

Traffic Congestion: A Case Study of Walled City of Jaipur, India

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Abstract—The ever increasing population has aggravated the vehicular density on roads and hence, vehicular congestion is now the driving issue in modern day world. One can very well observe the storm of rapid urbanisation, which has taken its toll almost everywhere leading to congested city cores and its cons equals to vehicular congestion on roads. Improper traffic management is one of the leading causes of the issue, focused in this paper, leading to various other consequences like densification of prime city roads, encroachment of street sides and areas marked for parking and worsening air quality. This paper also presents some general recommendations based on the identified issues as discussed in the paper.

1. INTRODUCTION

Well developed and evolved transportation system is a pre-requisite for development of an urban system and is necessary for the ease of fulfillment of various day to day activities. The efficiency of the transport system is one of the primary indicator of the wellness and livability of a city. The unprecedented growth in population, steep increase in vehicle ownership, and increase in various allied activities have resulted into various traffic and transportation related problems in Jaipur city such as vehicular congestion, time-delays, very low traffic speeds, accidents and poor state of environment. Jaipur is the capital city of Rajasthan state of India and is the largest city in the state in terms of population.

2. BACKGROUND

Jaipur is a fast growing city, ranked 10th in the list of populous Indian cities with a metropolis population of 30,73,350 (Census-2011)[1] and annual growth rate of 4.5%[1].

The year 2011 saw registration of 79,86,265 motor vehicles in the state of Rajasthan, which shows a rise of 11.4% over the previous year where it was 71,65,662 [2]. These figures are highest in terms of percentage growth in the country and it accounted for 5.6% of the total registrations in India, though in numbers it ranked sixth overall. Within Rajasthan, Jaipur was the leading city where 16,93,972 were registered with the RTO in 2011 which account for 21.2% of the total registrations in the state [2]. This is in contrast to the

percentage share of population of Jaipur district which is 9.6% of the population of state of Rajasthan [1]. In the non-metro category, Jaipur ranked second, next to Pune in terms of registration of vehicles.

Rajasthan had a total road network of 125652 kms (upto31, March 2013) and accounted for a total of 10072035 registered vehicles (up to March 2013) of which 20.24% were in Jaipur district itself thereby clearly implying one in every 5 registered vehicle in the state of Rajasthan is registered in Jaipur district [2]. Comparing the road network, Jaipur district has about 4.5% of the total road length of Rajasthan [2].

Table 1: Share of Jaipur district in road length available and registered vehicles in Rajasthan state [2].

	Road length(in km)	Registered vehicles	Road length per 100 vehicle
Jaipur	5682	2038565	0.279
Rajasthan	125652	10072035	1.248

Table 2: Table showing road and vehicle density in Jaipur district and Rajasthan [2].

	Area(in sq km)	Road Length per 100 sq km area	Vehicles per sq km
Jaipur	11143	50.99	18295
Rajasthan	342240	36.71	2943

Jaipur has got roughly 6 times more vehicular density of registered vehicles in comparison to the vehicular density of the entire state of Rajasthan, i.e. 18295 vehicles per sq km in Jaipur district as compared to 2943 vehicles per sq km in Rajasthan [2]. Jaipur district has got a denser network of roads, with about 51 km road length per 100 sq km area in comparison to road density in Rajasthan state which has 37 km road length per 100 sq km (Table 2) [2].

Table 3: Growth of two-wheelers in Jaipur district over the past 10 years [2].

Year	Growth percentage of two wheelers	Growth percentage of cars
2003-04		
2004-05	10.88	13.44
2005-06	12.31	13.86
2006-07	10.56	12.57
2007-08	10.42	11.84
2008-09	4.85	8.11
2009-10	9.49	12.00
2010-11	8.29	10.89
2011-12	9.18	11.40
2012-13	8.12	8.56

There has been a constant increase in the no. of registered two wheelers and cars in Jaipur district. The growth percentage of cars has outpaced the growth percentage of two-wheelers in the district (Fig.3). There have been only two instances, from 2003-04 to 2012-13, when the annual growth rate of cars in the district has gone below 10 per cent (Table 3) [2].

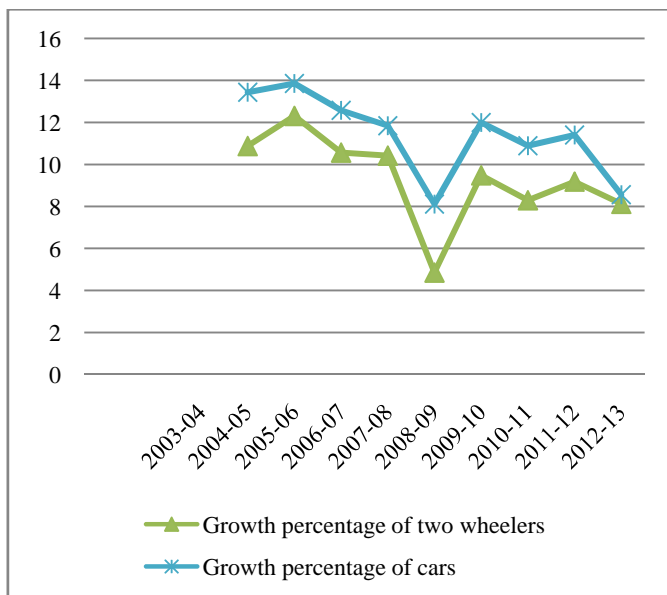


Fig. 1: Comparison of annual growth trend between registered cars and two-wheelers in Jaipur district [2].

3. STUDY AREA: WALLED CITY OF JAIPUR

Walled city of Jaipur was planned and constructed in the 18th century. Vidhyadhar Bhattacharya was the chief architect and planner of the city. It was planned with well laid out wide roads and shaded walkways for pedestrian movement.

One of the unique features of the walled city is its compactness and walk ability from one market to the other. The Walled City, in 2011-12 had a very high population density of 58,207 persons per square kilometer [3]. Since the

area has developed over the years as the Central Business District (CBD), it has seen an unprecedented rise in the commuter numbers. The situation has worsened due to the rise in no. of 4-wheelers occupying the roads.

4. TRAFFIC ISSUES



Fig. 2: Road categorisation in the study area.

Roads in the walled city of Jaipur can be classified according to the road widths into primary (eg. Johari Bazaar, Kishanpole Bazaar etc.) with road width of 10m or more, secondary with road width less than 10m but more than 3 m and tertiary streets with widths equal to or less 3 m. (Fig. 2)

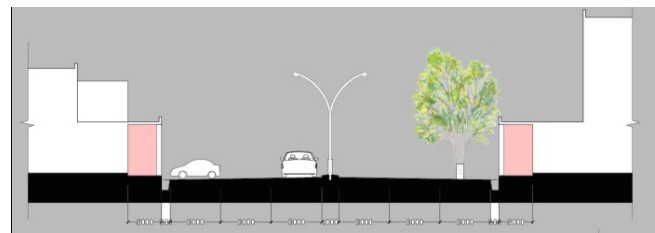


Fig. 3: Typical section of a primary road.

The effective carriage-way of the primary streets is reduced due to various reasons, like on- street parking, encroachment, informal activities, constructions, trees etc. So, for six lane road, effective carriage-way is reduced to four lanes, which is roughly a 33% reduction in effective carriage way.

Table 4: Volume/ Capacity ratio of important roads in and around walled city, Jaipur [3].

Road Name	Location	Peak Hour Traffic Volume (PCU)	Capacity of Road (PCU)	V/C Ratio
Surajpol-Chandpol road	Tripolia Bazaar	3831	5100	0.75
Amer Road	Johari Bazaar	4347	5100	0.85
MI Road	Ghat Gate to Sanganer Gate	4123	5100	0.81

V/c or 'Volume/capacity' ratios for few important roads in the walled city of Jaipur are listed in *Table 4*. V/C ratio in the range of 0.75-0.90 represents traffic operations approaching unstable flow of heavy congestion, and characterized by restrictions in maneuverability [3].

Since increasing the road capacity to meet the future traffic requirements is not an option due to the limitation in road widening and other issues, we need to optimize the use of present infrastructure which includes optimal use of available carriage way, pedestrian walkways, on street parking lots etc.



Image 1: Mixed traffic conditions in Tripolia Bazaar.

Several issues need to be addressed for to achieve efficient use of available carriage way. Mixed traffic, which is evident in many other Indian cities as well, is one of the key reasons for the slow traffic speed in the walled city area of Jaipur. Being the commercial hub of the city, shops, stores and showrooms dealing with a variety of articles and goods, the area experiences a heavy freight activity which employ a range of transportation modes from heavy vehicles to manually or animal pulled carts (See *Image. 1*). In absence of lane system and time specific freight activity hours, they mix with other traffic, and lead to further congestion of the roads, and slowing down average traffic speed.



Image 2: Absence of Lane system

Mixing of slow and fast moving traffic eventually reduces the average traffic speed. Motorists and cyclists tend to move forward through any available *gap* in the traffic volume, while car drivers tend to drive in the lane nearest to the median irrespective of the driving speed (see *Image. 2*). In absence of any dedicated bus lane, buses are forced to merge with the traffic, blocking the traffic behind every time it makes a stop. While the government buses have marked bus stops, private buses also sometimes make stops according to the potential rider.



Image 3: Traffic at a node at Johri Bazaar.

Generally, traffic in the first lane next to median moves with the fastest speed, but it seen that frequent cuts in the median, in absence of lane system, substantially slows the traffic speed (see *Image. 3*) as commuters tend to cross the traffic flow abruptly which might sometimes also lead to accidents. Many of the cuts in the median have been blocked by barricades in the past few years, but still many remain which disrupt the traffic flow.



Image 4: Market in the interior area of the Walled city.

In the walled city area of Jaipur, commercial activities have penetrated in the interior areas along secondary and tertiary streets, and over the period of time have evolved in established

markets (see *Image. 4*). Hence, a substantial volume of traffic infiltrates the inner streets. Since many of these markets have so less road widths which restrict car traffic, so people generally commute with two-wheelers, manual rickshaws, or as pedestrians. But in absence of two wheeler parking along these secondary markets, customers and other users use the already narrow carriage way for parking. Even the average traffic speed along these markets in the interior are slowed down by the slow moving manual rickshaws and pedestrians occupying carriage way in absence of footpaths.



Image 5: Animals on the carriage way near Subhash Chawk.

Intrusion of animals on the carriage way, and on squares lead to chaotic traffic situation (See *Image. 5*).

5. PARKING

Parking space has become an indispensable requirement in the 21st century, with the constant increase in number of vehicles. With the increasing traffic volume on the prime roads in the walled city of Jaipur which is evident by the *V/C ratio* (*Table 4*), available parking spaces are fast being outnumbered by the demand. In absence of available parking spaces, people tend to halt their vehicles, especially cars and autos, on the carriage way waiting for their co-riders to finish their work and return. This in turn, proves obstruction to the already slow moving traffic (see *Image. 6*).



Image 6: Autos waiting for customers in Tripolia Bazaar.

Parking spaces provided for auto rickshaws and manual rickshaws are less in comparison to the required numbers. Hence these vehicles can be seen, waiting for potential customers along the road side (see *Image. 6*).



Image 7: Loading of goods during business hours.

Though separate loading areas have been allocated along prominent markets in the Walled City area, they prove to be an obstruction to traffic and also potential contenders for parking space, which otherwise could have been for customers (see *Image 7*) in case the freight activity hours were kept reserved for non- business hours.



Image 8: Hand pump in Tripolia Bazaar.

Structures like transformers, ramps, un-used tree-guards and hand-pumps also prove to be an obstruction in optimization of the available on-street parking space (see *Image. 8*).



Image 9: Encroachment of walkway in Tripolia Bazaar.

Various informal activities and *spillage* of products on the pedestrian walkway and parking space force the users to occupy additional space on the carriage way and hinder the traffic (*see Image. 9*)

6. RECOMMENDATIONS

Availability of space and cost of infrastructure for building new parking spaces are the two important factors which will guide the construction of parking lots in the coming future. Hence the limitation of these two factors, guide us to find a solution in discouraging the demand, rather than to supplement the requirement. And, to optimize the present on-street and off-street parking spaces.

Hence, to discourage the demand some of the possible solutions can be in terms of parking charges and congestion taxation. Parking prices are must be governed by market oriented approach, which justifies the cost of the land which the vehicle is occupying.

Indian cities lie mostly in the leftmost upper or middle regions of the chart shown (Fig. 4), whereas ideal case should be in the central V (cone) which is the region for value of 1 to 4 for a ratio between the office rent prices and CBD parking prices in various cities [4].

Promotion of public transport will ideally reduce the traffic congestion on the streets by discouraging the use of privatized vehicles. One important factor which can help in this regard is the provision of dedicated bus lanes, which will greatly improve the speed of the bus traffic and may help in turning people to use public transport by establishing it as a faster mode of travel. Also, eradicating or controlling the mixed traffic situation will help in easing the stress level in traffic.

De-centralization of the activities in the *Walled city area* will help to split the traffic and distribute it to other regions rather than concentrating it into the CBD. But as evident from the past, it must have social acceptance and public participation which is necessary to make most of the proposed solutions a success.

The above discussed measures are not the only solutions, but only some are discussed here in this paper. Solutions must be sought in the light of social acceptance, economic feasibility and practical applicability in local context.

REFERENCES

- [1] Census 2011, "Ministry of Home Affairs", *Government. of India.*
- [2] Statistical Abstract 2012-13, "Table 2.1, Table 5.5, Transport Department, Government of Rajasthan.
- [3] *Master Development Plan 2025*, Jaipur, Jaipur Development Authority, Rajasthan, India.
- [4] *Parking Policy in Asian Cities, 2011*, Asian Development Bank.

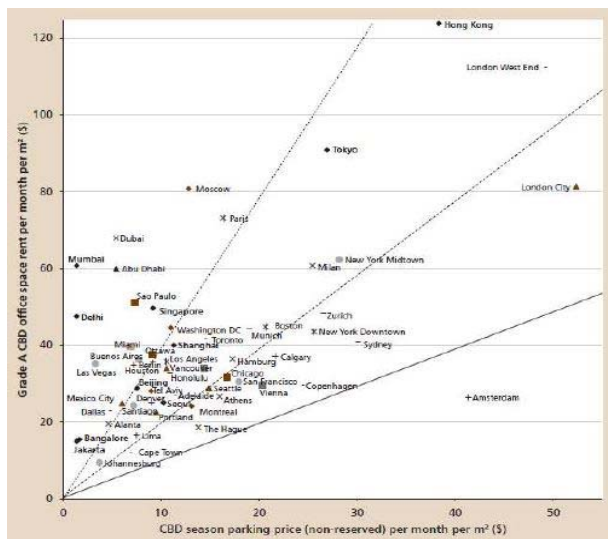


Fig 4: CBD Parking Prices Compared with CBD Grade A Office Rents In Many International Cities [4].