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Nagpur City: Road Vehicles and Air Pollution

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ABSTRACT

Various types of vehicles are used in the urban areas of India. The continuous increase of vehicles is creating new problems for traffic and road transport every day. These problems are traffic congestion, air and noise pollution, accidents; travel Time delays etc. have manifested in the form of continuous increase. Increased fuel consumption at traffic signal intersections increases in journey length, increasing attractiveness of personal vehicles for travel. Vehicle use and increasing number of vehicles per household changes traffic patterns. Air pollution is increasing due to smoke. Therefore, in this research essay, the road vehicles of Nagpur city and the air pollution caused by it have been studied.

Keywords: *Road traffic, vehicles, air pollution, correlation.*

I. INTRODUCTION

Private road vehicles are used in Nagpur city. Vehicles of different sizes and speeds are seen on the roads. Primary survey of traffic flow was conducted in the months of February (winter season), May (summer season) and August (rainy season) from 16th to 22nd of the year 2021. 6.30 a.m. to 7.30 a.m., 9.30 a.m. to 10.30 a.m., 12.30 p.m. to 1.30 p.m., 4.30 p.m. to 5.30 p.m. and 8.30 p.m. to 9.30 p.m. By observing the traffic flow between the points, the figures of the movement of vehicles on the road were compiled.

"Whenever there is an increase of carbon dioxide, nitrogen dioxide in the air, then such air is called polluted air and this type of pollution is called air pollution." In other words, "Air unbalanced condition due to air mixture of external elements generated from natural and human generated sources is called air pollution and the factors by which air is polluted are called air pollutants."[2]

(A) Aims and objectives

- To study road traffic in Nagpur city.

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[2] *Air Pollution* (2023) *Encyclopædia Britannica*. Available at: https://www.britannica.com/science/air-pollution (Accessed: 16 August 2023).

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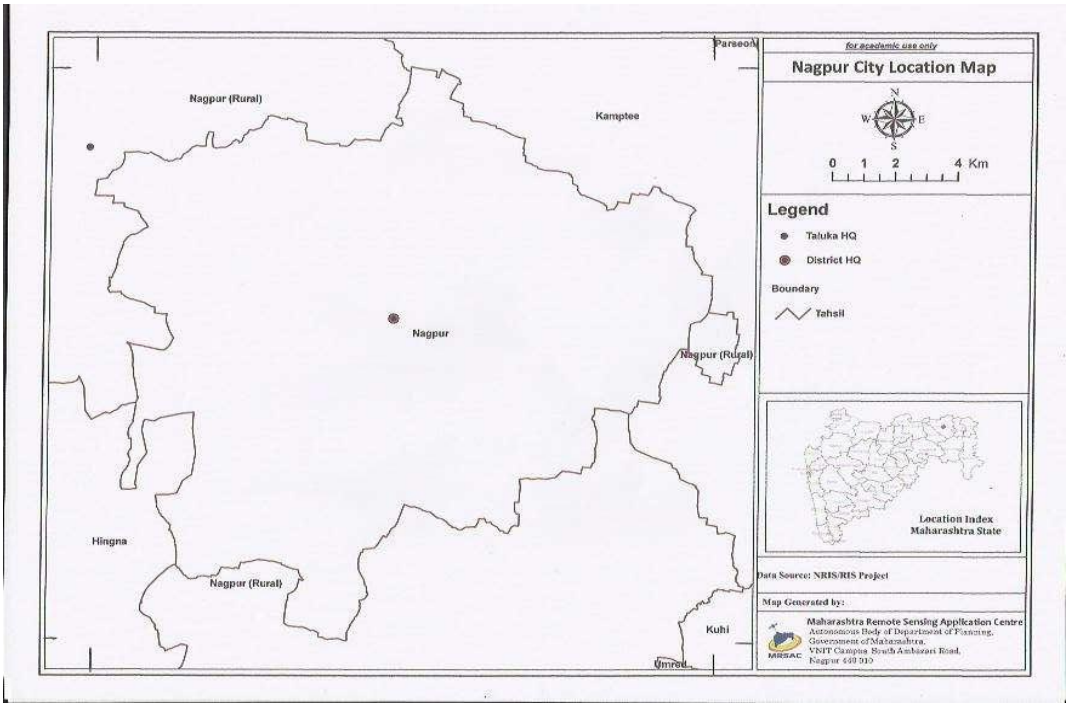
- To study number of road vehicles and its impact on air pollution.
- To study the air pollution components according to seasons.

II. STUDY AREA

Nagpur city is situated between 21° 04' N to 21° 07' north latitude and 79° 16'E to 79° 27' east longitude. According to Dr. Babasaheb Ambedkar, people of Nagraj dynasty lived in this state, who were followers of Buddha. That's why the river here is named Nag and the city is named Nagpur. The city is located in the heartland of India and is situated in the eastern region of the Vidarbha division of Maharashtra State. It is spread 21.8 km from north to south direction and 21 km east to west direction.

Location map of Nagpur City



Source : - Maharashtra Remote Sensing Application Centre, Nagpur.

The city of Nagpur is located on the Deccan Plateau of the Indian peninsula. The city is situated at an altitude of 312.42 m (1017 feet) above sea level. Crystalline metamorphic rock and granite are found in the eastern part of the city. While in the northern part yellow-colored stones and sand are found of Gondwana formations.[3]

Nagpur city has Ambajhari lake, Gorewada lake and Futala lake, Sonegaon lake and Gandhisagar tank are built by historical rulers. Nag river flows from west to east through the

[3] District Social and Economic Review, District - Nagpur, March 2021, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai, p. 2

center of Nagpur city. The Pili River flows in the northern part of Nagpur and the Pohra River along the southern border of Nagpur city from west to east.

III. DATA COLLECTION

Primary and secondary data has been used. Season wise and with time schedule vehicle Survey has been conducted. Secondary data was obtained from Regional Transport Office and Maharashtra Pollution Control Board, Nagpur City. Similarly, information has also been collected from internet website http://www.ngpinformation.org.in and www.businessdictionary.com/definition/air-pollution.html. Thus collected data has been classified, tabulated analyzed and interpreted with the help of maps and graphical diagrams.

TRAFFIC FLOW / VOLUME FIELD SURVEY - (W/S/R)

Name of surveyor:- _____ Date :- _____

Name of square:- _____ Time: (From - _____To_____)

TWO W H E E L	Cycle	
	Scooter	
	Moped / Luna	
	Motor Bike	
THREE W H E E	Cycle -Rickshaw	
	Auto - Rickshaw	
	Passenger/Good 6 – 10 seater	
FOUR W H E	NMC StarBus	
	S.T., M. P., Sch./College/	
	Jeep	
	Car	

E I	Other	
FIVE WHEE- LERS	Auto & other	
HEAVY VEHICLE	Tanker, Roadroller,	

Note : -W – Winter season, **S –** Summer season, **R –** Rainy season.

IV. NUMBER OF ROAD VEHICLES IN NAGPUR CITY

Table no.1 depicts number of vehicles in Nagpur city as on 31st March, 2021.There are total 1883782 vehicles, out of which 81.51 percent vehicles are two wheelers (motorcycle, scooters and mopeds).Four wheelers including cars, jeeps, trucks, lorries and delivery vehicle shares least (only 9.77 percent).

Table No.1 Nagpur city : Number of Road Vehicles **(**Year **2021)**

Sr. No.	**Types of Road Vehicle**	**Number of Vehicles**
1.	2 WHEELERS	15,35,548
2.	3 WHEELERS	27,863
3.	4 WHEELERS	1,84,062
4.	5 WHEELERS	5234
5.	OTHERS	131075
TOTAL		**18,83,782**

Source :- Regional Transport Officer, Nagpur City.

Graph No. 1 Nagpur city : Number of Road Vehicles (Year 2021)

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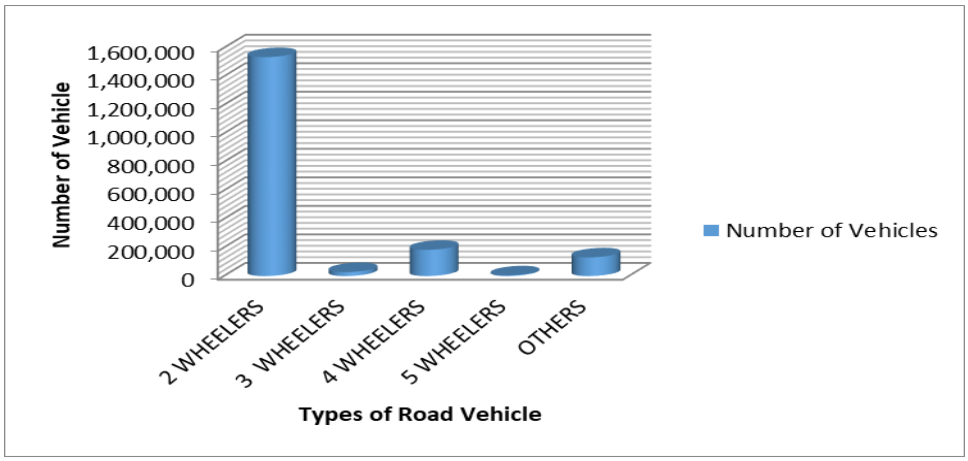


Table No.2 Nagpur city : Population Growth rate and Vehicular Growth Rate

Sr. No.	Year	Population	Population Growth Rate	Total Vehicle	Vehicular Growth Rate
1.	2001	2052066	----	0554108	---
2.	2011	2405421	17.21	1157034	108.81
3.	2015	2582099	7.34	1631354	40.96
4.	2021	2991000	1.73	1883782	20.00

Source :- Calculated by author

Graph No.2 Nagpur city : Population Growth rate and Vehicular Growth Rate

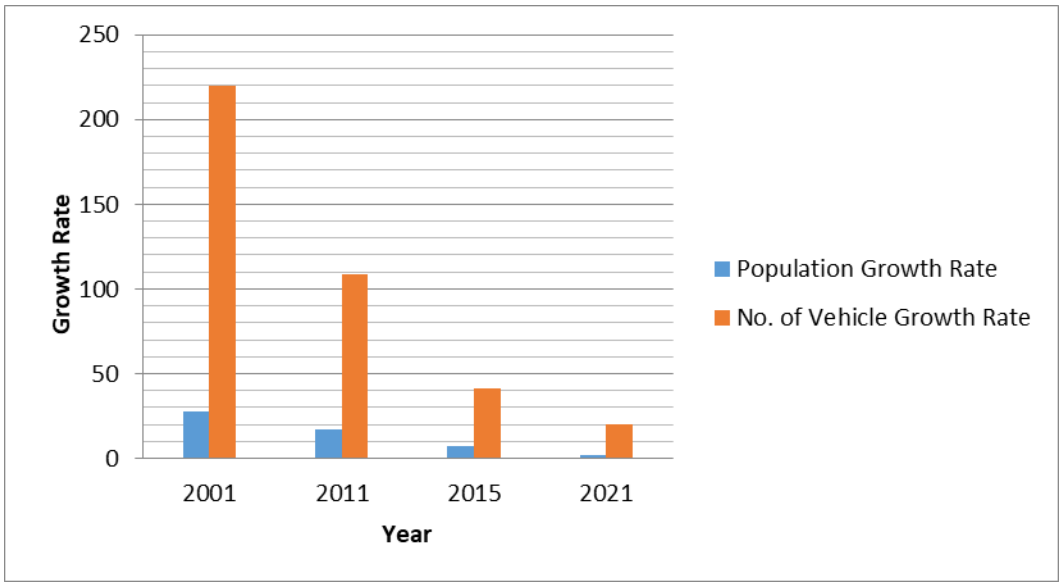


Table No. 3 Nagpur city : Vehicular Density (Per sq. k.m.)

Sr. No.	Roadways	Vehicular Density		
		Year 2001	Year 2011	Year 2021
1.	National Highway	0.19	0.21	0.25
2.	State Highway	0.21	0.23	0.26
3.	Main District Roadways	0.28	0.29	0.31
4.	Internal Roadways	0.79	0.98	1.23

Source :- Calculated by author

Graph No.3 Nagpur city : Vehicular Density (Per sq. k.m.)

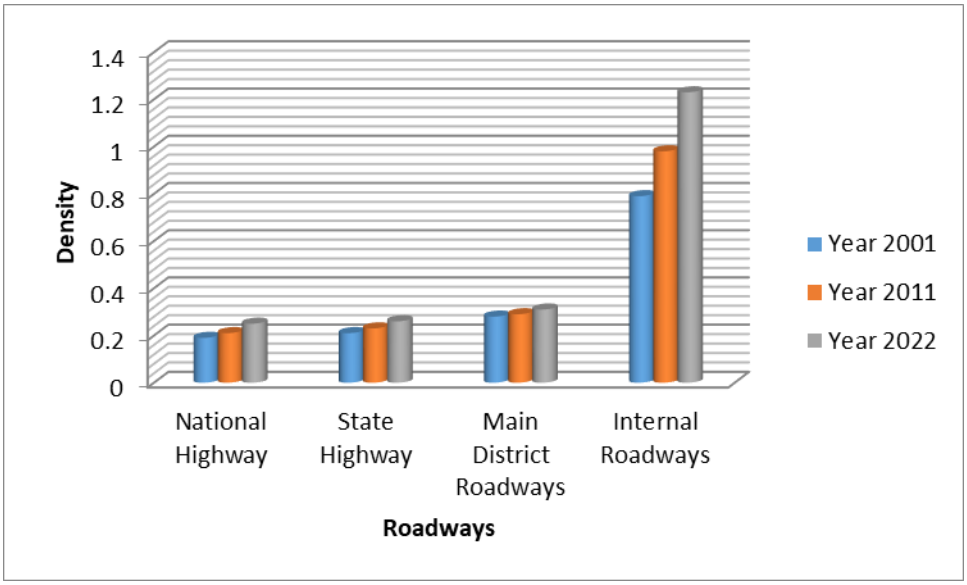


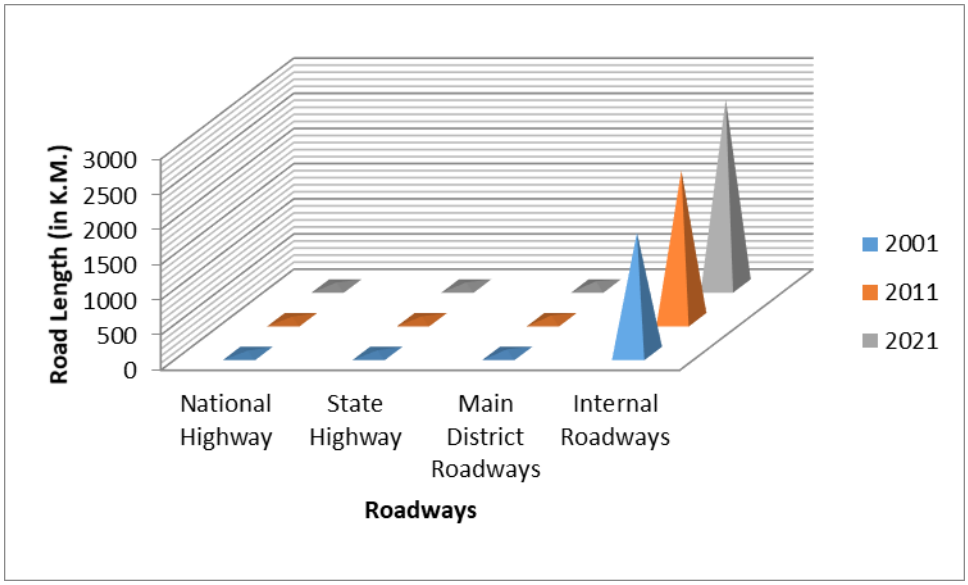
Table No. 4 Nagpur City: Road Length (For per ten thousand people)

Sr. No.	Roadways	Road Length (For per ten thousand people in %)					
		Road Length (in K.M.) 2001	Year 2001	Road Length (in K.M.) 2011	Year 2011	Road Length (in K.M.) 2021	Year 2021

1.	National Highway	41	0.20	45	0.19	50	0.17
2.	State Highway	46	0.22	49	0.20	52	0.16
3.	Main District Roadways	60	0.29	64	0.27	69	0.24
4.	Internal Roadways	1718	0.84	2123	0.88	2652	0.93

Source :- Calculated by author

Graph No.4 Nagpur City : Road Length (For per ten thousand people)



V. RELATIONSHIP BETWEEN AIR POLLUTION AND TRAFFIC IN NAGPUR CITY

"Whenever there is an increase of carbon dioxide, nitrogen dioxide in the air, such air is called polluted air and this type of pollution is called air pollution." In other words, "Air unbalanced condition due to air mixture of external elements generated from natural and human generated sources is called air pollution and the factors by which air is polluted are called air pollutants."[4]

Air pollution is a major factor in reducing the level of human health all over the world. According to the 2021 revision by the World Health Organization, more than 2 million people die from air pollution. The World Health Organization has studied the status of air pollution in 1600 cities in December 2021. On the basis of which Bhiwandi, Rajasthan (with a population of around 104883, with PM2.5:92.7µg/m³) has been declared as the most polluted city in India.

Components of air pollution – sulfur dioxide, carbon monoxide, carbon dioxide, nitrogen

[4] Supra note 2

dioxide in inorganic gases; Among the organic gases are hydrocarbons, aldehydes (acrolein and formaldehyde); Types of particles (gases) - aerosols, smoke, dust particles, soot, fames; liquid - smoke, fog, mist; Secondary pollutants are ozone, smog, acid rain.

Of these, the following air pollutant has been studied to know the pollution caused by vehicle traffic on roads.

1. Sulfur Dioxide (SO2) is one of the gas known to be highly counter reactive. It is associated with number of adverse effects on the respiratory system.

2. Nitrogen Dioxide (NOx) comes under highly reactive gases. When fuel gases are burnt at high temperature. Then they come mainly as stationary sources of motor vehicle exhaust, electric utilities and industrial boilers.

3. SPM Suspended particulate matter is fine particulate matter, solid or liquid, suspended in the Earth's atmosphere. Aerosol generally refers to a mixture of particles in the air.

4. RSPM - Presents air quality under National Air Quality with respect to Respirable. Air pollution is measured by the amount of air pollutants present in a specific amount of air.

Air pollution is expressed in micrograms per cubic meter (μg/m³).[5]

In the presented short research essay, automobile pollution (vehicular emissions) has been studied. Diesel, petrol and sometimes kerosene is also used as fuel in vehicles. Due to which sulfur dioxide, nitrogen dioxide, R. S. PM (respiratory suspension + particles) and the amount of PM (suspended particles) increases.

(A) Nagpur City: Level of Air Pollution

T. No. 5 shows the level of air pollution. The average amount of Sulfur dioxide, a component of air pollution in Nagpur city is observed 43.33 μg/m³, which is half of its certified limit of 80.00 μg/m³. Whereas the average amount of nitrogen dioxide is 153.2 μg/m³, which is one and a half times more than its certified limit. The average amount of PM (respiratory suspension) is 467.7 μg/m³, which is more than three times its certified limit. The average amount of PM (suspended particles) is 515 μg/m³, which is more than twice the certified limit. Its excessive amount explains the air pollution in the city. Among the components of air pollution, only the amount of sulfur dioxide is within the pollution certified limit. All other pollutants are in excess amount.

[5] Khullar D.R. and Rao J.A.C.S., 2016, p5.8

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(B) Nagpur City: Air Pollution and Seasons

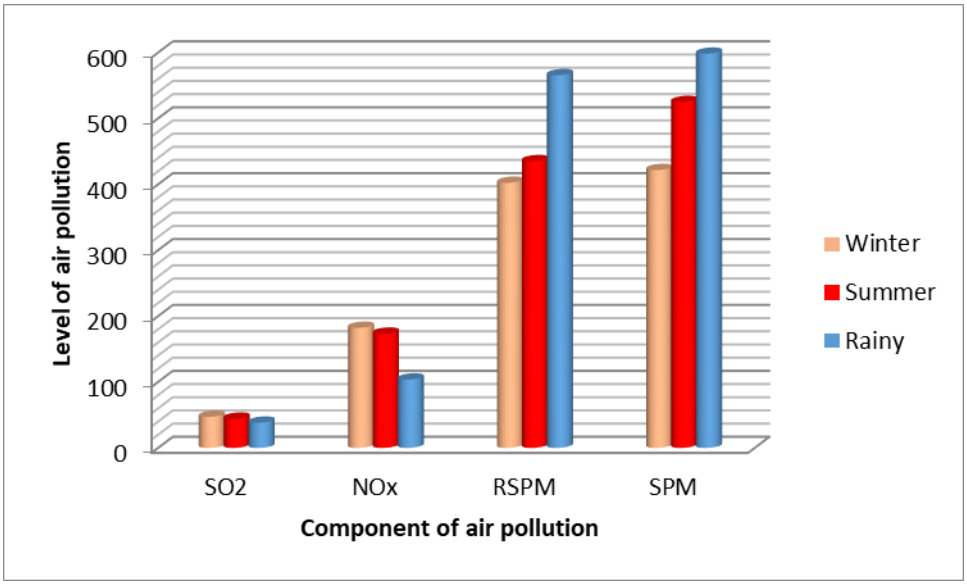
Graph No.5 clearly shows that air pollution in Nagpur city changes according to seasons. It shows that RSPM (565.6 µg/m³) and SPM (598.3 µg/m³) are found highest in rainy season, while Sulfur dioxide (47.29 µg/m³) and Nitrogen Dioxide (182.26 µg/m³) is found highest in winter season. In summer season all the air pollution components are rather moderate. It is because of hot weather people avoid going outside which affects number of vehicles on the road, Educational and judicial institutions are closed due to which vehicular traffic is comparatively less than other seasons. In short Nagpur city shows fluctuations in the amount of air pollution along with the changing seasons.

Table No. 5 Nagpur City : Level of Air Pollution **(**Year 2021)

Season	**SO2** µg/m³ **(80.00)**	**NOx** µg/m³ **(80.00)**	**RSPM** µg/m³ **(100.00)**	**SPM** µg/m³ **(200.00)**	**No. of Vehicles (Year 2021)**
Winter	47.29	182.26	402.38	421.75	503853
Summer	44.4	173.4	435.2	524.9	595121
Rainy	38.3	103.8	565.6	598.3	371239
Average	**43.33**	**153.2**	**467.7**	**515**	**490071**

Source : - Calculated by author

Graph No. 5 Nagpur City : Level of Air Pollution **(**Year 2021**)**



VI. CONCLUSIONS

The total number of vehicles on the roads in Nagpur city has increased by 7 lacs in one decade. (2011to 2021). Which shows the increasing number of vehicles on the roads and with it the increasing amount of smoke coming out of the engines of the vehicles, increasing the air pollution. Similarly, there is an increase of 20% road density and 64% number of vehicles.

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