
Transportation and Air Pollution : Case Study of Jaipur City

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Summery

Jaipur being the capital of Rajasthan is the focus of the socio-economic and political life of the state. It is the 10th largest city and one of the fastest growing cities in India. It is the center of both traditional and modern industries and is a very popular tourist destination for cultural heritage and historic architecture. It witnessed fast growth both physical and demographic i.e. with 2011 population at 30.73 lakhs, the city is likely to attain a population of 64.95 lakhs by the year 2025 with 5.3per cent annual growth rate. Jaipur City forms part of the famous “Golden Triangle”, “Golden Quadrilateral” and “Delhi Mumbai Industrial Corridor”. Due to spatial disparity in growth, traffic movement is from periphery to the core city. The radial roads especially in the periphery are inadequate, with the absence of more circumferential roads connecting the radial roadway system.

Keywords : *Capital, Socio-economic, Political life, Traditional, Modern, Tourist, Cultural, Heritage, Architecture.*

Introduction:

Air Pollution has reached a critical level as a result of increasing vehicle population and resultant traffic congestion. The level of particulate matters and nitrogen oxide contamination is rising.

This rapidly growing number of vehicles is also leading to increasing ill-health. Residents of high air pollution localities suffer from respiratory and cough-related ailments.

So the increasing number of vehicles is posing a big challenge to the environment and consequently to the society.

WHY JAIPUR?

Jaipur being the capital of Rajasthan is the focus of the socio-economic and political life of the state.

It is the 10th largest city and one of the fastest growing cities in India.

It is the center of both traditional and modern industries and is a very popular tourist destination for cultural heritage and historic architecture.

It witnessed fast growth both physical and demographic i.e. with 2011 population at 30.73 lakhs, the city is likely to attain a population of 64.95 lakhs by the year 2025 with 5.3% annual growth rate.

Jaipur City forms part of the famous “Golden Triangle”, “Golden Quadrilateral” and “Delhi Mumbai Industrial Corridor”.

For the purpose we have taken the boundary of the Jaipur Development Authority as the study area.

Pollution Survey Analysis :

This survey is carried out at 10 locations in the study area. In this survey ambient air quality data is collected at each location for 24 hours on a working day. In air pollution

survey data pertaining to particulate matters (PM10, PM2.5), SO₂, NO₂, O₃, Lead, CO, Ammonia, Benzopyrene, Benzene, Arsenic and Nickel are collected.

Table 1 : National Ambient Air Quality Standards (NAAQS)

S No.	Pollutant	Unit	Prescribed Limit
1	Particulate Matter Size < 10 µm-(PM10)	µg/m ³	100
2	Particulate Matter Size < 2.5 µm-(PM2.5)	µg/m ³	60
3	Lead (Pb)	µg/m ³	0.5
4	Sulphur Dioxide (SO ₂)	µg/m ³	80
5	Nitrogen Dioxide (NO ₂)	µg/m ³	80
6	Carbon Monoxide (CO)	mg/m ³	2
7	Ozone (O ₃)	µg/m ³	180
8	Ammonia (NH ₃)	µg/m ³	400
9	Nickel (Ni)	ng/m ³	20
10	Benzo(a)Pyrene (BaP)	ng/m ³	1
11	Benzene	µg/m ³	5
12	Arsenic (As)	ng/m ³	6

Table 2 : Air Pollutants' Data at Survey Locations- Part1

S No	Locations	PM10 (µg/m ³)	PM2.5 (µg/m ³)	Lead (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)
1	Transport Nagar Bus terminal	105.42	45.03	BDL (DL 0.0005)	10.88	32.41	BDL (DL 0.02)
2	Jaipur Railway Junction	121.29	51.24	0.16	12.35	28.16	BDL (DL 0.02)
3	Ajmer Gate	113.86	48.12	0.12	13.74	25.07	BDL (DL 0.02)
4	B2 Bypass Circle	168.32	57.11	BDL (DL 0.0005)	12.89	30.05	BDL (DL 0.02)
5	Chandpole Gate	188.2	55.74	BDL (DL 0.0005)	15.32	33.85	BDL (DL 0.02)
6	BadiChaupar	174.62	58	BDL (DL 0.0005)	12.57	31.74	BDL (DL 0.02)
7	Rambagh Circle	149.61	49.63	BDL (DL 0.0005)	11.63	27.61	BDL (DL 0.02)
8	Sodala	186	56.6	BDL (DL 0.0005)	14.24	34.2	BDL (DL 0.02)
9	RidhiSidhi Circle	181	45.29	0.19	10.23	26.78	BDL (DL 0.02)
10	ChomuPulia	190.73	68.2	BDL (DL 0.0005)	15.26	36.52	BDL (DL 0.02)

Table 3 : Air Pollutants' Data at Survey Locations- Part 2

S No	Locations	O ₃ (µg/m ³)	Ammonia (µg/m ³)	Nickel (ng/m ³)	Benzo(a)Pyrene (ng/m ³)	Benzene (µg/m ³)	Arsenic (ng/m ³)
1	Transport Nagar Bus terminal	10.21	13.25	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
2	Jaipur Railway Junction	8.4	12.54	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
3	Ajmer Gate	9.24	11.9	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
4	B2 Bypass Circle	15.57	19.2	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
5	Chandpole Gate	13.67	17.63	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
6	BadiChaupar	16.24	18.2	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
7	Rambagh Circle	16.24	18.2	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
8	Sodala	13.89	15.69	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
9	RidhiSidhi Circle	13.1	20.14	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)
10	ChomuPulia	13.1	17.14	BDL (DL 0.5)	BDL (DL 0.5)	BDL (DL 1.0)	BDL (DL 0.5)

Factors Escalating Vehicular Emission

1. Road Infrastructure
2. Personalized Transport
3. Public Transport
4. Traffic

5. Vehicle and Fuel Efficiency

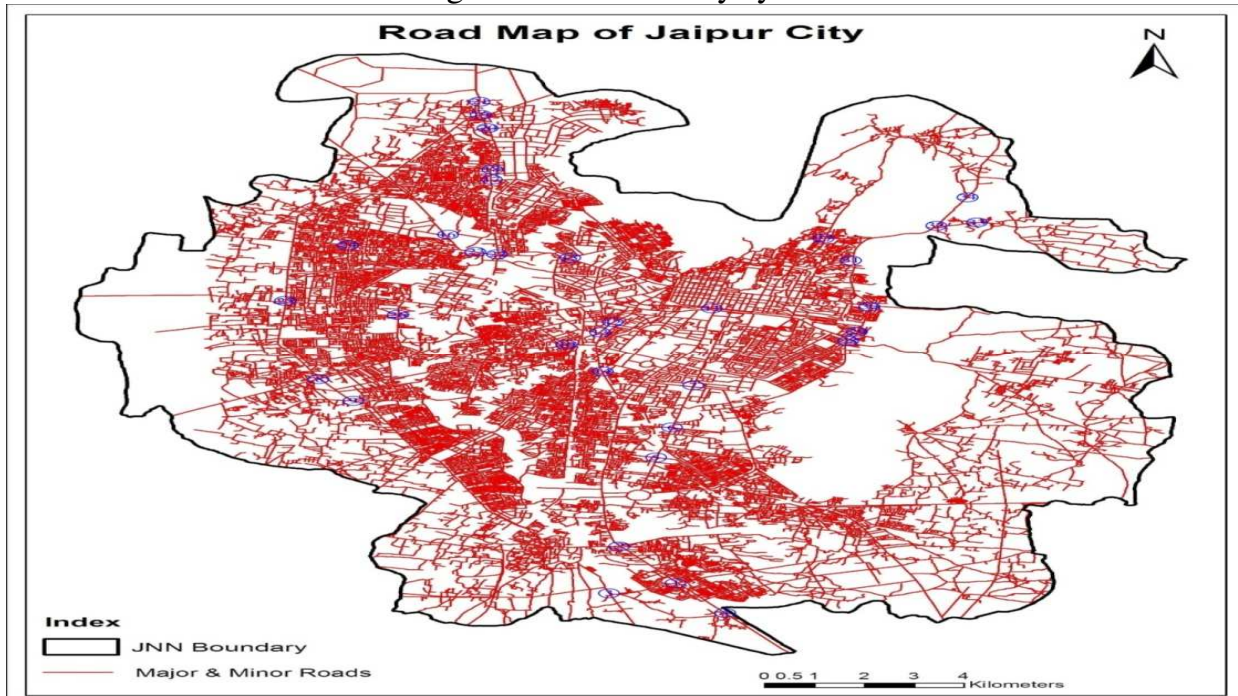
Road Infrastructure:

Jaipur has a total road network of around 1500 km. Approximately 34 per cent of the roads are two lane roads. Although 52% of the roads surveyed are 4 lane, parking and encroachments on carriageway has led to underutilization of the road capacity.



Pic. 1 : Road Traffic in Jaipur City

Due to spatial disparity in growth, traffic movement is from periphery to the core city. The radial roads especially in the periphery are inadequate, with the absence of more circumferential roads connecting the radial roadway system.



Map 1 : Road Map of Jaipur City

Personalized Transport:

The average annual growth rate of vehicles in Jaipur is around 8.4%. Increase in the number of registered vehicles on the limited road space has led to overcrowding and congestion on roads.

Jaipur district has a total number of 2423648 motor vehicles registered till the year 2016, of which two wheelers and cars constitute 73.18 per cent and 13.76 per cent respectively.

Table 4 : Registration of vehicles in Jaipur district upto the year (cumulative)

Year	Number of Vehicles	Annual Growth Rate (in percentage)
2006-07	1176754	-
2007-08	1324624	12.57
2008-09	1387857	4.77
2009-10	1549737	11.66
2010-11	1695302	9.39
2011-12	1870976	10.36
2012-13	2038565	8.96
2013-14	2222060	9.00
2014-15	2389124	7.52
2015-16	2423648	1.44

Table 5 : Types of vehicles upto the year 2015-16 (cumulative)

Type of Vehicle	Number of Vehicle
Two wheeler	1773513
Auto Rickshaw	27448
Tempo Passenger	6128
Tempo Goods	14611
Car	333587
Jeep	71618
Tractor	48496
Trailer	2911
Taxi/Maxi Cab	31939
Bus	24338
Truck	83262
Others	5797

Public Transport:

The bus system both public and private is inadequate in terms of comfort and frequency. They always operate at crush capacity. The available buses per lakh population are around 30 which is less than desirable (50 per lakh).

Due to in-efficient rationalization of routes, public transit routes are unregulated with too many buses in one route causing confusion and congestion.

Jaipur Metro is also at very initial stage and does not provide proper connectivity and mobility.

Traffic:

Traffic volumes are very high in the Walled City vicinity, Jhotwara, RajaPark, Sodala, Sindhi Camp etc.



Pic. 2 : Traffic situation in Jaipur City

Volume Capacity Ratio is found to be more than 1 during the peak periods sometimes. The average speed in the commercial areas of the city is 16 km per hour during peak hours.

Volume Capacity Ratio in the range of 0.75-0.90 represents traffic operations approaching unstable flow of heavy congestion and characterized by restrictions in maneuverability.

Table 6 : V/C Ratio for few important roads in the Walled City of Jaipur

Road Name	Location	Peak Hour Traffic (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 Sanganeri Gate	4123	5100	0.81

Vehicle and Fuel Efficiency :

Auto Industry has had the capability of making BS4 vehicles since 2010, but lack of proper BS4 fuel prevented it from selling such vehicles nationwide.

The exhaust emissions for BS-III two-wheelers direct that the petrol-powered engine should have carbon monoxide and Hydrocarbon + Nitrous Oxide emission restricted to 1.00 g/km. For a vehicle to be BS-IV compliant it must have an emission not more than 0.75 g/km of CO and HC+Nox respectively.

Solutions :

1. Moving People Rather Than Vehicles
2. Integrating Land Use And Urban Transportation
3. Priorities To Non-Motorized Transport
4. Switching To More Efficient Fuel and Vehicles
5. Promoting Hybrid Vehicles

Moving People Rather Than Vehicles:

Promotion of public transport will ideally reduce the traffic congestion on the streets by discouraging the use of personal 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.

Integrating Land Use And Urban Transportation:

While most of the economic activities are located in the Walled City area, the residential colonies have grown in the western and southern parts, which are far from the main centre of activities.

This imbalance in the location of jobs and residences over space coupled with inadequacy of public transport system generates huge volumes of intermediate and personalized traffic especially on arterial roads.

Priorities To Non-Motorized Transport:

Footpaths should be made in residential streets and on major roads with commercial activities and the existing footpaths should be redeemed from encroachments and obstructions.

Besides road space should be demarcated exclusively for movement by pedestrian and cyclists.

Better Fuel And Vehicles

- BS-VI should be implemented soon
- Battery Driven Vehicles and Hybrid Vehicles should be promoted
- e-Rickshaws should be made more popular
- Fleet Modernization Policy should be implemented with vigor which will help reducing vehicular emission by 25% according to an estimate.

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