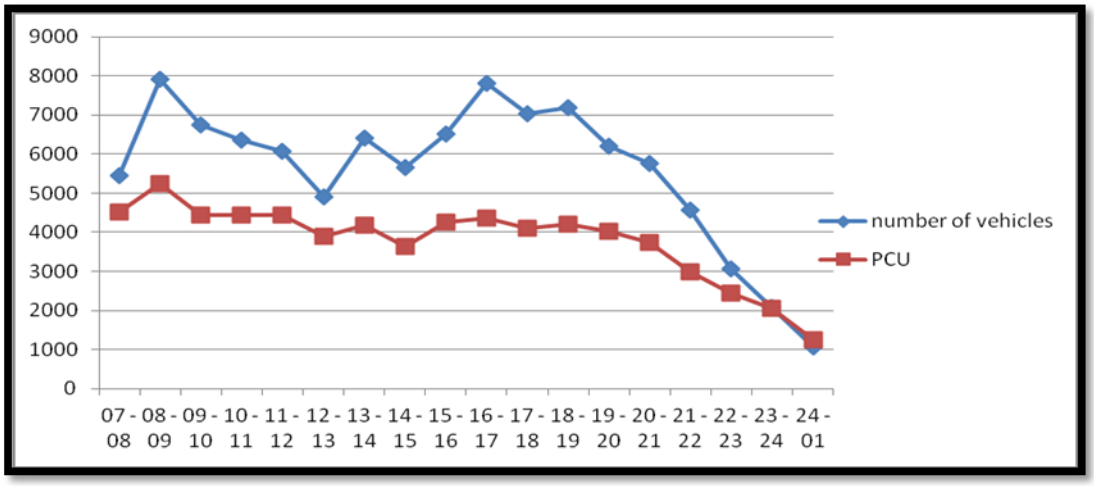

Fig 4: Hourly Variation of traffic at Devegowda Intersection

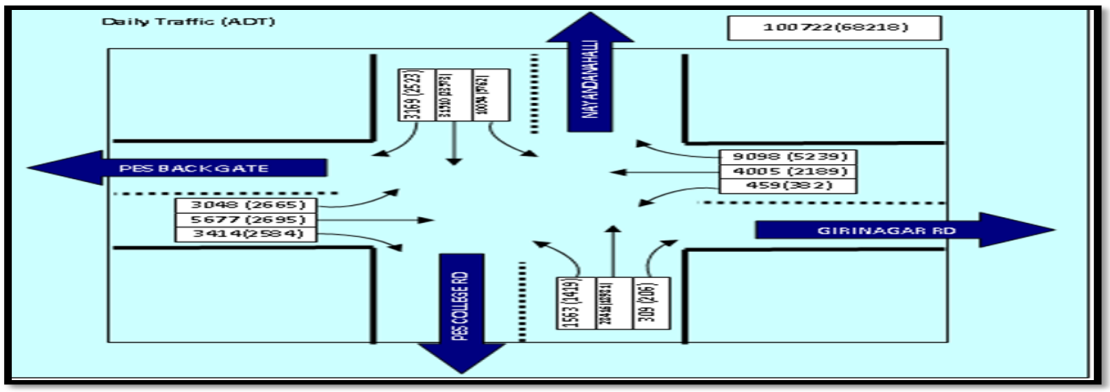

Fig 5: Average Daily Traffic at Devegowda Intersection

3.3) SPEED ANALYSIS

Speed analysis was carried out by Direct-Timing procedure was adopted for the calculation of speed studies at all the stretches where initially tow points was marked at a distance of 50m on the road surface. Now with the help of road stopwatch the time taken by the corresponding vehicle to pass through these points was noted. Now finally we obtain the speed and time were obtained with the help of which speed was calculated.

Speed of a vehicle = (Fixed distance)/(Total time taken)

The PCU depends on the mean speed and area of the vehicle, so speed of various categories of all class of vehicle is calculated by the help of stop watch and mean speed is calculated and maximum, minimum and design speed is determined

SPEED ANALYSIS (2)

From : Nayandanahalli To : Junction

	Time (sec)											Velocity (Km/hr)										
	2 Wheeler	Autos	Cars	Utility Vehicle	LCV Goods	Mini Bus	Bus	2 Axle	3 Axle	Multi Axle	Tractor	2 Wheeler	Autos	Cars	Utility Vehicle	LCV Goods	Mini Bus	Bus	2 Axle	3 Axle	Multi Axle	Tractor
	6.6	7	4	7	11.4	5.6	10.3	7.7	7.5	13.5	8	27.27	25.71	45.00	25.71	15.79	32.14	17.48	23.38	24.00	13.33	22.50
	7	6.5	5	8.4	6.4	7.5	6.3	7.4	20.8	10.8	10	25.71	27.69	36.00	21.43	28.13	24.00	28.57	24.32	8.65	16.67	18
	5.6	6.4	4.7	6.3	8.2	6	6	6.1				32.14	28.13	38.30	28.57	21.95	30.00	30.00	29.51			
	7.1	6.9	6	8	7.5		7.5	7.3				25.35	26.09	30.00	22.50	24.00		24.00	24.66			
	7.1	7.2	5.8	6.6	10.3		5.6	6.8				25.35	25.00	31.03	27.27	17.48		32.14	26.47			
	5.1	7.5	5.1		9.6		7	8.1				35.29	24.00	35.29		18.75		25.71	22.22			
	5.2	6.5	5.6		9.3		10.8	9				34.62	27.69	32.14		19.35		16.67	20.00			
	6.8	8.7	4.6		8.9		6.5	6.5				26.47	20.69	39.13		20.22		27.69	27.69			
	8.7	6.9	8.6				6.1	10.4				20.69	26.09	20.93				29.51	17.31			
	4.7	10.2	7.2					10.6				38.30	17.65	25.00					16.98			
Average	6.39	7.38	5.66	7.26	8.95	6.37	7.34	7.99	14.15	12.15		29.12	24.87	33.28	25.10	20.71	28.71	25.75	23.25	16.33	15.00	20.25

Fig 6: Speed Analysis Data

4. MODELLING OF ROUNDABOUT USING AUTODESK INFRAWORK SOFTWARE

Modelling of roundabout is done by using autodesk infrawork software and the result of the modelling is shown in the models below. Traffic simulation is also performed to measure the queue length and delay time, the existing intersection is shown in Fig 7 and modelled roundabout intersection using autodesk infrawork software is as shown in Fig 8 and Fig 9 .

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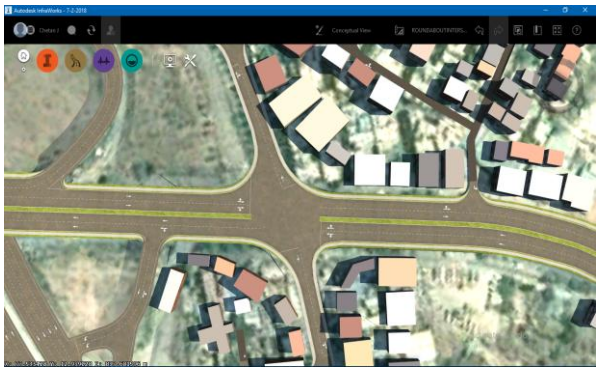

Fig 7: Existing Intersection

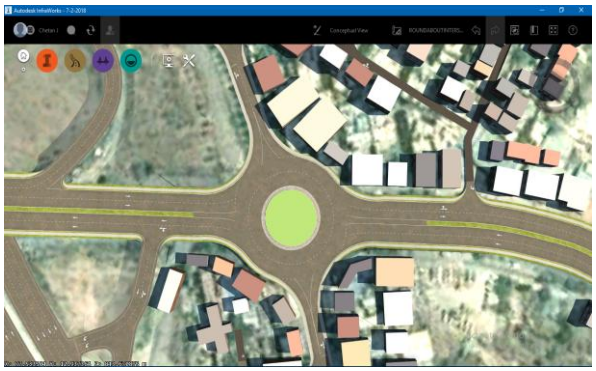

Fig 8: Roundabout Intersection

Fig 9: Traffic simulation using Infarwork

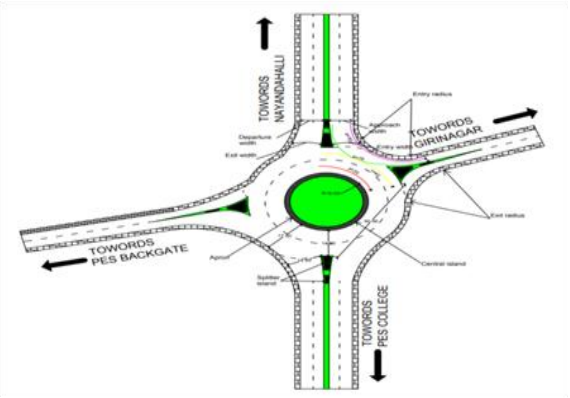

Fig 10: AutoCadd Plan Of Roundabout

5. CALCULATION OF ROUNDABOUT CAPACITY USING IRC 65:1976

The capacity of roundabout is calculated as per IRC 65:1976 and the results is shown below

$$Qp = \frac{280w\left(1+\frac{e}{w}\right)\left(1-\frac{p}{3}\right)}{1+\frac{w}{l}} \quad \text{..... (1)}$$

Where,

Qp = Practical capacity of the weaving section of the rotary in passenger car unit (PCU) per hour.

w = width of the weaving section in meters (within the range of 6-18m)

e = average entry eidth in meters (i.e., average of e1 and e2) $\frac{e}{w}$ be in range of 0.4 to 1.

l = length in meters of the weaving section between the ends of channelizing islands (w/l to be within the range 0.12 and 0.4)

p = proportion of weaving traffic i.e., ratio of sum of crossing streams to the total traffic on the weaving section, p = $\frac{b+c}{a+b+c+d}$, p ranges from 0.4 to 1.

$$Qp = \frac{280*17.5*(1+\frac{14.5}{17.5})*(1-\frac{0.59}{3})}{1+\frac{17.5}{50}} = \textbf{5332 PCU/Hr}$$

6. RESULT AND DISCUSSIONS

Queue length and Delay time using traffic simulation in Infrawok Software as shown in Table 1

TABLE 1: Computed Analysis of Queue Length and Delay Time

	Normal Intersection		Roundabout Intersection	
Route	Queue length (Before in m)	Delay time (Before in sec)	Queue length (After in m)	Delay time (After in sec)
Towards PES College	166	117	15	9
Towards Nayandanahalli	231	234	40	15
Towards Girinagar	73.4	223	54.8	53
Towards Back Gate	114.9	405	41.7	12

5. CONCLUSION

By comparing the results obtained by the model, before and after implementation of roundabout it is found that

- Queue length and delay time are considerably reduced after the implementation of roundabout.
- Conflict points at present intersection is 32 which will be reduced to 8 in roundabout which reduces accident rates considerably.
- Capacity of roundabout is calculated as per IRC 65:1976 to be 5332 PCU/Hr which is more than peak hour traffic 5253 PCU/Hr, roundabout can be successfully implemented.

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