

AN ANALYSIS OF AIR QUALITY DETERIORATION FROM VEHICULAR POPULATION IN BANGALORE AND POTENTIAL SOLUTIONS.

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Abstract

Air is a lifeline for all living beings and it is impossible to imagine life sustenance on earth without air. The silicon city Bangalore today is stuffed with plethora of burning issues pertaining to environment demanding for solutions at the earliest. Not only helmets but also face masks might be mandatory in Bangalore these days because the air quality is deteriorating. The reasons for this would be increase in number of vehicles, industries, construction activities etc. Among all, the share of vehicles in air pollution is the major. The research paper focuses on vehicles population and its share of pollutants in air quality deterioration, in order to achieve this, relevant data has been collected from various sources and analyzed. The findings of the research show that Bangalore's air quality has sunk with increase in vehicles. Thanks to rampant and erratic urbanization with its concomitants such as escalation of Human and Vehicular population thereby contributing to Air pollution. Shifting reliance from Petroleum products to other eco-friendly source, bringing awareness among public etc can be a worthy solution.

Key words: Urbanization, Air Quality deterioration, Vehicular Population, Eco Friendly source.

Introduction

In one of recent publication, Bangalore has been rated as one of the top destinations for employment and has the lowest unemployment rate in South India. This implies more jobs are being created by the day and more people are coming into the city for employment. Apart from in-migration, due to high income people can afford to own private vehicles. Further, another estimation revealed that one in every four persons in Bangalore owns a private vehicle with more than 70% owning two-wheelers. Indeed, this exponential growth of vehicles has led to dwindling of quality of city's air.

Study Area

Bangalore also rendered Bengaluru is the capital of the Indian state of Karnataka. Geographically Bangalore lies in the southeast of south Indian state of Karnataka. It is in the heart of the Mysore Plateau (a region of the larger Precambrian Deccan Plateau) at an average elevation of 900m (2,953 ft). Its latitudinal extension is 12°58' N – 12° 97' N and 77° 34' E to 77° 56' E is its longitudinal extension.

Problem of the Research

Increase in Vehicular population from 14, 38, 057 in the year 2000 to 50, 50,057 (31-0302014). This abrupt increase in vehicles has led to increase in levels of air pollutants such as RSPM (above national prescribed limits), SO₂, and NO₂etc. posing respiratory health challenges among Bangaloreans.

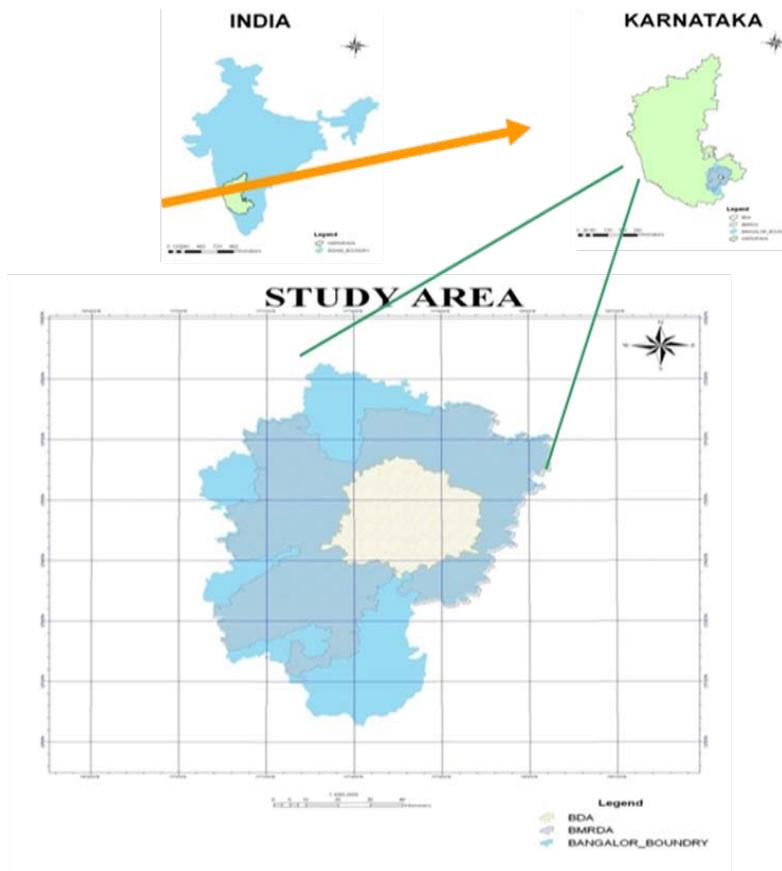


Figure 1. Study Area.

Objectives

To elucidate the major role of Vehicular population in Air Quality deterioration. To know zonal wise pollution levels in Bangalore. To suggest solutions to achieve clean air.

Methodology

With the help of ARC GIS software and Google map editor Bangalore road map has been divided into four zones, then zonal wise road length has been measured to know the road density thereby to identify the pollution levels. Obtained Data has been analyzed in order to give out reliable outputs.

The data pertaining to vehicular statistics, pollutants levels and health impacts has been collected from different sources namely – Karnataka State Pollution Control Board, Traffic Management Centre, News Paper Articles, Concerned websites, Research Articles.

Sources of Air Pollution in Bangalore

The sources and their share of contribution to Air pollution are mentioned:

Transport – 42%, Road dust – 20%, Industries – 14% , Construction activities – 14%, DG Sets – 7%, Domestic activities – 3%.

Role of Vehicles in Deterioration of Air Quality

1. Increase in number of Vehicles

YEARS	TWO WHEELERS	THREE WHEELERS	CARS	JEEPS	TAXIS	BUSES	TRUCKS	TRACTORS	TRAILERS	MAXI CAB	OTHERS	TOTAL
2000	1067430	61424	201052	6827	6299	20656	41887	6158	5544	4238	16542	1438057
2001	1162111	64001	221508	6934	7062	22841	47683	6743	6100	4723	16436	1566142
2002	1292228	67778	245893	7091	7974	24989	53424	7681	6873	5270	19728	1738929
2003	1419396	72107	269648	7434	9444	28262	59150	8723	7359	7219	23599	1912341
2004	1586397	74357	314931	7991	13132	34271	68186	10481	9456	10458	27820	2157480
2005	1811361	80432	359580	11012	16484	36888	84571	11994	11023	12659	31266	2467270
2006	2074306	90934	426394	7587	20025	39162	91699	18564	10699	16100	45682	2841152
2007	2232271	95029	490982	7609	28223	48159	109761	19646	11670	18017	45197	3106564
2008	2263552	95859	515109	7272	30940	48605	119051	20151	11779	18653	53668	3184639
2009	2607536	105630	606427	8188	31879	42164	129312	20353	12133	20903	68843	3653368
2010	2546728	93058	681500	7003	35126	73357	138304	7273	5608	20034	78266	3686257

As on 31-03-2014 - 5050057

Inflow of Outstation vehicles into the city Estimation of State Transport Department that annually, about 10,000 to 12,000 outstation vehicles are brought into the city due to huge inward migration in search of jobs.

Existence of Old vehicles Records of Transport Department shows the vehicles of 15 years old as on 31-03-2013.

According to KSPCB, the older vehicles use older technology to keep the pollution levels high.

Vehicle Category	Number
Non-transport	2,91,543
Transport	9,972
Light Goods vehicles	8,503
Total – Including buses, light goods vehicles, taxis, LMV passenger and other vehicles	3,64,518

Two-wheelers the worst emitter According to statistical report, during the year 2010, out of 36, 86,257 vehicles the share of two-wheelers is 25, 46,728 i.e. **69.08%**.

Two-wheelers comprises two-stroke engines. The advantage of two-stroke engine over four stroke engine is that lower cost, excellent power, mechanical simplicity (fewer moving parts and resulting ease of maintenance), lighter and smaller engines. But the negative side of such engines are most dangerous as unburnt petrol (sub-micron particles) is emitted which is highly dangerous and leads to cancer and heart attacks.

Fuel Adulteration Issues For instance, Front engine autorikshaws in revenue layouts, consume huge amounts of adulterated fuel readily available in the market.

Exacerbation of Vehicle Emissions due to Traffic Congestion. Traffic congestion in Bangalore has reduced the travelling speed of the vehicles during peak hours. It has been estimated that in Bangalore during peak hours the travelling speed is reduced to about 5-10 kms/hr, while medium peak hours it is 10-15 kms/hr and it is 20-30km/hr during less peak hours, this in turn leads to escalation in travelling hours thereby increase in fuel burning duration resulting in more of emissions.

RSPM above Prescribed Limits Respirable suspended particulate matter are particles smaller than 10 microns and could derived from several material such as silica, soot or metal, explains, S.K. Satheesh, Professor at Centre for Atmospheric and Oceanic studies at the IISC. "Anthropogenic particulate air pollution can come from Vehicle exhaust or any form of combustion and dust from construction. These particles are small enough to enter our respiratory filtering mechanism and so penetrate our lungs. RSPM above a prescribed limits poses a health hazard to anyone inhaling it. But unfortunately, RSPM levels in Bangalore above National Prescribed limits (60 microgram per cubic meter).

Location	RSPM Levels		% *
	May 2014 (2013-14)		
Graphite India	159	133	121%
KHB Industrial Area, Yelahanka	104	128	113%
Peenya Industrial Area	136	125	108%
Yeshwantpur Police station	164	110	83%
AMCO Batteries, Mysore Road	264	170	183%
Central Silk Board, Hosur Road	256	175	191%
DTDC House, Victoria Road	196	114	90%
City Railway Station	80	64	6%
Sensitive Areas			
Victoria Hospital	164	88	46%
Indira Gandhi Children Care Institute (NIMHANS)	104	79	31%
* Percentage Increase in RSPM Levels Against National Limit of 60 Microgram, per cubic metre (April 2013 – March 2014)			

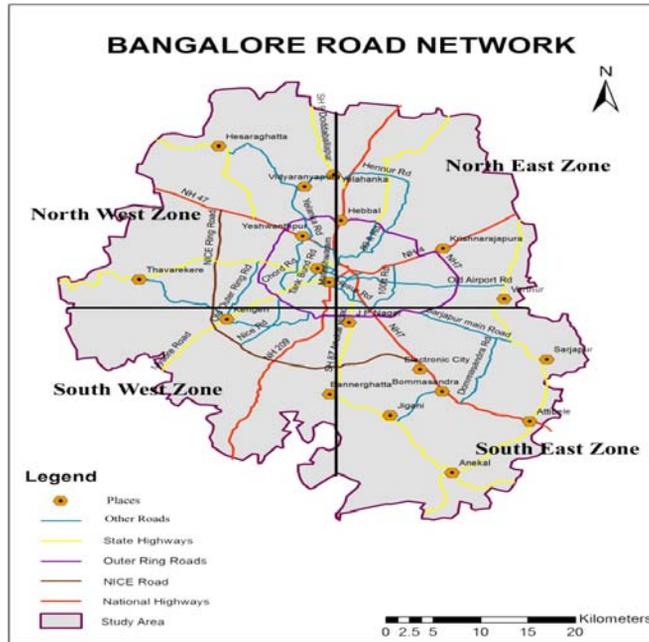
Health Impact of RSPM: Study by Dr. Paramesha paediatric pulmonologist, of 3,900 children about 25.5% (2013) of children had asthma but it was only 9% in 1979.

8. Loss of vegetation cover. Trees act as a lifeline as they play a vital role in human sustenance. Trees are good absorbers of pollutants. But due to rapid urbanization demand for more infrastructural facilities specifically road up gradation in terms of extension or

widening to accommodate ever increasing vehicular population the vegetation cover in Bangalore is burgeoning leading to increase in pollution levels.

Results

Increase in levels of pollution with increase in vehicular population. Zonal wise Distribution of Roads. Zonal Wise Road Density of Bangalore.



Zonal Wise Road length in Bangalore

<p style="text-align: center;">North East Zone</p> <ul style="list-style-type: none"> ▪ National Highways – 27.1 kms ▪ State Highways – 80 kms ▪ Outer ring road – 11.6 kms ▪ Others – 34 kms ▪ Total – 152.7 kms 	<p style="text-align: center;">North West Zone</p> <ul style="list-style-type: none"> ▪ National Highways – 28.1kms ▪ State Highways – 61.5kms ▪ Nice road – 28 kms ▪ Outer ring road – 22.8kms ▪ Others – 41.1 ▪ Total – 181.5
<p style="text-align: center;">South East Zone</p> <ul style="list-style-type: none"> ▪ National Highways – 27.1 kms ▪ State Highways – 80 kms ▪ Outer ring road – 11.6 kms ▪ Others – 34 kms ▪ Total – 152.7 kms 	<p style="text-align: center;">South West Zone</p> <ul style="list-style-type: none"> ▪ National Highways – 13.1 kms ▪ State Highways – 24.5 kms ▪ Nice Road – 23 kms ▪ Outer ring road – 6.7 kms ▪ Other roads – 23.6 ▪ Total – 90.0 kms

The above statistics of road length among different zones clearly shows that North East and North West zone has got maximum share of roads that means in terms of pollution also they stand high. But, indeed it is not only the location but meteorological parameters play a vital role in dispersal, dilution and cleansing of these pollutants.

Winds – As Bangalore experiences South-west and North-east monsoon winds during this process, the pollutants which in south west zone would be pushed towards north east and vice versa happens during north-east monsoon winds.

Inversion Effect – When the temperature rises, pollutants move up in the air and spread. At night, temperature falls resulting in pollutants descending. Hence the level of pollutants is higher at night compared to day time.

During **Rainy season**, pollutants gets washed away by precipitation and thereby pollution levels during rainy would be less.

Suggestions and Conclusion

Strict Vehicle registration

Only vehicles of Bharat IV (Euro modeled engine – nonpolluting vehicle) must be given registration. Registration should not be given to additional vehicles in each family. Registration of Old vehicles of about 15 years old during re-registration process should be advised for replacement. During Peak hours vehicles with single passengers should not be allowed instead carpooling system should be made mandatory. All heavy goods vehicles should not be allowed during day time.

Trees can help in reducing pollution – As per research made by researchers at Ashoka Trust for Research in Ecology and the Environment. Of the 10 major roads that were studied (including magadi, hennur and Bannerghatta roads) only 8 had SPM levels higher than permissible limits where there were no trees, while only two roads that had trees showed SPM levels above safe levels.

Park and ride at the outskirts of urban centres would help in avoiding number of private vehicles entering the city.

Quality of BMTC service should be improved – A study title “Urban bus transport Service Quality and Sustainable Development: Understanding the gaps” by IISC and M S Ramaiah Management Institute has revealed that commuters feels BMTC should do more to ensure satisfaction.

Technology which can curb pollution – According to this, a microscopic pollution-eating particles of titanium dioxide which use sunlight and oxygen to react with nitrogen oxide pollutants and purify the air. This can be applied to billboards and advertisements alongside congested roads to cut pollution. (Developed by UK Researchers).

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