

A case study on traffic data analysis and suggestions for congestion removal at Rambagh intersection of Jaipur city

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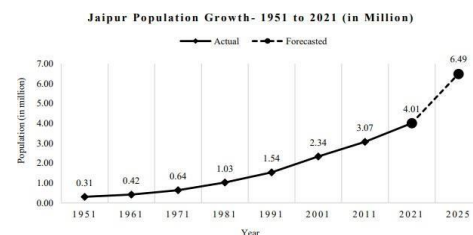
Abstract- In today's growing world traffic management is an important aspect for efficient flow of traffic. The problem worked out in present study is mainly traffic congestion. Congestion of traffic creates a major problem of delay and path fluctuations for the road users, it also affects the environment and causes hindrance to the pedestrians. The present study focuses on the existing traffic congestion conditions at the Rambagh intersection. To identify the problems and possible solutions to ease in traffic movement. A detailed study has been carried out in terms of measurements, location, bus stops, amenities, potential hazard points, etc. Google earth Pro software is used for the measurements at Rambagh intersection. Traffic Data Extractor software is being used for collecting the traffic volume count at the intersection. The analysis of traffic movement count has been done and outputs in form of hourly variations, vehicle-wise variation etc. have been computed. This study will help find out the effective strategies for traffic congestion and their management and focus on easing the traffic movement at Rambagh intersection which will help in reducing travel time, pollution and other issues related to transportation. The various measures to improve existing features and infrastructure have been suggested to make surroundings user-friendly.

Keywords- Traffic congestion, Accidents, Safety, Traffic Data Extractor, Google Earth Pro, Measurements.

1. INTRODUCTION

At present, the population evolution rate is around 1.05% per year and is 7,794,798,739, [1]. The average growth in population is estimated at 81 million people per year. The peak of the annual growth rate was seen in the 1960s which was around 2%. Since then, the rate has become half and the decline will continue to occur in the upcoming years. Figure 1 shows the urban population growth from year 1951 to 2021.

Traffic congestion is mobility problem in which numerous numbers of people want to move at the identical time each day. During year 2018, [2] total 21,743 road accidents were reported in the state. Out of these 9295(42.7%) were fatal, 3990(18.4%) were grievous injury, 7701(35.4%) were minor



injury and 757(3.5%) were no injury accidents.

Figure 1 Jaipur urban population growth from 1951 to 2021

Thanks to lockdown in 2020 due to which the number of road accidents in Rajasthan went down slightly compared to the year 2019. While more than 22,000 accidents resulting in 10,563 fatal were reported in 2019, it came down to 19,114 with 9,250 fatal last year, Registration of 14900562 motor vehicles in the Rajasthan state are shown in the year 2016-17, which shows an increase of 9.3% over the last year 2015-2016 wherever it was 13632176. These statistics are highest in terms of percentage increase in the country and it reported for 6.49% of the entire registrations (210023289)

Two wheelers constituted 67 per cent of the registered vehicles, while private cars accounted for 16 per cent of the total registered vehicles. The percentage stake of population of Jaipur district which is around 10.67(approx.) of the population of state of Rajasthan. In terms of registration of vehicles Jaipur (second) is next to Pune (first) in the non- metro category [2]. Till 31st March, 2017 Rajasthan had reported 14900562 total registered vehicles till March 2017 out of which 18.73% were of Jaipur district only. clearly one out of 5 registered vehicles in the Rajasthan state are listed in Jaipur district.

2. LITERATURE REVIEW

Congestion improvement is discussed in various past studies to understand the basic causes, results and resolution of road congestion problems. The license Plate matching method using a video graphic survey was used for data collection to evaluate the travel time of different of vehicles under heterogeneous road traffic conditions. 7:00

AM to 10:00 AM are peak hours and from 1:00 AM to 3:00 AM are off-peak hours are considered. Evaluation of congestion is done for every direction and every road from the data collected from the video recordings [3].

The Webster's model is used for redesigning of signal to predict the delays, by using this method delay can be reduced to 45-50% from the present scenario and deliver orderly movement of the road vehicles similarly through the appropriate geometric layouts the vehicle movement in right, left, or straight the traffic handling capacity [4]. To determine the number of vehicles and measure the vehicles values in definite form as census method is based on type of precision, economy, and process of evaluation of PCU (passenger car unit) survey done by methods like photographic method [5].

Studied the possible chances of congestion becoming one of the factors in accidents occurrence. However, solid arguments are not being given to settle this issue and to understand its impact on accidents the relationship between accidents and congestion was established. It was found that to create a relationship between accidents and their factors, real-time traffic characteristics are needed to be observed using modern techniques and advanced technical support [6]. looks at several ways of highlighting challenges faced in the reduction of congestion, without a significant change in private car ownership and the sharing economy. The government is required to find out and define the functional setting within which reduction in congestion can be achieved with the way of smart mobility. Also, road pricing can help in contributing to pay for the infrastructure [7].

To decrease accident rates effectively the statistical study of particular road stretch is being carried out. By proper enforcement and education, the road accidents can be effectively decrease to assured amount. according to study 60% of registered accidents occurred between 06.00 to 18.00 (Daylight Hours) and in these registered accidents 54% involved minor injury accidents [8]. Possible solutions for traffic congestion and parking problem, these are major problems we are facing in our metro cities and still government is not able to tackle issues relate to traffic and parking spaces. Developing parking lots, removing encroachment, innovative technique such as WSN (Wireless Sensor Network) which is based on intelligent car parking system [9].

As traffic congestion is intolerable problem in urban cities like Asansol city which is second largest city of Kolkata. This paper is study of congestion through primary survey during peak hours and logical solutions such as changing

routes, regular monitoring, parking management system are being provided for proper execution of traffic [10]. Due to rapid urbanization which leads to improper traffic management system densification of the city roads, encroachment by vendors at street sides, less parking areas and deteriorating the air quality & demand for travel with limited supply of services. Which can be resolved by giving parking spaces & promoting public transport to reduce traffic congestion, providing dedicated bus lanes which will increase the traffic speed [11].

3. OBJECTIVES OF THE STUDY

The major objectives of the study are as follows:

1. To identify the causes of congestion at Rambagh intersection.
2. To conduct traffic studies at Rambagh intersection using Traffic Data Extractor software.
3. To find road geometrics data.
4. To analyze the data collected and suggest suitable measures for improvement of intersection.

4. NEED, SCOPE, SIGNIFICANCE AND STUDY AREA

Rambagh is the major intersection of Jaipur city. Due to heavy traffic movement during current years, the Rambagh intersection is unable to cater the increased volume of traffic of Jaipur city which leads to harmful effects on road users, surrounding environment, human health and economy. Thus, it has become essential to carry out traffic study at the intersection and signals for ease in traffic movement.

The aim of this is to study to find out the effective strategies for traffic congestion and their management. This study is also convenient for the governing authorities and city planner to resolve the broader traffic problems in the future. The main focus of this study is to identify the need of a road user as the main element. How lack of facilities influences the daily movement of a road user and how it can affect the social, economic, and built-in environment of the Rambagh intersection in the study. Due to the high frequency of motorized transport on the road, it has been difficult for the road user and facing hostile situations due to the traffic congestion. So, to offer them a safe and congestion free movement that can help in reducing the no. of accidents involving pedestrians, reducing travel time, pollution and other issues related to transportation. To counter delay process new transportation facilities are to be introduced to carry out the increased peak hour traffic capacity.

5. METHODOLOGY AND DATA COLLECTION

Primary research included conducting an individual in depth site investigation and survey which was carried out to understand the existing conditions to identify the congestion problems. The steps government has taken and, or is planning to take in the future regarding this problem were discussed through the survey. The second section discusses the procedure for data collection by traffic studies were used to gather qualitative and quantitative information on the social and economic impacts of traffic congestion at the intersection. Site visits in the identified areas of traffic congestion will be conducted during peak hours. The purpose of these observations was the quantification of vehicular volume circulating on the site.

5.1 Geographical Location

The location of the selected intersection lies at latitude of 26.894804, longitude of 75.808663 of i.e., Rambagh intersection, and connecting major roads of Jaipur Tonk Road, JLN Marg Road, Bhavani Singh Road, MI Road. Figure 2 shows the geographic location of the Rambagh Intersection.



Figure 2: Satellite image of Rambagh intersection

5.2 Observation and investigation at Rambagh intersection

Due to lack of bus stops on Narayan Singh circle leg, JDA circle leg, Laxmi mandir leg it results in unauthorized/unorganized bus stops and leads to conflict with traffic flow. There is only one bus stop on high court circle leg shown in figure 3 So, bus stops are to be designed with proper width of stoppage without any conflict with the flow of



traffic.

Figure 3 Satellite image of bus stop at Rambagh intersection

Deteriorated road condition, improper markings on median or separator. These road markings must be up to the mark and can be achieved by proper maintenance. Zebra crossings were abruptly ending at a number of locations on the intersection as shown in figure 4



Figure 4: Deteriorated Road condition

The Bottle Neck Road results in congestion for vehicles moving from Nagar Nigam to Narayan Singh Circle as shown in figure 5. It can be countered by increasing the lane road width or the government and development agencies should look into the proposal for development of roads, flyovers, intersections, pedestrian facilities etc. seriously and see if it can help to reduce traffic congestion in the area.



Figure 5: Bottle neck on Narayan Singh circle leg results in congestion and long queue length

No slip lane alongside PC jewelers which results in congestion for vehicles moving from JDA circle to Nagar Nigam. Unorganized Pickup/drop area on all legs of intersection which leads to conflict in flowing traffic leads to chaos as shown in figure 6.

Figure 6: Unauthorized and unorganized pickup/drop area on



Laxmi Mandir leg.

less law enforcement measures shown in figure 7. according to the size of intersection it lacks parking

facilities and traffic rules are not followed. Pedestrians, generally students from nearby colleges cross the intersection without a care can be clearly seen. Vehicle users have been fined by the traffic police after walkers make their way in between the moving car, which force them to apply brake while signal was green. Subway could be provided for pedestrians considering the current traffic volume.



Figure 7: Unauthorized and unorganized pickup/drop areas Narayan Singh circle leg.

6. RESULTS AND ANALYSIS

6.1 Geometric Analysis

The geometric measurements with the help of Google Earth Pro were taken which makes it calmer and feasible to take measurements without going to the site itself. The movement of vehicles on the road also makes it harder to take dimensions in between the flow of traffic especially the dimensions of medians, lanes, existing footpaths, etc. In figure 8 the length is shown as 2.61m road lane width between point P-1 to P-2 on Narayan Singh circle leg. Two points (P-1 and P-2) are selected and the values were taken in meters.

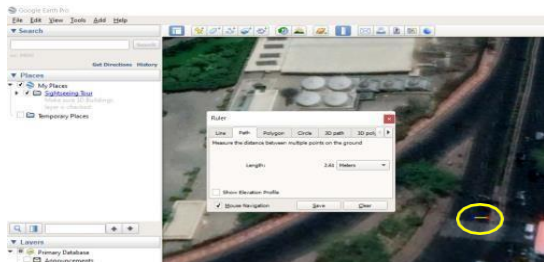


Figure 8: Width of road lane of Narayan Singh circle leg of Rambagh intersection

6.2 Volume Count

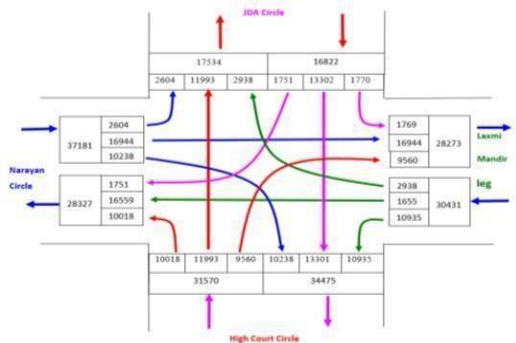


Figure 9: Volume count diagram total vehicle wise at Rambagh

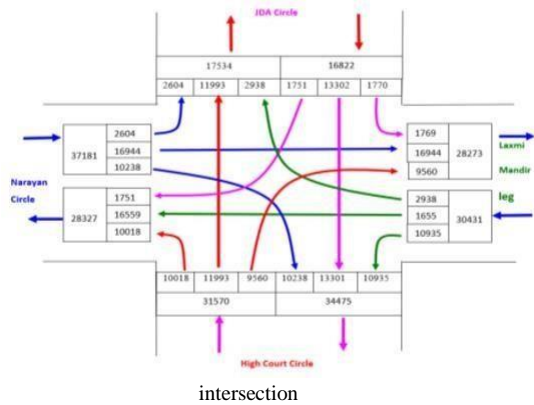
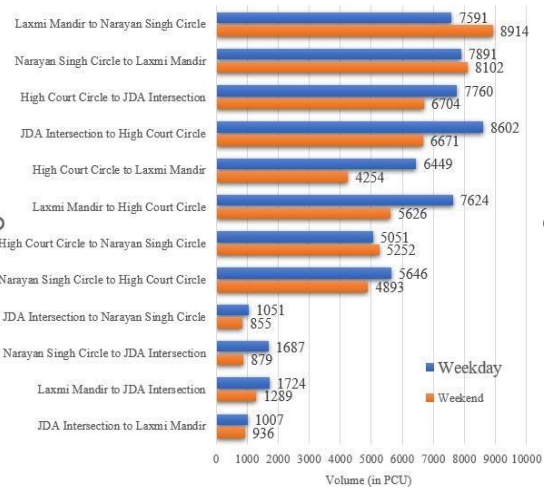


Figure 10: Volume count diagram total PCU wise at Rambagh intersection

Movement of Cars at Rambagh Intersection (in PCU)



6.3 Analysis of Traffic Movement Count

Figure 11: Movement of cars at Rambagh intersection

Among all the vehicles the movement of cars at Rambagh Intersection on weekend is maximum on Laxmi mandir to Narayan Singh circle and Narayan Singh circle to Laxmi mandir which crosses 8000 PCU and on weekdays the movement is maximum

Movement of 2-Wheelers at Rambagh Intersection (in PCU)



on high court circle to JDA intersection and High Court circle to Laxmi mandir.

Figure 12: Movement of 2-wheelers at Rambagh intersection

The movement of 2-Wheelers at Rambagh Intersection on weekdays is maximum on Laxmi mandir to Narayan Singh circle crosses 5000 PCU, on High Court circle to JDA Circle crosses 4000 PCU and on High Court circle to Narayan Singh Circle crosses 3000 PCU on the weekdays. Movement of 2-Wheeler is maximum on Narayan Singh Circle to Laxmi Mandir among all legs.

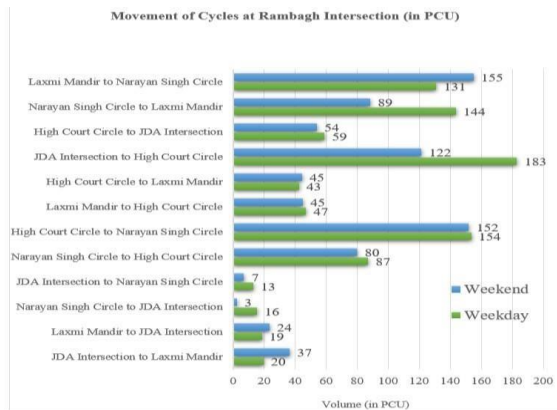


Figure 13: Movement of cycles at Rambagh intersection

The movement of Cycles at Rambagh Intersection on weekdays is maximum on JDA intersection to High Court Circle crosses 180 PCU, and on weekend Laxmi mandir to Narayan Singh circle crosses 150 PCU. Movement of Cycles is maximum on JDA intersection to High Court Circle among all legs.

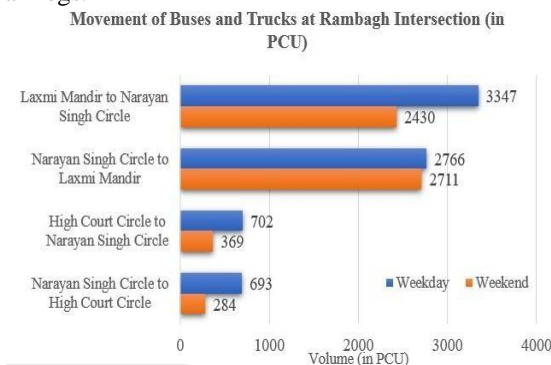


Figure 14: Movement of buses and trucks at Rambagh intersection

4. CONCLUSIONS AND RECOMMENDATIONS

Rambagh Intersection is a four-legged intersection and there is very heavy traffic volume of all types on its all four legs of intersection. For Narayan Singh circle leg number of vehicles are 71,993 and its PCU count is 57,969 and Laxmi Mandir leg number of vehicles are 32,286 and its PCU count is 37,388. For JDA Circle leg number of vehicles are 20,520 and its PCU count is 21,828 and High Court circle leg number of vehicles are 41,132 and its PCU count

is 43,889. On Rambagh Intersection volume count of total no of vehicles is 1,65,931 and its PCU count is 1,61,074 for all legs of intersection.

- As per IRC 103: 2012 codal provisions the road lane width should be 3.75 m, median should be 2.5 m, footpath/side walk of 1.8m and 3m crosswalk width and measurements on site are found for road lane width, median, footpath/side walk and crosswalk width not matches the IRC Standards hence improved by modifications.
- The existing condition of footpaths and existing road markings were not up to the mark as it degraded with time, with proper maintenance these can be served to pedestrians for ease in mobility. Lack of pedestrian’s refuge islands leads to pedestrians make their way in between moving cars which forces vehicle users to apply brake results vehicle users get fined by traffic police.
- The pedestrian facility as per IRC: 103-2012 “Guidelines for Pedestrian Facilities” needs to be improved. At-grade zebra crossing with timer and blinker must be installed. Traffic Island for the mid-way stop area and proper signages needs to be constructed.
- Considering the huge traffic volume at the junction several technologies related, to time-segregation, -segregation etc. must be adopted. Several traffic calming measures must be adopted to slow-down the traffic.

5. FUTURE SCOPE OF WORK

- The major part of Jaipur city lacks these facilities and amenities on some of the busiest stretches. These kinds of studies can achieve improvement and enhancement in terms of safety and mobility.
- With the introduction of electric vehicles, the charging stations can also be installed on different sections of these major roads. There is a scope of research in finding out the finest possible solutions in terms of design for ease in traffic and road user behavior which gets affected by congestion.

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