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CAPACITY AND PERFORMANCE ANALYSIS ON ROAD ROUNDABOUT WITH TRAFFIC SIGNALS IN URBAN AREA

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ABSTRACT

The purpose of this study is to analyze the capacity and performance of signalized roundabout to find out possible effective and cheaper way to resolve the traffic congestion problem in short term or interim basis for urban Indian context. This is done by determining the capacity, Level of Service (LOS), queue length and delay of a multilane roundabout with the application of several methodologies. It is quite essential to calibrate such methods to meet regional needs. The signalized roundabouts describe new model for capacity estimation of derived under heavy demand conditions at large roundabout. Methods for capacity estimation models, FHWA, IRC & SIDRA shown that selected roundabout is under saturation condition and level of service (LOS) is found out to be satisfactory.

Keywords: Signalized urban roads, capacity analysis, level of service (LOS), delay, queue & gap acceptance method.

I. INTRODUCTION

The developing road network and hike in traffic has increased the complexity of traffic behaviour. The models developed to analyze the traffic behaviour take homogeneous nature of traffic, while the traffic conditions here are highly heterogeneous. Very little study has been made in Indian context regarding this issue. The intersection is a place with numerous conflict points and needs a higher safety concern and proper design. The roundabouts are the emerging type of intersection in India. The code referred to information is dated back to 1976. There is a need of lot improvisation in specific code to give proper way to calibrate the capacity of roundabouts for traffic behaviour in India. Robust equations to find the operational performance measures of roundabout are not provided in the code are needed to be analysed. To estimate the capacity and corresponding degree of saturation using several calibrated method to check the operational efficiency of the signalized roundabout. To compare the output given by different models using the field data.

The title of Tribune chowk is taken from *tribune* is an Indian English-language daily newspaper. There is two marg namely:

1. Dakshin Marg nearby cities Zirakpur, Panchkula and Chandigarh.
2. Purv Marg, Industrial Area Phase I, Chandigarh, Chandigarh is a Locality in the city of Panchkula in Haryana State, India. It is belongs to Ambala Division.

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II. LITERATURE REVIEW

Since the introduction of the modern roundabout in many different types of models have been developed for determining the roundabout capacity and level of service. This chapter addresses several different approaches used to determine roundabout performance. The literature review will go through the different theories upon which these models are based, and the various equations that use a series of variables and parameters for estimating capacity and delay.

Mereszczak et al. (2006) did a detailed study on the effects of exiting traffic and width of Splitter Island on the capacity of roundabouts in United States. The studies showed that the capacity determined considering the effect of exiting traffic gives much more improved prediction of the actual capacity of the roundabouts over the estimates without considering it.

Bie and Lo (2006) estimated the entry capacity of each lane using the lane utilization analysis for multi-lane roundabouts. The reserve capacity was then used as a measure to assess the overall roundabout performance. This showed the sensitivity of driver's lane choices on the overall capacity of traffic roundabouts.

Wang and Chen (2007) studied the differences on capacity and delay performance of two lane streets intersections between two-way stop-controlled (TWSC) types, all-way stop controlled (AWSC) types and roundabouts under different flow patterns based on mathematic models. The TWSC intersection has some advantages as low delay of minor street are higher and it also shows inefficient under balanced flow pattern. The AWSC intersection shows good performance in the case of unbalanced flow patterns and high left-turn percentage, but it has a low capacity and bad performance of anti-disturbance.

Zhaowei and Yuzhou (2008) analyzed the existing capacity models and proposed an outlook on roundabout capacity and focused on the problem research principles and methods such as empirical regression model, gap acceptance model and model based on simulation software. Determining the interaction mechanism among each traffic flow and considering the significant impact factors, the capacity model is established on the whole.

Bared and Afshar (2009) planned the capacity models for two lane and three-lane roundabouts by separate entry-lane and separate circulatory-lane traffic volumes. VISSIM micro simulation software was used to compare with the new NCHRP models as well as SIDRA and Tanner-Wu models.

Grenard and Shah (2011) presented a streamlined process to develop capacity models for communities with congested roundabouts. The process consists of video data collection, data processing and verification, and model development.

III. STUDY AREA

An important urban signalized road intersection of Tribune chowk, Chandigarh is a city and a union territory of India that serves as the capital of the Indian states of Haryana and Punjab, India is picked out for this study.The map of the considered roundabout is as shown in the Figure 3.1

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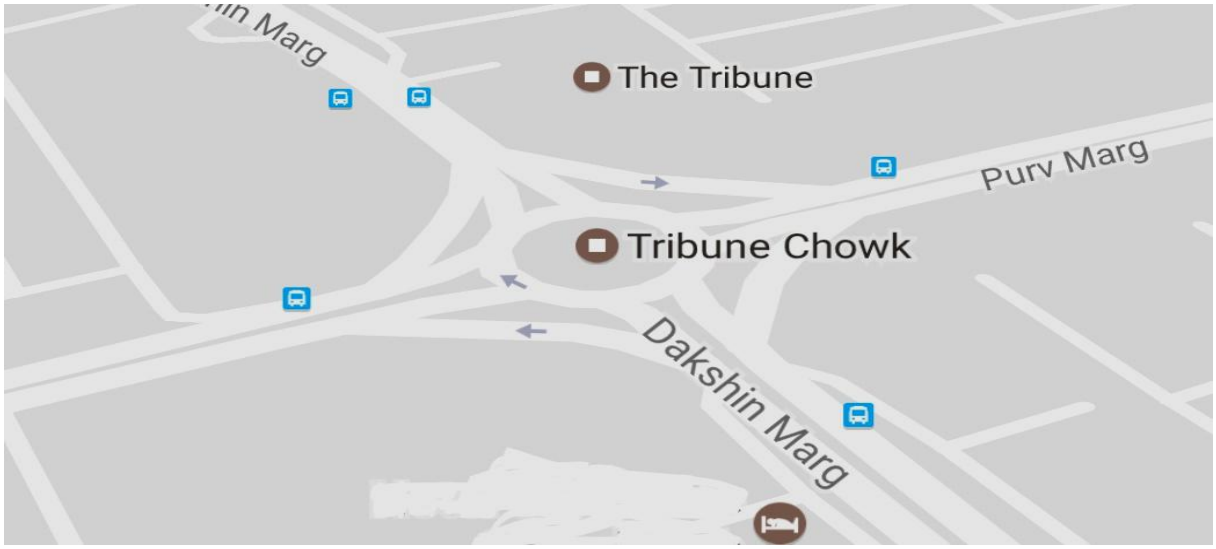

Fig.1 Map of Tribune chowk, Chandigarh.

IV. DATA COLLECTION

A digital camera is installed on a stand beside the south approach leg of the selected roundabout from where movement of the vehicles through each of the legs is visible and recorded. The data is recorded for 1 hour during peak flow of vehicles. The different geometric features of the selected roundabout is taken such as carriageway of each of the approach leg, entry width, width of the weaving section, width of non-weaving section, length of weaving section, diameter of weaving section etc. From the 1 hour data, number of different types of vehicles like heavy vehicle, cars, autos, two wheelers is found out.

Traffic Flow Data

From the considered roundabout, the number of all types of vehicles such as heavy vehicles, light vehicles and two wheelers are found out for each of the approach leg of the roundabout as shown in the table 1

Table 1 One hour traffic flow data

Roundabout	Leg No.	Heavy Vehicles	Light Vehicles		Two Wheelers
			Cars	Auto	
Tribune Chowk, Chandigarh	N	32	362	219	783
	S	28	657	486	1530
	E	12	176	58	257
	W	7	425	358	1034

Geometric Features

The geometric characteristics such as carriage way of approach road, entry width, width of the weaving and non-weaving section, length of weaving section, of the selected roundabout was measured which are as shown in the table 2.

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Table 2 Geometric features of the roundabout

Roundabout	Leg No.	Carriage Way of Approach Road	Entry width	Width of non-Weaving Section	Width of Weaving section	Length of Weaving Section	Diameter Of Central Island
Tribune Chowk, Chandigarh	N	14	14.6	9.30	10.67	32.25	76.21
	S	13.82	14.6	9.05	10.67	34.57	76.21
	E	13.85	14.6	10.10	10.67	29.54	76.21
	W	13.85	14.6	9.0	10.67	30.43	76.21

Comparison Between Different Akcelik Models

Akcelik models (M3D, M3T, M1 & M2) of N, S, E & W zones. For comparison, linear regression was performed between Akcelik models and the results have been shown in the graphs.

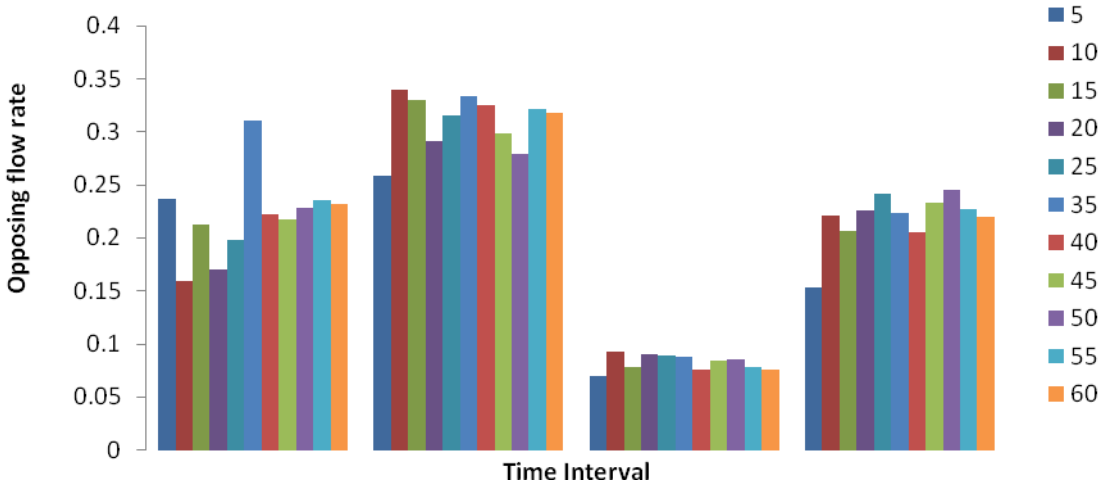

Fig.2 Opposing flow rate of Akcelik models (M3D,M3T,M1 & M2) (N, S, E, W).

V. CONCLUSION

In this work, during the study a peak hour traffic capacity and performance of the rotary and traffic control system at site has been analysed. As such out of the total volume of traffic about 85% of the quantum is made proved at presently. The remaining volume of traffic about of the total remained uncontrolled but the present total volume of traffic shall be accommodated as per study is to increase the weaving section by way of decreasing the length of splitters.

On further performance analysis of the roundabout, the remaining 15% problem can be solve with decrease the width of splitters, the capacity of roundabout increases up to 100%.

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